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SPECIFICATIONS FOR

MANATEE COUNTY SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

BID NO.

MANATEE COUNTY, FLORIDA

APRIL 1999

COUNTY PROJECT NO.

ISSUED FOR BID

PROJECT OWNER:

County of Manatee, Florida
c/o Manatee County
Project Management Department
4422-A 66TH Street West
Bradenton, Florida 34210
Tel: (941)792-8811

PREPARED BY:

McKim & Creed Engineers, P.A.
601 Cleveland Street, Suite 205
Clearwater, Florida 33755
Tel: (727) 442-7196

McKIM&CREED

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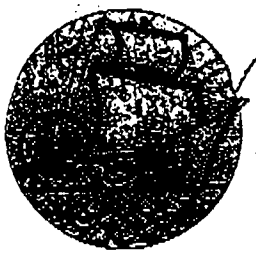

Note 7671 | Date 5-20 | # of pages ▶ 24
From MARGE
Co.
Phone # 941-749-3058
Fax #

TEE COUNTY
VERNMENT
ANAGEMENT DEPARTMENT,
CHASING DIVISION
ERVE WITH EXCELLENCE

OFFICIAL No. 1

May 19, 1999

TO: All Interested Bidders

SUBJECT: Invitation for Bid #99-2691-DC
Southeast Regional Wastewater Treatment Plant Expansion
ADDENDUM #1

Bidders are hereby notified that this Addendum shall be acknowledged on page 00300-2 of the Bid Form and made a part of the above named bidding and contract documents.

The following items are issued to add to, modify, and clarify the bid and contract documents. These items shall have the same force and effect as the original bidding and contract documents, and cost involved shall be included in the bid prices. Bids to be submitted on the specified bid date, shall conform with the additions and revisions listed herein.

1. Opening Time and Date Change to: **3:00 P.M., MAY 28, 1999**

2. Section 00010 - Instructions to Bidders
Page 000010-1, paragraph A.04 - Add: One of the three (3) copies submitted shall be marked "Original".

3. Section 00300 - Bid Form, Material and Equipment List
Page 00300-7, 11350 Coarse Bubble Air Diffuser System, Delete: Parkson.

Page 00300-8, 11387 Centrifugal Air Blower, Delete: Sutorbilt and Tuthill.

4. Section 01030 - Special Project Procedures
Page 01030-2, paragraph 1.2A - Add: The County will waive all building permit fees.

Page 01030-4, paragraph 1.13A - Replace the one year warranty period with a three (3) year warranty period.

Page 01030-4, Delete paragraph 1.13D in its entirety.

5. Section 01590 - Field Offices
Page 01590-1, paragraph 2.1C - Add: The Contractor shall pay for all Engineer's office telephone costs, including long distance calls.

<addendum.LET>

• 1112 Manatee Avenue West, Suite 803 • Bradenton, Florida 34205 • (941) 749-3014 • FAX (941) 749-3034 •

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6. Section 01690-Starting Process Systems
Page 01690-1, paragraph 3.2B - Delete in its entirety and replace with the following:

B. The Owner shall provide plant electric power, reclaimed water, and wastewater to Contractor at no cost during start-up of equipment and processes. The Contractor will be responsible for paying for chemicals, diesel fuel, lubricants, and potable water during startup. The Contractor will also pay for electrical power used by the Contractor's trailer and construction equipment during construction.

7. Section 03360-Elongated Prestressed Concrete Tanks
Page 03360-3, paragraph 2.3A, Replace all references to 4 ½ inch thick floor with the words 5 inches thick.

Page 03361-3, paragraph 2.3A, Replace all references to 4 ½ inch thick floor with the words 5 inches thick

8. Section 09900-Painting and Coatings
Page 00990-10, paragraph 2.8, C.1. - Add: Walkways included in prestressed concrete tanks shall receive a light broom finish.

Pages 09900-12, 13, and 14, Table 09900-1- Painting Schedule
Items D.2, F.2, H.2, and N.2: Add: (Primer - One coat of Thoroseal White).

Pages 00990-12, 13, and 14, Items D, F, H, and N: Add: All Shotcrete surfaces shall be soft-broom finished, not brush-off blasted.

Pages 09900-12, 14, and 15, Items D.3, N.3, and Q.2, Delete the words "and floor".

9. Section 11350-Coarse Bubble Air Diffuser System
Page 11350-1, paragraph 1.2 B-Delete: Item 2, Parkson, Inc., Fort Lauderdale, Florida

10. Section 11387-Centrifugal Air Blower
Page 11387-1, paragraph 1.3B-Delete: Item 3, Sutorbilt and Item 4 Tuthill.

Page 11387-2, paragraph 2.1B, Sand Filters, Air Flow-SCFM-Change to 4,200

Page 11387-4, paragraph 2.3D-Add: The wafer butterfly valves specified in this paragraph shall be used with the blowers and air piping specified in this Section. AWWA valves are not required for the air blowers and piping in this Section.

11. Section 13300-Controls and Instrumentation
Page 13300-13, paragraph 2.14A-Add to the last sentence: "or similar model and equipment from McCrometer, Inc."

12. Section 15064-Plastic Pipe
Page 15064-2, paragraph 2.1H-Add: HDPE pipe for reclaimed water services may be colored white or black with lettering identifying its intended usage or with a lavender stripe painted or taped on the pipe every two linear feet.

13. Section 15100-Valves and Appurtenances
Page 15100-3-Change 6th line: ....pumps shall be Class 150.....

14. Drawings:
S-13 1) Detail 9. Replace finished floor elevation of 10.00 with 37.33.
2) Replace Tank Bottom/Top of Concrete encasement elevation of 8.25 with 35.58.

S-14 1) Section 1. Replace bottom of trough elevation 43.00 with 43.50.

D-2 1) Add the following Note No. 9:
"9. Existing DAF/Aerobic Digesters have a 12" thick concrete floor with up to 2' thickness of concrete grout to form tank bottom."

15. Revised Plan Sheets C11, C12, and C13 are revisions to the proposed Leachate Collection System and interconnection with the existing system.

16. **Insert revised page(s) 00010-1, 00300-7, 00300-8, 01030-2, 01030-4, 01590-1, 01690-1, 03360-3, 03361-3, 09900-10, 09900-12, 09900-13, 09900-14, 11350-1, 11387-1, 11387-2, 11387-4, 13300-13, 15064-2, 15100,3, and Plan Sheets C11, C12, and C13, Addendum #1**

If you have submitted a bid prior to receiving this addendum you may request in writing that your original, sealed bid be returned to your firm. All sealed bids received will be opened on the date stated.

THIS ADDENDUM MUST BE ACKNOWLEDGED AND THE REVISED BID FORM PAGES SUBMITTED IN ORDER FOR YOUR BID TO BE CONSIDERED RESPONSIVE.

Bids will be received at Manatee County Purchasing, 1112 Manatee Avenue West, Bradenton, Florida 34205 until **3:00 P.M., May 28, 1999.**

Sincerely,

R.C. "Rob" Cuthbert, C.P.M.
Purchasing Division Manager
RCC:MP
Encls

<addendum.LET>

SECTION 00010
INFORMATION TO BIDDERS

A.01 OPENING LOCATION

These bids will be publicly opened in the Manatee County Purchasing office, 1112 Manatee Avenue West, Suite 803, Bradenton, Florida 34205 in the presence of County officials at the time and date stated, or soon thereafter. All bidders or their representatives are invited to be present.

A.02 BID FORM DELIVERY REQUIREMENTS

Any bids received after the stated time and date will not be considered. It shall be the sole responsibility of the bidder to have their bid delivered to the Manatee County Purchasing Office for receipt on or before the stated time and date. If a bid is sent by U.S. Mail, the bidder shall be responsible for its timely delivery to the Purchasing Office. Bids delayed by mail shall not be considered, shall not be opened at the public opening, and arrangements shall be made for their return at the bidder's request and expense. Telegraphic Bids and/or Facsimile Bids will not be considered.

A.03 CLARIFICATION & ADDENDA

Each bidder shall examine all Invitation for Bid documents and shall judge all matters relating to the adequacy and accuracy of such documents. Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to the Invitation for Bid shall be made through the Manatee County Purchasing Office. The County shall not be responsible for oral interpretations given by any County employee, representative, or others. The issuance of a written addendum is the only official method whereby interpretation, clarification or additional information can be given. If any addenda are issued to this Invitation for Bid, the County will attempt to notify all prospective bidders who have secured same, however, it shall be the responsibility of each bidder, prior to submitting their bid, to contact Manatee County Purchasing (see contact on page 1) to determine if addenda were issued and to make such addenda a part of their bid.

A.04 SEALED & MARKED

Three signed copies of your bid shall be submitted in one sealed package, (**one of the three (3) copies submitted shall be marked "ORIGINAL"**) clearly marked on the outside "**Sealed Bid #992691DC Southeast Regional Wastewater Treatment Plant Expansion**" and addressed to:

Manatee County Purchasing
1112 Manatee Avenue West, Suite 803
Bradenton, Florida 34205

A.05 LEGAL NAME

Bids shall clearly indicate the legal name, address and telephone number of the bidder. Bids shall be signed above the typed or printed name and title of the signer. The signer must have the authority to bind the bidder to the submitted bid.

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11311	Waste Sludge Pumps		( )	Aurora
			( )	Goulds
			( )	Allis-Chalmers
		Alternative Product	( )	
11313	Vertical Turbine Pumps (Effluent)		( )	Fairbanks-Morse
			( )	Aurora
			( )	Paco/Johnston
			( )	Floway
		Alternative Product	( )	
11314	Vertical Non-Clog Centrifugal Pumps (Return Activated Sludge)		( )	Aurora
			( )	Allis-Chalmers
			( )	Fairbanks-Morse
		Alternative Product	( )	
11330	Raw Sewage Screening Equipment	No Substitutions		Parkson
11350	Coarse Bubble Air Diffuser System		( )	Wilfley-Weber
			( )	-
			( )	Sanitaire
			( )	Aercor
11352	Clarifier Equipment		( )	Baker Process (Eimco)
			( )	Envirex
			( )	Walker Process
11355	Rotary Drum Thickeners		( )	Jones & Atwood
			( )	Parkson
			( )	Moyno Hercules
		Alternative Product	( )	
11372	Traveling Hood Filter System	No Substitutions		Eimco
11376	Carrousel System Slow Speed Mechanical Aerators	No Substitutions		Eimco
11382	Fine Bubble/Draft Tube Aeration		( )	Wilfley-Weber
			( )	Envirex
		Alternative Product	( )	
11385	Submerged Turbine Mixers		( )	Eimco
			( )	Chemineer
			( )	Lightnin Technology

BIDDER: _____

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11387	Centrifugal Air Blower	( )	Hoffman
		( )	Roots
		( )	
		( )	
	Alternative Product	( )	
11500	Wet Scrubber Odor Control System	( )	Duall
		( )	RJ Environmental
	Alternative Product	( )	
15102	Power Actuating Devices for Valves	( )	Limitorque
		( )	EIM
		( )	Rotork
16106	480 Volt Switchgear	( )	Cutler Hammer/ Westinghouse
		( )	Square D
		( )	General Electric
16216	Diesel Engine Driven Generator	No Substitutions	Caterpillar
16370	Variable Frequency Drives	( )	Allen Bradley
		( )	Square D
		( )	Asea Brown Boveri
16921	480-Volt Motor Control Centers	( )	General Electric
		( )	Square D
	Alternative Product	( )	

END OF SECTION

BIDDER: _____

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1.2 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Owner. The costs for obtaining all permits shall be borne by the Contractor. **The County will waive all building permit fees.**

1.3 CONNECTIONS TO EXISTING SYSTEM

A. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems as shown on the Drawings or where directed by the Owner. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner.

1.4 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various pipelines, electrical, or other utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines. Cost for relocation of all existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs.

B. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered.

C. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.

D. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Engineer and/or the Owner.

1.5 SUSPENSION OF WORK DUE TO WEATHER

A. Refer to FDOT "Standard Specifications for Road and Bridge Construction", Section 8.

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1.11 CONSTRUCTION CONDITIONS

A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a minimum period of **three (3) year**, unless otherwise stated in the individual specification section. Warranty period shall commence on the date of Owner acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications.

~~D. In the event that the manufacturer is unwilling to provide a one year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty starting at the time of equipment delivery to the job site. This two year warranty shall not relieve the Contractor of the one year warranty starting at the time of Owner acceptance of the equipment.~~

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01590 - FIELD OFFICES

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Promptly after starting work, the CONTRACTOR shall provide a field office for his use and, provide and equip a suitable office for the exclusive use of the ENGINEER. The CONTRACTOR shall maintain both offices until the completion of the work to be done under this Contract. The CONTRACTOR's field office shall be the size required for his use plus adequate space to hold project meetings (minimum seating - 6). The ENGINEER's office shall be a separate structure located, as directed, where it will not interfere with the progress of the work. An approved, suitably constructed and equipped trailer of adequate size and designed for the purpose may be furnished as the ENGINEER's office.

B. The CONTRACTOR shall provide office space and facilities for the ENGINEER when the CONTRACTOR moves on the job site.

C. The CONTRACTOR shall furnish, install and maintain storage and work sheds as needed or required for the construction.

D. Should the construction site change, field offices, storage and work sheds shall be moved to a convenient location at the new site.

PART 2 - MATERIALS AND EQUIPMENT

2.1 ENGINEER'S OFFICE

A. The office shall be of a suitable height and of ample size to accommodate the furniture and equipment listed below, without crowding (at least 128 square feet of floor area). It shall be weathertight; insulated and suitably ventilated; the floor shall be tight and of double-thick construction. The office shall have at least two operable, screened, windows which can be locked shut, and one door which shall have a cylinder lock with two keys. The door shall also have a screened door.

B. The office shall have adequate heating and cooling unit(s) for the geographic location.

C. Operating expenses (heating-cooling, electric, water, sanitary and telephone) shall be paid for by the CONTRACTOR. **The Contractor shall pay for all Engineer's office telephone costs, including long distance calls**

D. Provide parking spaces for two vehicles.

2.2 OFFICE FURNITURE AND EQUIPMENT

A. The CONTRACTOR shall provide the following:

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SECTION 01690 - STARTING PROCESS SYSTEMS

PART 1 - GENERAL

1.1 PLAN SUBMITTAL

A. Prior to attaining 75 percent completion of construction, the CONTRACTOR shall submit his plan for placing the facility into operation.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 START UP PLAN

A. The plan shall include but not necessarily be limited to:

1. Procedures for inspection of systems, equipment, instrumentation and controls to be carried out prior to their being energized;
2. Schedule for on-site inspections, supervision of installation and start-up by manufacturer's personnel;
3. List of equipment and controls for which a manufacturer's certificate of proper installation shall be submitted prior to energizing; and
4. Sequence of start-up of each system.
5. Start up instruction classes for each different type of equipment with Manatee County Public Works Department personnel.

3.2 MATERIALS, SUPPLIES AND ENERGY

A. In conjunction with start-up, testing, and up to the time of acceptance of the facility by the OWNER, the CONTRACTOR shall furnish all required materials, supplies and energy.

~~B. The above requirement applies to all expendable items required to operate and test the facility including: chemicals, electric power, diesel fuel, lubricants, and custodial supplies, water and/or wastewater.~~

B. "The Owner shall provide plant electric power, reclaimed water, and wastewater to Contractor at no cost during start-up of equipment and processes. The Contractor will be responsible for paying for chemicals, diesel fuel, lubricants, and potable water during startup. The Contractor will also pay for electrical power used by the Contractor's trailer and construction equipment during construction"

END OF SECTION

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Prestressing Wire

Wire Size	Diameter	0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250"
Working Stress, Wall	f_s	115,000 psi
Working Stress, Dome Ring	f_s	120,000 psi
Allowable Tensile Stress Before Losses	f_{si}	145,600 psi or no greater than 0.70 f'_s
Ultimate Tensile Strength	f'_s	231,000 psi or greater for 8 gauge 222,000 psi or greater for 6 gauge

Prestressing Strand

Seven-Wire Strand Size	0.6" Diameter
Ultimate Tensile Strength	270,000 psi

Prestressing Rods

Rod Size	1" Diameter
Ultimate Tensile Strength	150,000 psi

Reinforcing Steel

Allowable Tensile Stress	f_s	18,000 psi
Yield Strength	f_y	60,000 psi

2.2 SUBMITTALS

A. Submit to the Engineer complete design calculations and a complete set of detailed working drawings for the tank, including:

1. Concrete mix designs.
2. Guarantee document as specified in Paragraph 1.4 A.

2.3 FLOOR

A. Concrete membrane floors (minimum 5 inches thick) shall be thickened to a minimum of 8 inches of concrete over all pipe encasements and around sumps. The minimum percentage (0.625%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent minimum 5 inch thick floor.

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Prestressing Wire

Wire Size	Diameter	0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250"
Working Stress, Wall	f_s	115,000 psi
Working Stress, Dome Ring	f_s	120,000 psi
Allowable Tensile Stress Before Losses	f_{si}	145,600 psi or no greater than 0.70 f'_s
Ultimate Tensile Strength	f'_s	231,000 psi or greater for 8 gauge 222,000 psi or greater for 6 gauge

Reinforcing Steel

Allowable Tensile Stress	f_s	18,000 psi
Yield Strength	f_y	60,000 psi

2.2 SUBMITTALS

A. Submit to the Engineer complete design calculations and a complete set of detailed working drawings for the tank, including:

1. Concrete mix designs.
2. Guarantee document as specified in Paragraph 1.4 A.

2.3 FLOOR

A. Concrete membrane floors (minimum 5-inches thick) shall be thickened to a minimum of 8 inches of concrete over all pipe encasements and around sumps. The minimum percentage (0.625%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent minimum 5 -inch thick membrane floor.

B. Minimum tank floor thicknesses are shown on the drawings and specified herein. The tank Contractor shall be responsible to design and provide a sufficiently thick reinforced floor slab, including the foundation slab beneath the walls for the vertical loading.

C. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

D. Floors shall be continuously water cured until tank construction is completed.

1. Surface Preparation: Level protrusions, fill tie rod holes with grout, brush blast to 6-inches below water line (if required), hose wash and let dry.
2. First Coat: One coat of high performance two component polyamide epoxy, minimum 4 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat.

2.8 GROUP M - SPECIAL COATINGS

A. System M-1. For use as barrier between dissimilar materials and metals.

1. Prime: None
2. Finish: Asphaltic varnish applied at a rate of at least 2.0 mils dry film thickness

B. System M-2. For use as a primer - sealer for coloring asphaltic and tar surfaces.

1. Prime: None.
2. Finish: Vinyl phenolic sealing coat for the prevention of discoloring of the finish coat. Apply at a rate of at least 2.0 mils dry film thickness.

C. System M-3. For sealing concrete floors where concrete is shown as natural in the Finish Schedules and on all exposed concrete floors where no finish has been shown.

1. Surface Preparation: Mechanically abrade floor to achieve a medium grip sandpaper profile. **Walkways included in prestressed concrete tanks shall receive a light broom finish.**
2. First Coat: One coat of clear epoxy floor sealer, minimum 10 mils DFT, Tnemec 201 Epoxoprime, or Equal.

2.9 FINISH COAT OVER EXISTING FINISH

A. The required painting shall consist of one coat of the system "Finish Coat" to provide continuity of texture and color over previously painted surfaces.

2.10 THINNING

A. Where thinning is necessary, only the products for the particular purpose and by the manufacturer furnishing the paint shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions and with the full knowledge and approval of the Engineer.

PART 3 - EXECUTION

3.1 SHOP PAINTING

A. All ferrous an non-ferrous surfaces shall be solvent cleaned before priming. Primer shall be applied in the shop to protect surfaces from rust during shipment and storage.

B. Apply two coats of paint to surfaces which are inaccessible after assembly or erection.

TABLE 09900-1

PAINTING SCHEDULE

A. Headworks:

1. Exterior concrete walls below a point 6-inches below finish grade - System A-4.
2. Exterior concrete walls above grade to a point 6-inches below finish grade - System A-3.
3. Concrete top- System M-3.
4. Concrete channels (sides and bottom) - System B-3 (2).
5. Interior concrete walls and ceilings - System A-2.
6. Interior concrete block walls - System A-5.
7. Steel and ductile iron pipe and equipment exposed to spray splash or corrosive atmosphere - System B-3 (1).
8. Hollow metal doors and frames and miscellaneous steel - System B-5.
9. Galvanized and non-ferrous metals in interior corrosive areas - System C-1.

B. Odor Control Facilities:

1. Exterior concrete walls above grade to a point 6-inches below grade - System A-3.
2. Secondary containment concrete tanks and top of concrete equipment pad - System A-2.
3. Steel and ductile iron pipe and miscellaneous equipment - System B-3(1).

C. Flow Splitter Box

1. Exterior concrete walls below a point 6-inches blow finish grade - System A-4.
2. Exterior concrete walls above grade to a point 6-inches below grade and concrete top - System A-3.
3. Interior concrete walls, floors and ceilings - System B-3(2).
4. Interior and aboveground exterior ductile iron and steel pipe and miscellaneous items - System B-3(1).
5. Miscellaneous steel and iron equipment - System B-5.
6. Monorail - System B-4.

D. Flow Equalization Tank:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tanks walls above a point 6-inches below finish grade to top - System A-3. **(Primer - One coat of Thoroseal White).**
3. Interior concrete tank walls (entire height) ~~and floor~~ - System B-3(2).
4. Aboveground ductile iron and steel pipe and equipment on outside of tank - System B-4.
5. Ductile iron and steel pipe and equipment inside tank - System, B-3(1).
6. **All Shotcrete surfaces shall be soft-broom finished, not brush-off blasted.**

E. MCC/Blower Building No. 2:

1. Exterior concrete masonry walls above grade - System A-3.
2. Interior masonry walls - System A-5.
3. Concrete floor - System M-3.

3. Concrete floor - System M-3.
4. Miscellaneous exterior steel items - System B-1.
5. Interior and exterior wood surfaces - System E-2.
6. Miscellaneous interior steel items - System B-2(1).

F. Anoxic/Aerobic Tank No. 3:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3. **(Primer - One coat of thoroseal White)**
3. Interior concrete tank walls from floor to top of tanks, including bottom of concrete top slab - System L-2.
4. Top of concrete top slab - System M-3.
5. Submerged steel and ductile iron piping and equipment, or subject to spray and splash - System B-3(1).
6. Aboveground steel and ductile iron pipe and equipment not in contact with wastewater spray or splash - System B-4.
7. **All shotcrete surfaces shall be soft-broom finished, not brush-off blasted.**

G. Clarifier Flow Splitter Box:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom of wall with pipe penetrations - System L-1.
2. Interior of concrete tank wall with pipe penetrations (entire wall, top to bottom) - System B-3(2).

H. Clarifiers
1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3. **(Primer - One coat of Thoroseal White).**
3. Interior concrete tank walls from floor to top of tanks, including exterior and interior of concrete launder - System L-2.
4. Submerged steel and ductile iron pipe and equipment, or subject to spray and splash, including influent feed well, center platform support, drive platform, sludge collection box, sludge scraper arms, and scum trough- System B-3(1).
5. Steel piping and equipment not exposed to splash and spray, including steel walkway, scum ejector pumps, and exterior steel and ductile iron piping - System B-2(1).
6. **All shotcrete surfaces shall be soft-broom finished, not brush-off blasted.**

I. Sand Filters:
1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete walls - System A-2.
4. Aboveground steel and ductile iron equipment, including pipe and supports, backwash equipment, slide gates, not subject to spray or splash - System B-2(1).
5. Submerged steel and ductile iron equipment, or subject to spray and splash - System B-4.

J. Filter Blower/ Compressor Building No. 4:

1. Exterior concrete masonry walls above grade - System A-3.
2. Interior masonry walls - System A-5.
3. Concrete floor - System M-3.
4. Miscellaneous exterior steel items - System B-1.
5. Interior and exterior wood surfaces - System E-2.
6. Miscellaneous interior steel items - System B-2(1).

K. Reclaimed Water Pumps and Piping:

1. Pumps, valves, piping and supports above concrete slab - System B-2(1)
2. Steel pumps parts submerged in water or subject to splash and spray - B-3(1).

L. Final Clarifier Sludge Boxes:

1. Exterior of concrete box walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete box walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete box walls (entire height) and floor - System B-3(2).
4. Steel floor stands, ductile iron pipe, weirs, and supports in box - System B-3(1).

M. Return and Waste Activated Sludge Pumps and Piping:

1. Above grade miscellaneous concrete - System A-2.
2. Aboveground pumps, piping, valves, and supports - System B-2(1).

N. Sludge Holding Tanks, Sludge Thickeners, and Thickened Sludge Pumps:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top, concrete columns, bottom of concrete second floor - System A-3. **(Primer - One coat of Thoroseal White).**
3. Interior concrete tank walls (entire height) ~~and floor~~ - System B-3(2).
4. Ductile iron and steel pipe supports and equipment inside tank - System, B-3(1).
5. Sludge thickeners - System B-3(1).
6. Thickened sludge pumps, aboveground piping, valves, supports, and equipment outside of tanks - System B-2(1).
7. Top of concrete floors on first and second floors - System M-3.
8. Structural steel beams and columns - System B-1.
9. Miscellaneous wood surfaces - System E-2.
10. **All shotcrete surfaces shall be soft-broom finished, not brush-off blasted.**

O. Monorail Hoist for Return Activated Sludge Pumps

1. Exterior concrete and concrete masonry walls, columns, beams and foundations aboveground - System A-3.
2. Structural steel columns and beams - System B-1.
3. Steel and iron equipment - System B-2(1).

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P. Main Electrical Building:

1. Above grade concrete interior walls and ceilings - System A-1.
2. Exterior concrete and concrete masonry walls aboveground - System A-3.
3. Interior concrete masonry walls - System A-5.
4. Structural and miscellaneous steel, interior and exterior - System B-1.
5. Steel and ductile iron piping and equipment - System B-2(1).
6. Miscellaneous galvanized, aluminum and other non-ferrous metals - System C-1.
7. Miscellaneous interior and exterior wood surfaces - System E-2.
8. Concrete floors - System M-3.
9. Steel frames, embedments, and lintels - System B-5.

Q. New Aerators in Existing Aeration Tanks:

1. Steel and ductile iron equipment subject to submergence, spray, and splash in wastewater - System B-3(1).
2. Concrete walls and ceilings ~~and floors~~ subject to submergence, spray, and splash in wastewater - System B-3(2).
3. Equipment and miscellaneous steel items above concrete top of aeration tank - System B-2(1).

END OF SECTION

SECTION 11350 - COARSE BUBBLE AIR DIFFUSER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install a coarse bubble air diffuser system in the two new sludge holding tanks. Each tank is 92 ft. diameter, with 19.5-ft. SWD (side water depth), and 2-ft. freeboard as shown on the Drawings. The Drawings and Specifications direct attention to certain required features of the equipment but do not purport to cover all details entering into the design and construction. The Contractor shall furnish and install the mechanisms complete in all details and ready for operation. The air diffuser system in each tank shall be capable of providing 4010 SCFM, or 15.2 SCFM per diffuser. Each diffuser shall be capable of providing a peak airflow of 50 SCFM.

B. ***Related Work Specified Elsewhere:***

1. Section 15100 - Valves and Appurtenances

1.2 QUALITY ASSURANCE

A. The equipment described in this Section shall form an integrated system and be furnished by one supplier, who is fully experienced and qualified in the manufacturing of the equipment to be furnished.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Wilfley Weber, Inc., Denver, Colorado
2. ~~Parkson, Inc., Fort Lauderdale, Florida~~
3. Sanitaire, Milwaikee, WI
4. Aercor, Sterling, MA

1.3 SUBMITTALS

A. Submit shop drawings and manufacturer's literature.

PART 2 - MATERIALS AND EQUIPMENT

2.1 AIR DIFFUSER ASSEMBLIES

A. The air diffuser manufacturer shall supply the diffusers, supports, support pedestal, anchor bolts, flanges, gaskets and other necessary appurtenances. The diffusers shall be Wilfley Weber Model CBS-24-OB, or equivalent.

SECTION 11387 - CENTRIFUGAL AIR BLOWER

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all labor, materials, tools, and equipment to furnish multi-stage centrifugal blowers as shown on the Drawings and specified herein. The blower equipment shall be used for the equalization and sludge holding tanks. The equipment and controls specified in this Section shall be provided by a single supplier as a complete package to ensure adequate coordination and system compatibility.

1.2 WORK INCLUDED

A. Six (6) blowers and respective constant speed electric motor drivers.

B. All appurtenances as described herein which are required for proper operation of the centrifugal blower.

C. Manufacturers' or manufacturers' authorized representative field services.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications - Manufacturers proposing to furnish equipment for this Section shall have demonstrated long standing experience and ability in the design, manufacture and installation of similar units conforming to the Specifications.

B. Available Manufacturers - Subject to compliance with the requirements, provide the following:

1. Hoffman Air and Filtration Systems, Syracuse, N.Y. (Basis of Design)

    a) (2) - Model No. 74109 Equalization Tanks
    b) (3) - Model No. 75107 Sludge Holding Tanks
    c) (1) - Model No. 75103 Air Scour Blower

2. Roots
3. ~~Sutorbilt~~
4. ~~Tuthill~~
5. Or Equal

1.4 SPECIAL DEFINITIONS

A. SCFM: *Standard cubic feet per minute* is understood to be air at 68 degrees F, 14.7 psia, and 36 percent relative humidity flowing at a rate of 1 cubic foot per minute.

B. ICFM: The volume of air *in cubic feet per minute* (cfm) actually entering the blower or filter inlet at the atmospheric condition specified.

C. Discharge Pressure: The pressure in *pounds per square inch gauge* (psig) at the blower discharge flange.

D. Overall Efficiency: The total efficiency for the motor, drive, and blower from the motor terminals to the pumped air.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PERFORMANCE REQUIREMENTS

A. Each blower shall be installed indoors and shall be shielded from weather. All components of the systems as specified herein shall be suitable for permanent installation and continuous operation. The blower equipment has been designed around the listed manufacturer's system.

B. Each blower shall be capable of providing the following air volumes measured at 68 degrees F, 14.7 PSIA, and 36 percent relative humidity when operated at an elevation of 0-feet, inlet pressure of 14.7 PSIA, inlet air temperature of 100 degrees F, 36 percent relative humidity:

Location	Equalization Tank	Sludge Holding Tanks	Sand Filters
Quantity	2	3	1
Model No.	74109	75107	75103
Air Flow - SCFM	1,280	4,010	**4,200**
Discharge Pressure - PSIG	10	10	3
Blower Horsepower (Not to Exceed)	98	222	81
ICFM	700	2,206	2,000
Drive Motor Horsepower	125	250	100

C. In addition, at a winter temperature of 10 degrees F, the blower horsepower shall not exceed the motor horsepower rating (excluding service factor) at the design flow measured in SCFM.

D. When the volumetric capacity is reduced by at least 45 percent, the blower under the specified inlet conditions shall:

1. develop at least 1.6, 0.95 and 0.95 PSI pressure, respectively, above the specified discharge pressure.
2. not be in surge.

E. The blower shall be selected based upon data previously established by tests in accordance with the ASME power test code for centrifugal compressors, PTC-10.

F. No exceptions to the Performance Requirements stated above shall be allowed.

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accordance with AFBMA Standards for Ball and Roller Bearings, Section 9. The blower manufacturer shall submit calculations to substantiate bearing life.

6. Coupling: Rexnord Omega flexible coupling, with OSHA approved coupling guard. The service factor of the coupling shall be at least 1.5 greater than the motor nameplate rating.

I. Drive Motor:

1. Each blower shall be furnished with a 3 phase, 60 hertz, 460 volt, 3600 rpm, TEFC enclosure, squirrel-cage induction motor with a 1.15 service factor, factory mounted with the blower. The service factor of the motor shall not be used in establishing the nameplate rating. Motors shall be suitable for starting on reduced voltage.
2. Provide motors with a full load efficiency of 95 percent (plus or minus 1 percent) and a full load power factor of 89 percent (plus or minus 1 percent).
3. Motors shall be premium efficiency conforming to all requirements of Section 16150.

2.3 ACCESSORIES

A. The inlet air filter/silencer shall be rated for 120 percent of the blower design ICFM. Filter elements shall be cleanable and replaceable. The inlet air filter/silencer shall be manufactured by JAWS, Inc.

B. Provide a flexible connection on the blower outlet connection. Flexible connection shall be of the single arch, reinforced flanged rubber expansion joint type with a minimum 8-inch laying length. Flexible connection shall be designed to mate with ANSI 125-pound flanges. Blower flexible connection shall have a working pressure of at least 15 psig to 15 inches Hg vacuum and a working temperature of at least 250 degrees F. The connection shall be furnished with stainless steel split rings and the necessary bolts, nuts, and washers. The discharge flexible connection shall be equipped with a control unit (control rods), suitable for mating to the blower outlet connection, to restrict axial pipe movement. Flexible connection shall be Proco, or equivalent.

C. Double disc check valve shall be wafer style, spring loaded with cast or ductile iron body, aluminum, bronze, or ductile iron doors; resilient seats shall be EPDM or Viton and shall be suitable for 250 degree F service; and stainless steel hinge pin and stop pin spring. Valve shall be Duo-Check II, or equivalent.

D. Wafer butterfly valves shall have semisteel bodies with 316 stainless steel disc, Type 316 stainless steel stem, and reinforced TFE or TFE coated packing material and EPDM resilient seat shall be suitable for 250 degree F service. Valves shall be suitable for mounting between ANSI 125-and 150-pound flanges. Valves shall be hand lever actuated. **The wafer butterfly valves specified in this paragraph shall be used with the blowers and air piping specified in this section. AWWA valves are not required for the air blowers and piping in this section.**

E. Discharge pressure gauge: Pressure gauge shall have a nominal 2-inch dial and accuracy of 2 percent (plus or minus) of span. Unit shall have a 1/4-inch NPT connection through the bottom. Units shall be Ashcroft, or equivalent.

2.12 SURGE PROTECTION - POWER, ANALOG SIGNAL

A. All electronic systems, equipment and devices provided in this contract shall be protected from surges.

B. These protective devices shall be external to and installed in addition to the protective devices built into the equipment. Power and signal protection shall be installed in either in a NEMA 4X enclosure or in the enclosure which houses the equipment to be protected.

C. Power line surge protection shall be Ditek Inc., Largo, FL.

D. Analog signal wiring protection shall be Joslyn signal line surge protectors.

2.13 LATCHING RELAYS

A. The motor controls for motors which are controlled by a PLC shall be designed to operate using a latching relay. The PLC shall be provided with two separate discrete outputs to control each motor: one to start the motor and the other to stop the motor. The outputs shall be designed to latch or unlatch a mechanical latching relay, so that the motor will continue to operate in it's last state, even when the PLC is shut down.

B. The latching relay shall be installed in the appropriate SCADA panel, and a contact of the relay shall be wired to the Hand-Off-Auto selector switch of the motor controls.

C. The latching relay shall be Square-D type KL or approved equal.

2.14 FLANGED TUBE METER

A. Flanged TUBE Meters shall be propellor flow transmitters fabricated into a flanged steel pipe spool. Flange ends shall be 150 pound class D flat face steel flanges. Fabricated steel meter tubes shall be equipped with straightening vanes and shall be protected inside and out with twelve (12) to fifteen (15) mils of fusion epoxy resin. Propellor shall be magnetically coupled with a drive mechanism through a sealed, oil-filled gearbox. Meters shall meet or exceed AWWA standard C704. Meters shall be equipped with a local totalizing register with protective cap. Meters shall also be equipped with an analog transmitter which shall be configured as an extender below the register. Meters shall be Water Specialties model ML-03-5G, equipped with transmitting totalizer TR-15, **or similar model and equipment from McCrometer, Inc.**

2.15 PROGRESSIVE CAVITY PUMP CONTROLS

A. The SYSTEMS INTEGRATOR shall coordinate the integration of protective devices supplied by the pump manufacturer. Control features shall be provided as described herein. A temperature switch imbedded in the motor shall be wired to the starter, to stop the motor from running if the motor overheats. The temperature sensor shall be wired to stop the pump and to provide an alarm to SCADA.

D1248, ASTM D2737, NSF-14 and AWWA C901. All tubing supplied shall be DR-9, C.T.S., with a 200 psi operating pressure at 73.4°F. Approved Products: Driscopipe 5100, Endot/Yardly-Blue Jet.

H. Plastic Pipe shall be colored blue for potable water, green for wastewater and lavender (Pantone 522C) for reclaimed water. **HDPE pipe for reclaimed water services may be colored white or black with lettering identifying its intended usage or with a lavender stripe painted or taped on the pipe every two linear feet.**

I. Thermal Insulation for PVC Pipe Carrying Liquid Sodium Hydroxide. Pre-formed one-piece sections of fiberglass (minimum density 4 pounds per cubic foot) insulation for pipe and fittings, K-factor of 0.24 BTU-in per hr-. sq. ft-. ° F at 75°F complying with ASTM C585 dimensionally and ASTM E84 for surface burning characteristics of 25/50. Materials shall be Micro-Lok Type AP-T as manufactured by Manville Corporation, TMZ 250 as manufactured by Accessible Products Company, Snap-On as manufactured by Certainteed, or Equal. Pipe and fitting insulation indoors and outdoors shall be covered with a preformed PVC fitting cover. Materials shall be Zeston 2000 as manufactured by Manville Corporation, Thermazip 300 as manufactured by Accessible Products Company, Snap-Form Pipe Fitting System as manufactured by Certainteed, or Equal. Insulation thickness shall be ½-inch for PVC pipe ½" to 3" in diameter. All PVC pipe used for conveying sodium hydroxide (NaOH) solutions shall be insulated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pipe shall be examined for defects, damage, dirt and debris in pipe. Clean if necessary. Discard and remove defective materials. Reject materials found unsatisfactory.

3.2 INSTALLATION

A. Install PVC, CPVC, PVDF, and HDPE pipe in accordance with the manufacturer's recommendations. Allow solvent weld joints to cure at least 24-hours at temperatures above 40° F before placing in use. Install insulation per manufacturer's recommendations.

B. Pipe shall be installed in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.3 TESTING

A. Test completed piping system in accordance with the requirements of Section 01660 - Testing Adjusting and Balancing of Systems.

END OF SECTION

E. Valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with current AWWA Standard C-507 Section 8, Paragraphs 8.1, 8.3, and 8.5 and AWWA Standard C-504, Section 10.

2.2 BUTTERFLY VALVES

A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves except for those specified hereinafter, shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, American, Kennedy, Mueller, or equal. Butterfly valves for reclaimed water high service pumps shall be Class 150. The valve discs shall be constructed of ductile iron conforming to ASTM A536, Grade 65-45-12 for Class 150 or less and for Class 250.

B. The face-to-face dimensions of flanged end valves shall be in accordance with AWWA Standard Specification C504 for short-body valves. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1. Mechanical Joint end valve dimensions shall be in accordance with AWWA Standard Specification C504.

C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8 inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where rubber seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where rubber seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housing of the through boss-type. Butterfly valves of the "wafer": or "spool" type will not be accepted.

E. The valve shaft shall be turned, ground, and polished, constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The Class 150 valves shall be tested in conformance with AWWA C504. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve

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MANATEE COUNTY GOVERNMENT

FINANCIAL MANAGEMENT DEPARTMENT
PURCHASING DIVISION
"TO SERVE WITH EXCELLENCE"

OFFICIAL Copy

FACSIMILE

May 21, 1999

TO: All Interested Bidders

SUBJECT: Invitation for Bid #99-2691-DC
Southeast Regional Wastewater Treatment Plant Expansion

ADDENDUM #2

Bidders are hereby notified that this Addendum shall be acknowledged on page 00300-2 of the Bid Form and made a part of the above named bidding and contract documents.

The following items are issued to add to, modify, and clarify the bid and contract documents. These items shall have the same force and effect as the original bidding and contract documents, and cost involved shall be included in the bid prices. Bids to be submitted on the specified bid date, shall conform with the additions and revisions listed herein.

1. CLARIFICATION:
All material supplied under this contract and specifications shall be warranted by the Contractor and the manufacturers for a minimum period of three (3) years unless a longer warranty period is specified in the individual specification section, in which case, the longer warranty period shall be provided. This provision supersedes any references to shorter warranty periods as contained in Article 9 of the General Conditions, Section 01030 - Special Project Procedures and/or other sections of the Contract Documents.

2. Section 03361 - Circular Prestressed Concrete Tanks
Page 03361-7, paragraph 2.10.A.1(a). Replace "T-6061 aluminum" with "fiberglass".
Paragraph 2.10.A1(b). Replace "316 Stainless Steel" with "fiberglass".

3. Section 1131 - Waste Sludge Pumps
Page 11311, paragraph 1.2.C. Add the following:
"Horizontal or vertical pumps with direct drives may be substituted as long as they have the design capacities, are compatible with variable frequency drives, fit the space allocated, and can conveniently connect to suction and discharge piping. Contractor shall submit piping layout to Owner's Representative for approval."

<addendum.LET>

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Addendum #2, page 4

DRAWINGS: (cont'd)

Sheet No.	
C-9	Fitting No. 131 taps into a 6-inch PVC reclaimed water line.
C-11	Added leachate pump station connection to existing 6-inch leachate force main
C-12	10-inch PVC pipe beginning at SC-MH#2, 80 linear feet in length to the cleanout, is perforated.
C-16	Fitting No. 90 is an 8-inch mechanical joint 11-1/4 degree bend.
C-16 & 17	Added 6" potable water line from existing fire hydrant extending south.
	Added fire hydrant to 6" potable water line southeast of proposed sludge storage.
C-20	8" LC running north-south on east side of plant is an 8-inch PVC pipe with no perforations. Delete Item identification No. 87.
	"Fitting No. 19. Remove 42" cap or plug.
C-21	Item No. 77 on the 12-inch reject pipeline is a 12-inch 90-degree bend.
C-30	Above ground Master Meter detail: Add Note 8 as follows: "8. Flowmeter shall be Badger 6" Recordall Compound Meter, or equal. Provide 8" X 6" reducers with meter."
L-1	Delete proposed fire hydrants shown connecting to the existing 8" reclaimed water main.
L-3	Add "Type D Curb" detail. Add "Type D Curb" to parking stall.
M-1 & 2	Provide 6-inch concrete walls as shown on Sheet Nos. S-1 and S-2.
S-3 & 5	Plan at Elevation 58.00 and Section 1.
	Delete the concrete slab over the overflow channel and cover with aluminum checkered plate as shown on Sheet No. M-5.

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Addendum #2, page 5

DRAWINGS: (cont'd)

Sheet No.

S-21 Filter Top Plan. East wall of filter. Replace elevation 42.75 with 42.25.

S-22 Section 3. The steel reinforcing #4 @ 12" O.C. each way, top and bottom shown above the concrete base slab is in the concrete base slab. The elevation of the top of the concrete base slab is 28.50. Replace vertical dimension 15' - 6-1/4" with 13' -9".

Section 4 - Replace vertical dimension of 14' - 61/4" with 13' - 9".

S-29 Section 1 - Replace floor slope of "12/0.5" with "12/1".

M-7 16' X 5' and 12' X 5' concrete slabs are 6-inches thick with 6 X 6 #10/#10 W.W.F. 6-inch Return Activated Sludge pipe and 8-inch leachate pipe run up the exterior wall of the flow equalization tank using pipe supports similar to Detail B, Drawing No. M-8. At the top of the wall, each pipe makes two (2) 90-degree bends into the interior of the tank. Each pipe ends one (1) foot below the top and on the interior side of the flow equalization tank.

E-2 1. INSERT "Notes ⑥ Install the WWTP plant wide fiber optic data highway. See drawings I-1, I-2, and I-3 for specific requirements."

2. For SCADA panel 1-4 (SP-4) DELETE "Homerun to SP-4, INSERT "Homerun to PIC." See drawings E-34 and I-5 for PIC location and installation requirements.

3. INSERT "Notes ⑦ All existing loads shown served by MCCs 9 and 10 shall remain in service at all times. The CONTRACTOR shall provide new conduit and wire to these loads if construction conflicts require the existing feeders to be removed from service.

4. INSERT "Notes ⑧ See drawing I-2 for date highway routing. Feeder FO-5 shall be routed through SP-1 to the PIC."

5. "The CONTRACTOR shall relocate the existing FP&L overhead from the FP&L service pole located in the southwest corner of the site north past the new sludge storage tank No. 1. Contact Mr. Jim Moon, FP&L, 941-739-3307 for specific costs and Contractor requirements. Field investigation prior to bid is required."

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Addendum #2, page 6

DRAWINGS: (cont'd)

Sheet No.

6. INSERT "L2" for homerun from reject pump station No. 2 to "L".

E-3 1. PROVIDE NEMA 4X stainless steel junction box at the base of the 4" pedestal used for gate operator mounting. Install the 2-50 VA transformers for gate power in this enclosure.

2. PROVIDE 2#14-3/4" from each gate operator to the motorized gate.

3. DELETE "1-3/4" with telephone cable to PIC" and INSERT "1-3/4" with 2-2 pr telephone cables to PIC."

4. Gate Operator System Notes: DELETE Note ①. INSERT "Note ① Provide and install two (2) Sentex mini key digital lighted keypad (100 code). Systems shall be wired in series with telephone cables routed to telephone board point of demarkation in the existing control building.

E-4 1. For VFD-108, 109, 110, and 111, DELETE "3-350 MCM, 2#12 and 1#3/0 GND-3" from the VFD to the existing effluent pumps and INSERT "2-3" with 3-350 MCM, 6#12 and 1#3/0 GND-3."

2. INSERT "Notes ⑤ Provide and install an auxiliary contact in the existing effluent pump motor disconnects. Contact shall open when disconnect is opened.

E-5 1. For VFD-112 and 113, DELETE "2-3" with 3-350 MCM, 2#12 and 1#1/0 GND each" from the VFD to the effluent pumps. INSERT "2-3" with 3-350 MCM, 6#12 and 1#1/0 GND-each.

E-11 1. For VFD-301, 302, 303, 304, 305, and 306 DELETE "3#10 and 1#10 GND-1" from the VFD to the sludge feed pump motors and INSERT "3#10, 4#12 and 1#10 GND-1"."

E-13 1. For VFD-101, 102, and 103 DELETE "3#1/0, 2#12 and 1#6 GND-2"" from the VFD to the RAS pump motors and INSERT "3#1/0, 6#12 and 1#6 GND-2"."

2. For VFD-104, 105, 106, and 107 DELETE "3#10 and 1#10 GND-1"" from the VFD to WAS pumps motors and INSERT "3#10, 4#12 and 1#10GND-1"."

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Addendum #2, page 7

DRAWINGS: (cont'd)

Sheet No.

E-18 1. INSERT "Effluent pump VFD elementary control diagram." See the attached drawing SK-E1.

E-21 1. From termination cabinet 12 to SCADA panel-2 (SP-2) PROVIDE "1-6 pair 2/c#16SH cable-2" RA."

2. From termination cabinet C2 to SCADA panel-2 (SP-2) PROVIDE "1-37/C#14-2".

E-22 1. INSERT "notes ① The 3" aerator 3A, 3B, and 3C motor feeder shall NOT be slabbed in the walkway as shown. These conduits shall be mounted to and supported from the basin walkways."

E-26 1. For the WAS pump flow element (FT-131) DELETE "1, 2/C#16SH-3/4" (RA) to 13." INSERT "1, 2/c#16SH-3/4" (RA) to SP-1."

2. From termination cabinet 13 to SCADA panel-1 (SP-1) PROVIDE "1-2" empty (RA)".

3. From termination cabinet C3 to SCADA panel-1 (SP-1) PROVIDE "2-37/c#14-3".

E-33 1. PROVIDE the following additional conduit and wire.
   a. 20#14-1" from generator #3 control panel (GCP3) breaker #3 (GB3)
   b. 6#12-1" from GCP3 to GB3
   c. 7 pairs 1-3/c#16SH-2" from GCP3 to GB3
   d. 2#10-1" from GB3 to 48 volt battery power

2. Show a generator battery charger adjacent to the radiator heater disconnect.
   a. PROVIDE "2#12 and 1#12 GND-3/4" from battery charger to panel L1."
   b. PROVIDE "2#6-1" from generator battery rack to generator No. 3 starting circuit."
   c. PROVIDE "1-37/c#14-2" from MCC-11 to SP-1."
   d. PROVIDE "1-37/c#14-2" from MCC-12 to SP-1."
   e. INSERT "Notes ① The Contractor shall develop a detailed sequence of construction for the work shown on this drawing. The Contractor is responsible for ALL costs associated with providing the temporary relocation of all power distribution and control equipment that is required to facilitate

SEWRTP-IFB 99-2691-DC
Addendum #2, page 8

DRAWINGS: (cont'd)

Sheet No.

the implementation of the new work depicted by the drawing. The following provides an overview of the required work:

- Build new electrical building addition
- Relocate existing effluent pump VFDs 108, 109, 110, and 111. Refeed the VFDs temporarily from the existing effluent pump MCC and existing switchgear.
- Relocate the isolation transformers and refeed from the existing switchboard. Relocate the existing effluent pump and reuse on a temporary basis if required. Provide weatherproof shields for the isolation transformers.
- Temporarily relocate the effluent pump CP to the new electrical room. This unit must remain in service until SCADA panel-1 is operational.
- Demo the existing VFD room and rehab as required.
- Install new electrical equipment and feed all equipment as shown on the drawings.
- Remove all MCCs noted to be removed.
- Demo wall behind MCC-2

E-34

1. PROVIDE "2-37/c#14-3" from MCC-1 to SP-2."

2. PROVIDE "2-37/c#14-3" from MCC-2 to SP-2."

3. PROVIDE "2-37/c#14-3" from MCC-3 to SP-2."

4. PROVIDE "2-37/c#14-3" from MCC-4 to SP-2."

5. PROVIDE and install a Tork 8001L timer. Mount adjacent to PC/TC-2A. PROVIDE 2#12 and 1#12 GND-3/4" to L2 and 2#14-3/4" to PC/TC-2A."

6. For "Partial Control Building Plan - See I drawings for additional conduit and wire requirements."

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DRAWINGS: (cont'd)

Sheet No.

E-35	1.	PROVIDE "1-37/c#14-2" from MCC-7 to SP-3."
	2.	PROVIDE "1-37/c#14-2" from MCC-8 to SP-3."
E-36	1.	PROVIDE "1-12 pair 2/c#16SH-2" from I-4 to SP-4."
	2.	PROVIDE "1-37/c#14-2 from C-4 to SP-4."
E-37	1.	Relabel panel "PC/TC-3A" to "PC/TC-3."

If you have submitted a bid prior to receiving this addendum you may request in writing that your original, sealed bid be returned to your firm. All sealed bids received will be opened on the date stated.

THIS ADDENDUM MUST BE ACKNOWLEDGED AND THE REVISED BID FORM PAGES SUBMITTED IN ORDER FOR YOUR BID TO BE CONSIDERED RESPONSIVE.

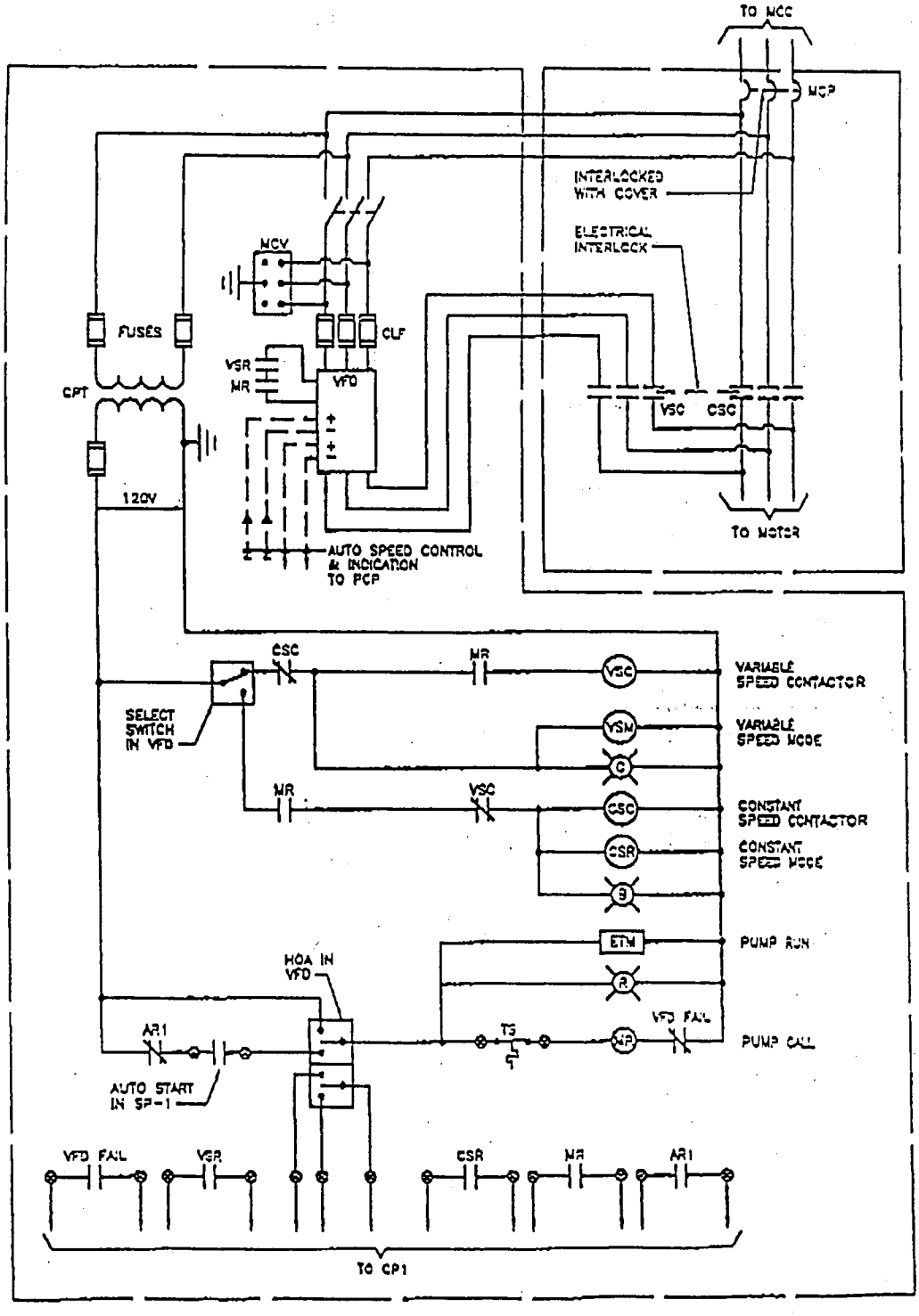
Bids will be received at Manatee County Purchasing, 1112 Manatee Avenue West, Bradenton, Florida 34205 until **3:00 P .M., May 28, 1999.**

Sincerely,

R.C. "Rob" Cuthbert, C.P.M.
Purchasing Division Manager

RCC:MP

11387	Centrifugal Air Blower		( )	Hoffman
			( )	Roots
			( )	
			( )	
		Alternative Product	( )	
11500	Wet Scrubber Odor Control System		( )	Duall
			( )	RJ Environmental
		Alternative Product	( )	
15102	Power Actuating Devices for Valves		( )	Limitorque
			( )	EIM
			( )	Rotork
16106	480 Volt Switchgear		( )	Cutler Hammer/ Westinghouse
			( )	Square D
			( )	General Electric
16216	Diesel Engine Driven Generator	No Substitutions		Caterpillar
16370	Variable Frequency Drives		( )	Allen Bradley
			( )	Square D
			( )	Asea Brown Boveri
16921	480-Volt Motor Control Centers		( )	General Electric
			( )	Square D
			( )	Cutler Hammer
		Alternative Product	( )	



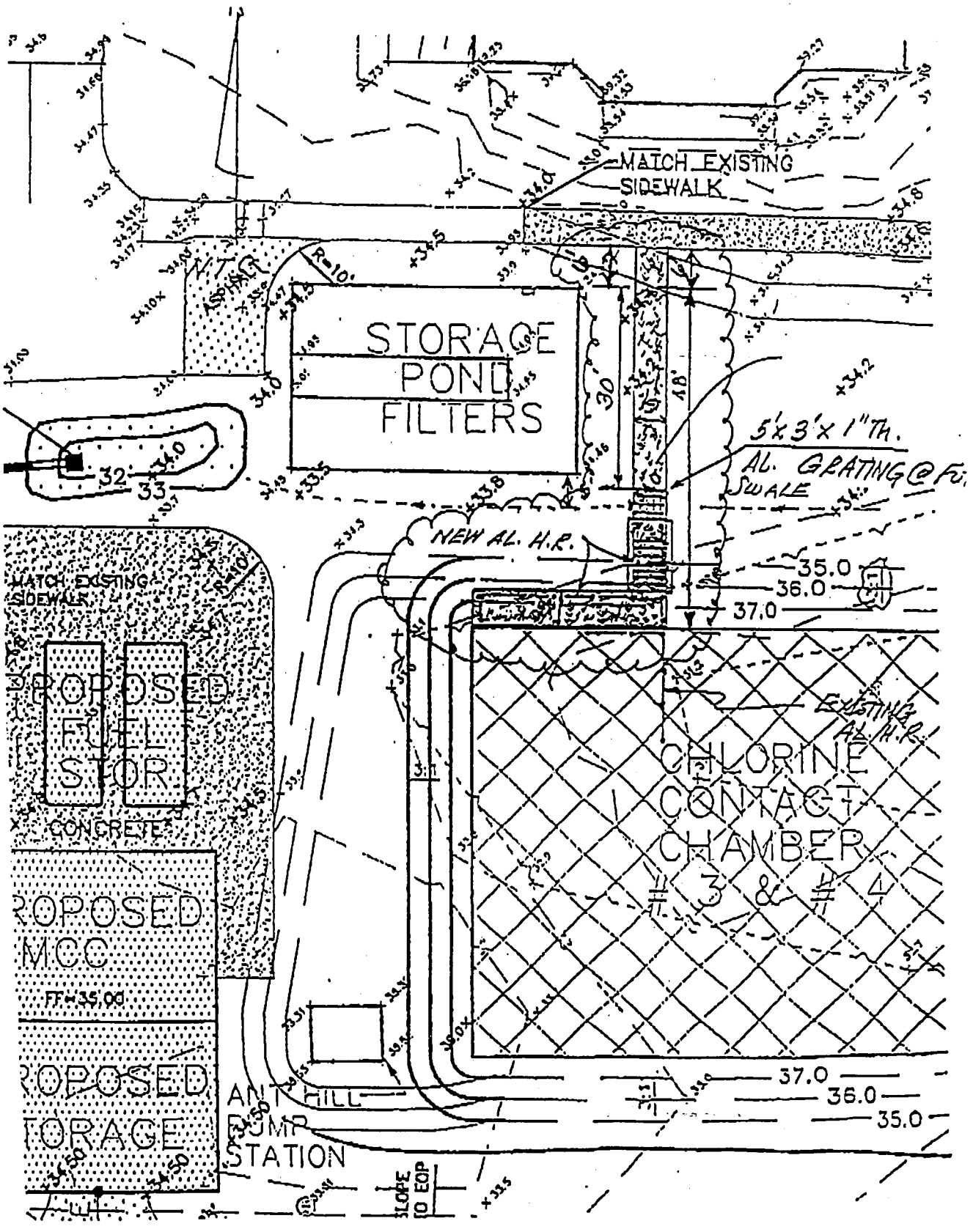
EFFLUENT PUMP VFD ELEMENTARY CONTROL DIAGRAM

SOUTHEAST REGIONAL WWTP EXPANSION
MANATEE COUNTY
EFFLUENT PUMP VFD
ELEMENTARY CONTROL DIAGRAM

McKIM & CREED
CLEARWATER FLORIDA

SK-E1

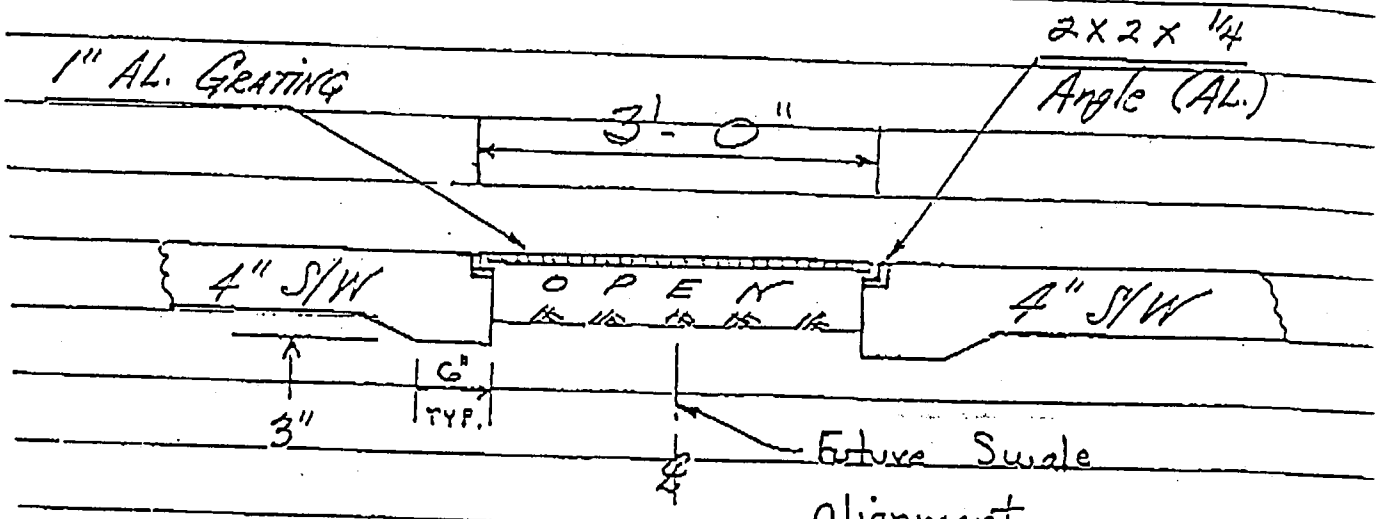
H:\DRAWINGS\SK-E1.dwg Plot: 5/17/99



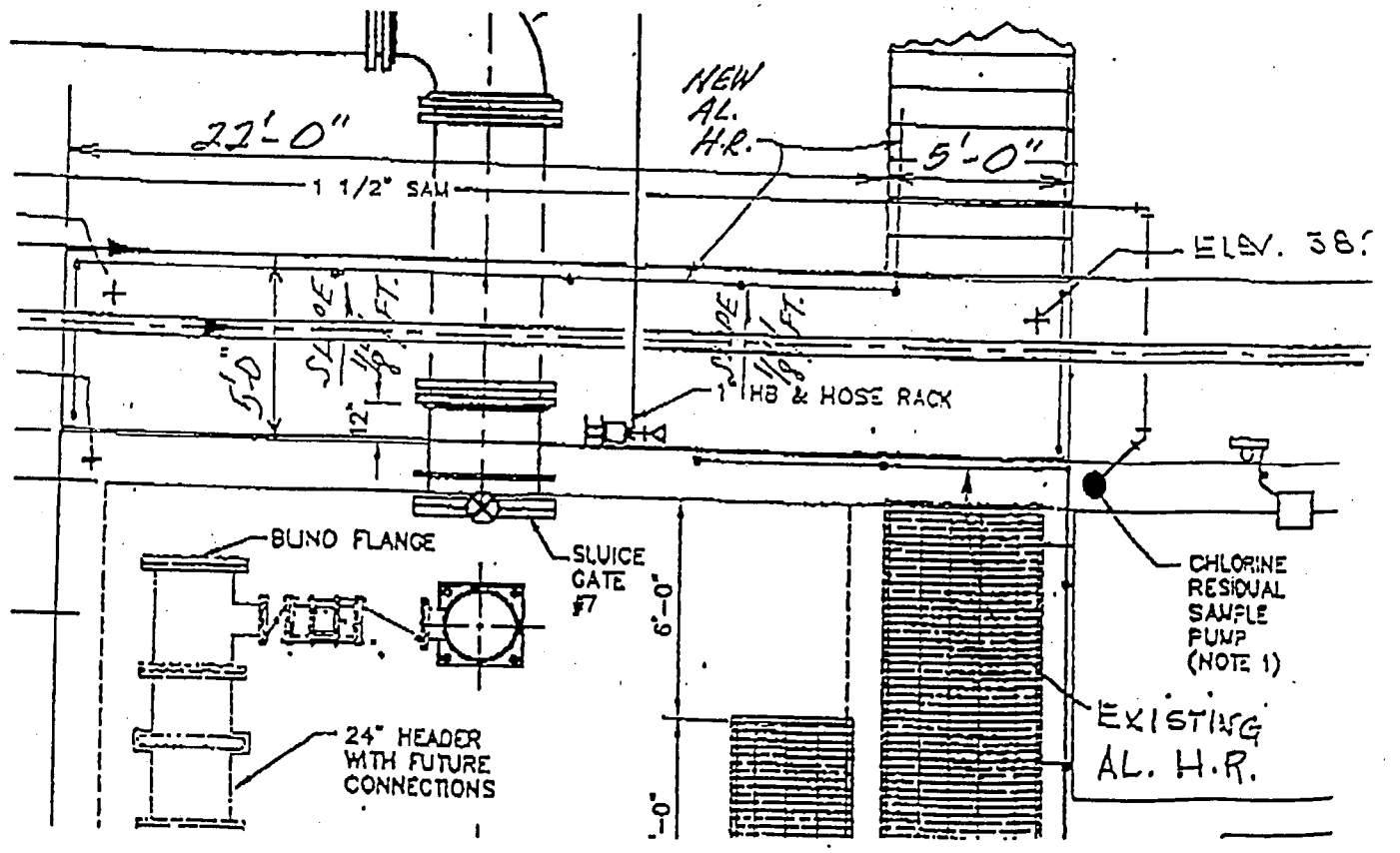
MCKIM & CREED

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY



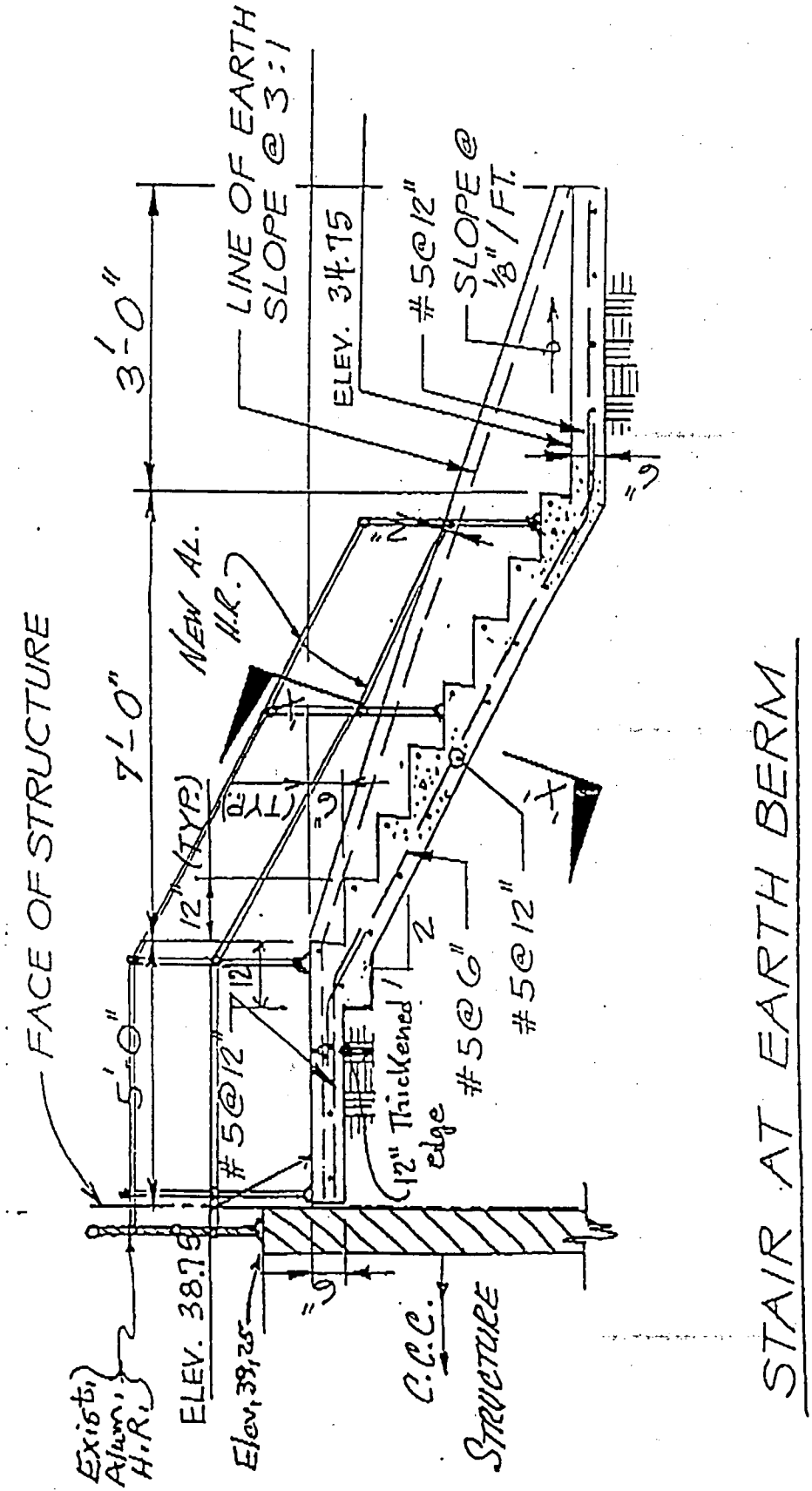
- DETAIL @ GRATING -
- N.T.S. -



McKIM & CREED

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY

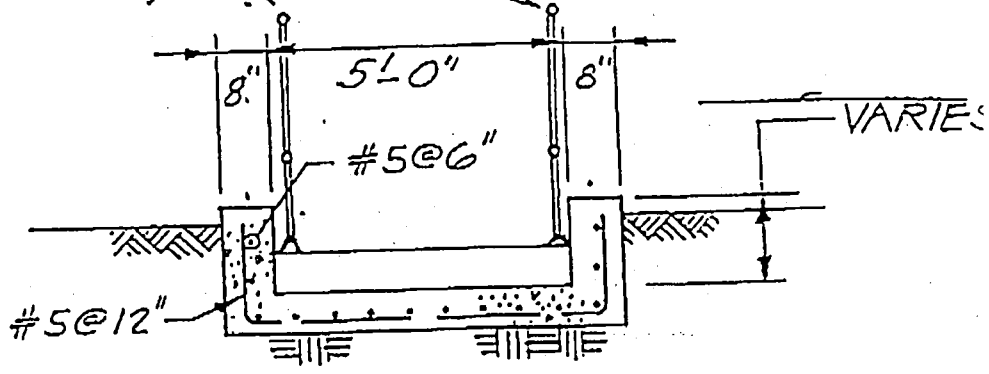


McKIM & CREED

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY

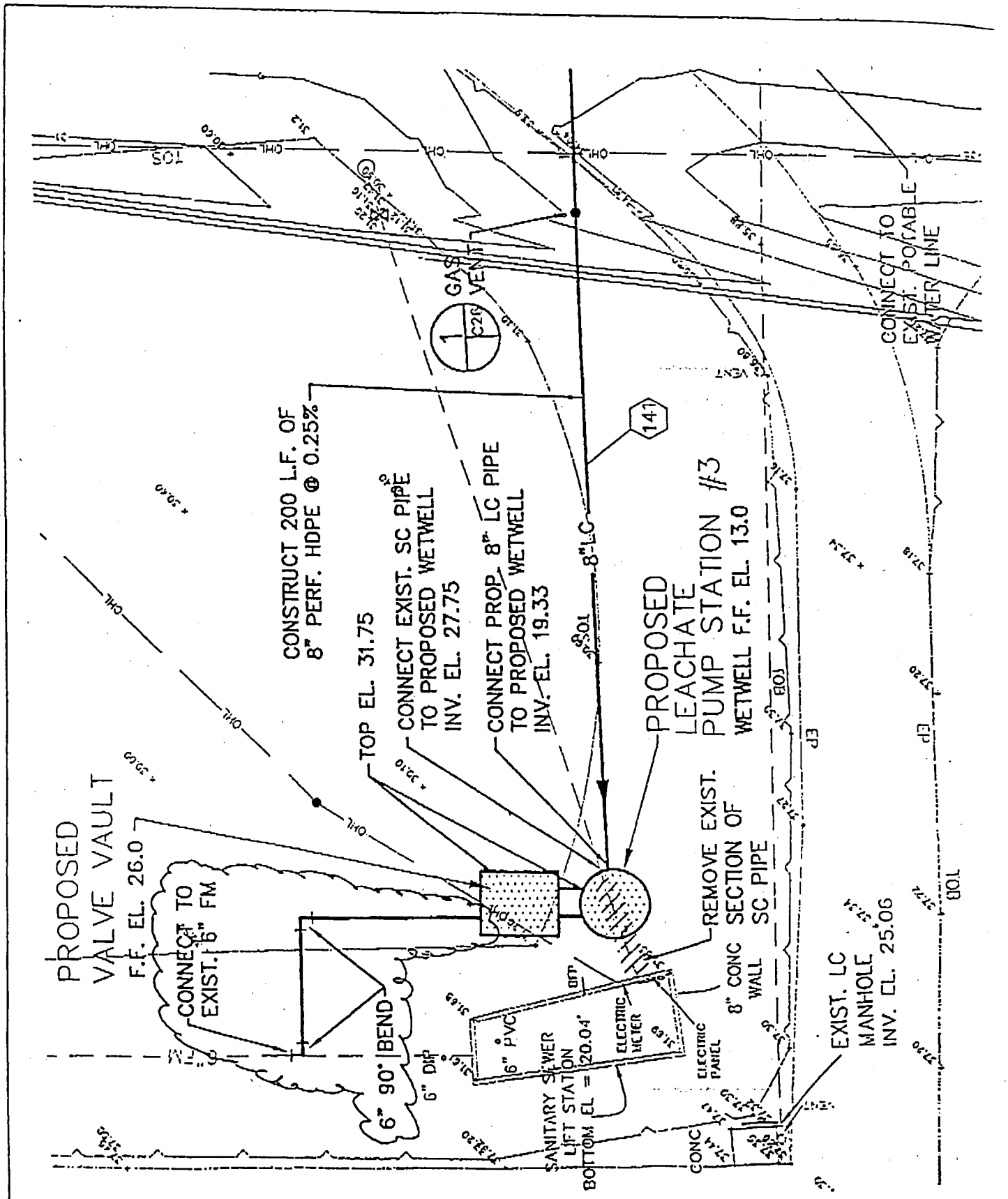
(Aluminum Handrail Per Plan Sheet M-G.)



SECTION X-X

"NOTE":

4" Thick, 3,000 p.s.i., Class I Concrete reinforced with 6x6, No. 10 Mesh



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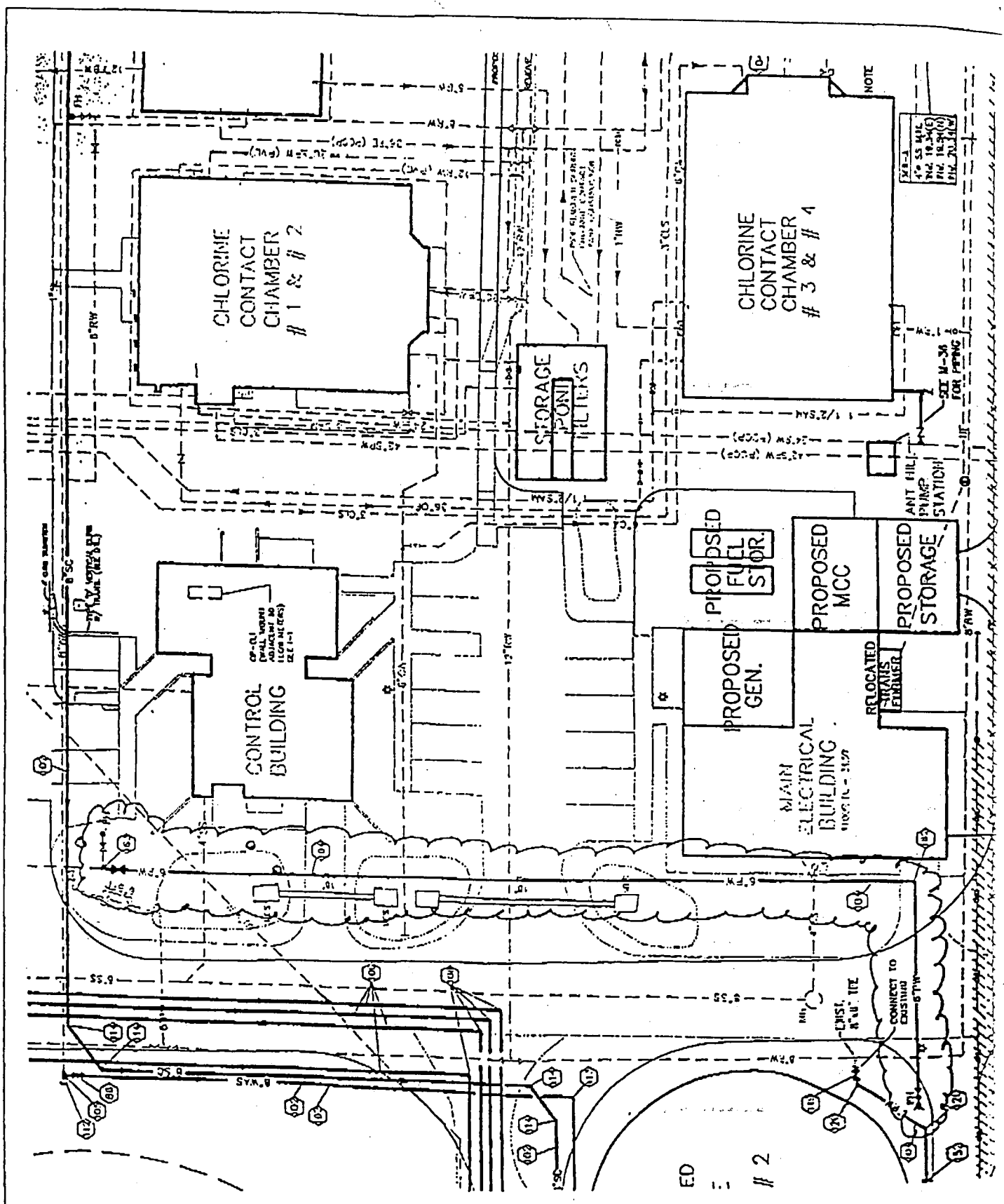
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY



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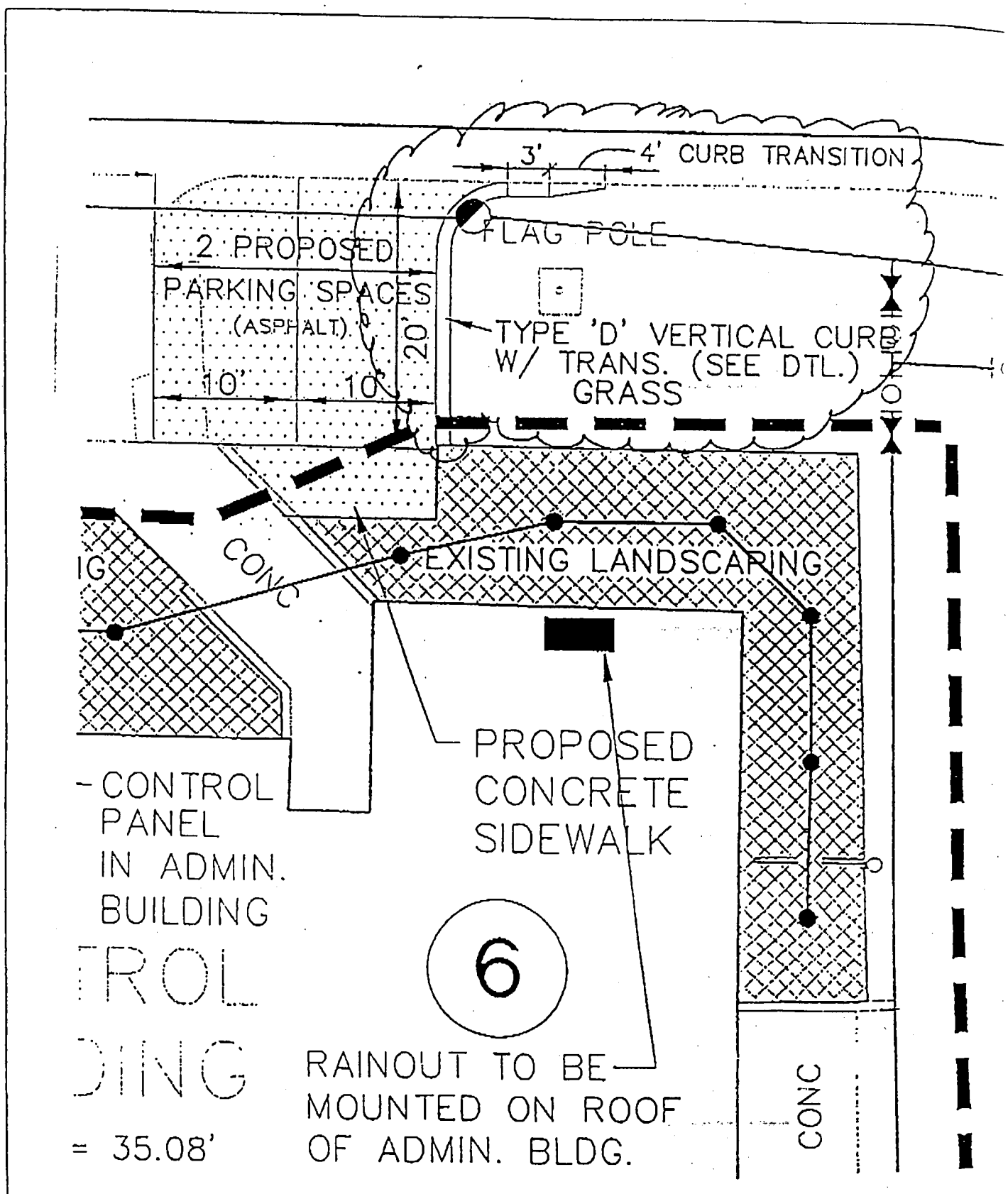
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY

ADDENDUM No. 2



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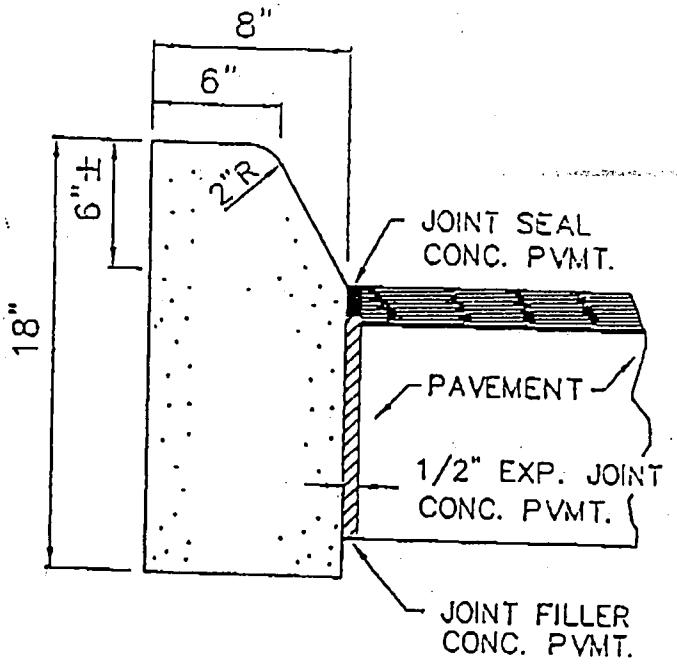
SOUTHEAST REGIONAL WASTEWATER
TREATMENT PLANT EXPANSION

MANATEE COUNTY

ADDENDUM No. 2

1-3



TYPE 'D' CURB

NTS

NOTES

1. CLASS I CONCRETE, 3000 PSI AT 28 DAYS.
2. CURB TO MEET SPECIFICATIONS ESTABLISHED BY FLORIDA D.O.T. STANDARD SPECIFICATIONS.

MANATEE COUNTY GOVERNMENT
FINANCIAL MANAGEMENT DEPARTMENT, PURCHASING DIVISION
"TO SERVE WITH EXCELLENCE"

FACSIMILE

- OFFICIAL Copy -

May 25, 1999

TO: All Interested Bidders

SUBJECT: Invitation for Bid #99-2691-DC
Southeast Regional Wastewater Treatment Plant Expansion
ADDENDUM #3

Bidders are hereby notified that this Addendum shall be acknowledged on page 00300-2 of the Bid Form and made a part of the above named bidding and contract documents.

The following items are issued to add to, modify, and clarify the bid and contract documents. These items shall have the same force and effect as the original bidding and contract documents, and cost involved shall be included in the bid prices. Bids to be submitted on the specified bid date, shall conform with the additions and revisions listed herein.

1. Section 16050 - Electrical -General Provisions
Page 16050-2, paragraph 1.2.D, Delete in its entirety and replace with the following:
Manatee County will pay charges by Florida Power & Light associated with the utility company's costs for the relocation of overhead power. All other installation and coordination costs required of the Contractor shall be included in the bid.

If you have submitted a bid prior to receiving this addendum you may request in writing that your original, sealed bid be returned to your firm. All sealed bids received will be opened on the date stated.

THIS ADDENDUM MUST BE ACKNOWLEDGED ON THE BID FORM IN ORDER FOR YOUR BID TO BE CONSIDERED RESPONSIVE.

Bids will be received at Manatee County Purchasing, 1112 Manatee Avenue West, Bradenton, Florida 34205 until **3:00 P .M., May 28, 1999.**

Sincerely,

R.C. "Rob" Cuthbert, C.P.M.
Purchasing Division Manager

RCC:MP

Post-it® Fax Note 7671	Date 5/25	# of pages ▶ 1
To TIM STREET	From MARGE	
Co./Dept.	Co.	
Phone #	Phone #	
Fax #	Fax #	

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END TOC

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The work consists of the construction of the following improvements:

1. Expand the existing headworks structure to incorporate a new channel with a new mechanical bar screen, including relocation of an existing grit dewatering unit and construction of a new dumpster building.

2. Construct a new flow splitter box with returned activated sludge and overflow channels, flow equalization tank return pumps, flow equalization tank recircluation pumps, and monorail hoist system.

3. Install a new odor control system for the headworks and flow splitter box including air exhaust ducts, air scrubber, air exhaust blower, chemical feed pumps, chemical storage tanks, and secondary containment basins.

4. Construct a flow equalization tank with a recirculation system and aeration system, including blowers, electrical/blower building, air piping, air diffusers, recirculation piping, and eductors.

5. Add a third anoxic basin and oxidation ditch to expand aeration and treatment capacity. Provide two additional mechanical aerators for the two existing oxidation ditches.

6. Construct modifications to the existing clarifier flow splitter box, including connection to a new 42-inch mixed liquor pipe and connections to the two new clarifiers.

7. Add two new clarifiers, each with a diameter of 110-feet, including a new scum ejector station for each new clarifier.

8. Construct two new automatic backwash sand filters, each 16-feet by 90-feet, including air scour equipment, blowers, compressors and blower building.

9. Construct two new return activated sludge control boxes, including control valves, piping, and stairway.

10. Replace existing three return activated sludge pumps with larger pumps operated by VFD's, including associated piping. Install a monorail hoist system for removing pumps, including structure modifications.

11. Replace the two existing waste activated sludge pumps with new pumps with VFD's. Install two additional new pumps with VFD's including associated piping renovations.

12. Replace the existing dissolved air flotation sludge thickeners with new rotary drum thickeners and associated building, chemical feed systems, structural supports and piping.

13. Construct two new aerated sludge holding tanks and aeration systems with new blowers, blower building, air piping and diffusers. Provide and install 6 new progressive cavity sludge pumps.

14. Construct new reclaimed water pumping systems to enable pumping to ground storage and/or to reclaimed water transmission mains.

15. Construct two new aboveground effluent flow metering stations.

16. Construct a new lined reject storage pond with a new reject pumping station.

17. Construct a new plant drain submersible pumping station.

18. Install yard piping and valves.

19. Upgrade and expand the electrical systems to all the new process components and equipment. Included are new and upgraded duct banks, expanded switchgear and motor controls expansion of the Electrical Building, a new emergency generator, two new aboveground fuel storage tanks, and three satellite electrical buildings.

20. Install new instrumentation and control systems.

21. Construct a new storage area for plant spare parts resulting from plant expansion.

22. Provide site grading, drainage, paving and stormwater management facilities.

23. Construct new access road to the SERWTP from Lena Road with associated drainage, lighting, 8-inch potable water main, 30-inch reclaimed water main, leachate underdrain piping, and leachate pump station.

24. Install new site fencing to control access to the plant site.

25. Construct new culvert under new access road.

26. Construct internal WTP access roads and drives, including lighting and drainage.

27. Install site landscaping.

28. Demolish existing structures, units and equipment, including a portion of the Headworks, one clarifier walkway, a portion of the RAS pump structure cover, the odor control unit at the Headworks, the air flotation sludge thickeners, the aerated sludge holding tanks, Electrical Building walls, and associated piping and electrical work.

B. The Contractor shall furnish all labor, equipment, and incidentals, which are necessary for the full completion of the work whether specifically indicated in the Contract Documents or not. This includes, but is not limited to, miscellaneous concrete, dewatering, workplace safety, cleanup, etc.

1.2 PLANS AND SPECIFICATIONS

A. The Plans and the Specifications indicate the extent and nature of the work to be performed.

B. The Contractor shall coordinate all deliveries with the respective Vendor in a manner not to impede construction on the individual project(s).

C. Plans: When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

D. Copies Furnished to Contractor: The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

E. Supplementary Drawings: When, in the opinion of the County or Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared and five paper prints thereof will be given to the Contractor.

F. Contractor to Check Plans and Data: The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the Owner, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Owner and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

G. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

H. Intent:

1. All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

3. The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.3 MATERIALS AND EQUIPMENT

A. Manufacturer

1. The names of proposed manufacturers, materialmen, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer and Manatee County Project Management for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

3. Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery: The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified.

3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment.

1. The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

2. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

3. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the Engineer and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

4. The Contractor shall, at his own expense, furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

5. Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M.

E. Service of Manufacturer's Engineer: The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.4 SUBMITTALS

A. The Contractor shall submit to the Engineer, within ten days after receipt of Notice to Proceed, a schedule of Shop Drawings Submittals which shall include:

1. The names of proposed manufacturers, suppliers, and dealers,
2. A list of materials and equipment for shop drawing submittals, and
3. Proposed shop drawing submittal dates.

B. The Contractor shall coordinate all submittals with the related Vendor in a manner not to impede construction on the individual project(s).

1.5 CONTRACTS

A. Furnish all the labor and needed materials as ordered on a project basis under the Contract (Agreement).

1.6 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the users of the system or facility. The Contractor shall coordinate his work with the Chief Operator of the SERWTP. There shall be no disruption of the treatment processes which could cause violations of water quality requirements.

B. The Contractor shall construct the work in stages to accommodate the Owner's use of the premises during the construction period; coordinate the construction schedule and operations with the Engineer.

1.7 CONSTRUCTION AREAS

The Contractor shall:

A. Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other contractors.
2. Owner Use.

B. Coordinate use of work site under direction of Owner's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored-products, under Contractors control, which interfere with operations of the Owner or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for operations.

1.8 OWNER OCCUPANCY

A. It is assumed that portions of the work will be completed prior to completion of the entire work. Upon completion of construction in each individual facility, including testing, if the Owner, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the one-year guaranty period shall commence on that date. The Owner has the option of not accepting any individual completed facility, but accepting the entire work as a whole when it is completed and tested.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01015 - CONTROL OF WORK

PART 1 - GENERAL

1.1 WORK PROGRESS

A. The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Proposal. If at any time such personnel appears to the Owner or Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the Owner or Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.2 PRIVATE LAND

A. The Contractor shall not enter or occupy private land, except by permission of the adjacent property owner.

1.3 WORK LOCATIONS

A. Work shall be located substantially as indicated on the drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.4 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades and other means to prevent accidents to persons and damage to property.

1.5 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Owner. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer. No separate payment will be made.

1.6 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work

on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Owner.

B. The protection, removal and replacement of existing physical features within the work area shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Proposal.

1.7 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The express approval of the Public Works Department for potable water utilization shall be obtained in writing. Hydrants shall only be operated under the supervision of Public Works Department personnel. All potable water usage shall be measured using a Public Works Department hydrant meter.

C. The Contractor shall be responsible for paying all water tap fees incurred for the purpose of obtaining a potable water service or hydrant meter.

D. The Contractor may use reclaimed water at the WTP site at no cost after coordination with the Chief Plant Operator.

1.8 MAINTENANCE OF FLOW

A. The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer and Owner two weeks prior to the interruption of any flow.

1.9 CLEANUP

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.10 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.11 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All structures shall be protected in a manner approved by the Owner and Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Owner. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01030 - SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 PROJECT PRECONSTRUCTION MEETINGS

A. The Engineer shall schedule and conduct a preconstruction meeting, monthly progress meetings and specifically called meetings throughout the progress of the work. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents. Engineer will attend meetings to ascertain that the work is expedited consistent with the Contract Documents and construction schedule.

B. The Engineer shall schedule a pre-construction meeting to be held within 15 days after date of Notice to Proceed. Attendance at the pre-construction meeting shall include Owner's Representatives, Engineer, Resident Project Representative and Contractor's Superintendent. The pre-construction meeting shall consist of at least the following items:

1. Distribution and discussion of:

    a) List of major subcontractors and suppliers
    b) Project Construction Schedules
    c) All Utility Company arrangements

2. Critical work sequencing
3. Project Coordination

    a) Designation of responsible personnel
    b) Procedure for communication

4. Procedures and processing of:

    a) Field decisions and field orders
    b) Proposal requests
    c) Submittals
    d) Change orders
    e) Request for Payment

5. Procedures and requirements for maintaining Record Drawings
6. Construction facilities, controls and construction aids

C. The Owner shall schedule and hold periodic meetings with the Contractor as required by the progress of the work. These periodic progress meetings shall be held at the project field office and as determined by the Owner.

1.2 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Owner. The costs for obtaining all permits shall be borne by the Contractor.

1.3 CONNECTIONS TO EXISTING SYSTEM

A. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems as shown on the Drawings or where directed by the Owner. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner.

1.4 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various pipelines, electrical, or other utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines. Cost for relocation of all existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs.

B. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered.

C. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.

D. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Engineer and/or the Owner.

1.5 SUSPENSION OF WORK DUE TO WEATHER

A. Refer to FDOT "Standard Specifications for Road and Bridge Construction", Section 8.

1.6 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.

B. In the event of inclement weather, or whenever Owner shall direct, Contractor will and will cause Subcontractors to protect carefully the work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any portion of work or materials have been damaged or injured by reason of failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.7 POWER SUPPLY

A. Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.8 SALVAGE

A. Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Engineer or Owner and if so shall be protected for a reasonable time until picked up by the Owner. Any equipment or material not worthy of salvaging, as directed by the Owner, shall be disposed of by the Contractor at no additional cost.

1.9 DEWATERING

A. The Contractor with his own equipment shall do all pumping necessary to prevent flotation of any part of the work during construction operations.

B. The Contractor shall, for the duration of the Contract and with his own equipment, pump out water which may seep or leak into the excavations.

C. The Contractor shall submit his proposed dewatering plan, including as a minimum location and size of equipment.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing structures or equipment, the Contractor shall notify the Owner, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide at his own expense all necessary temporary facilities for access to and for protection of, all existing structures. The Owner's personnel must have ready access at all times to the existing structures. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the Engineer.

1.11 CONSTRUCTION CONDITIONS

A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a minimum period of one (1) year, unless otherwise stated in the individual specification section. Warranty period shall commence on the date of Owner acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications.

D. In the event that the manufacturer is unwilling to provide a one-year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty starting at the time of equipment delivery to the job site. This two-year warranty shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01040 - COORDINATION

1.1 PROJECT COORDINATION

A. The Contractor shall provide for the complete coordination of the construction efforts. This shall include but not necessarily be limited to coordination of the following:

1. The work of subcontractors.

2. The flow of material and equipment from suppliers.

3. The effort of equipment manufacturers during test and checkout.

4. The interrelated work with public utilities companies.

5. The interrelated work with the Owner where tie-ins to existing facilities are required.

6. The effort of independent testing agencies.

7. The work of other General Contractors on the same site.

END OF SECTION

SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of Contract Documents.

5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.2 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with specifications and standards for each specific product involved.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products or performance of work.

C. Report unsatisfactory or questionable conditions to Owner. Do not proceed with work until Owner has provided further instructions.

3.2 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of Project from damage.

C. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work and maintain excavations free from water.

3.3 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of contract documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050 - FIELD ENGINEERING AND SURVEYING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying services required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the work of his contract.

1. All survey work required in execution of Project.
2. All costs of construction layout shall be included in the lump sum price contained in the contract.
3. Civil, structural or other professional engineering services specified or required to execute Contractor's construction methods.

1.2 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Section 01010: Summary of Work.

1.3 QUALIFICATION OF SURVEYOR OR ENGINEER

A. All construction staking shall be conducted by or under the supervision of a Florida registered professional land surveyor approved by the Owner. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Owner or Engineer.

1.4 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are designated on the Contract Drawings.

B. Locate and protect control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of control points shall be borne by the Contractor.

1. Make no changes or relocations without prior written notice to Owner.
2. Report to Owner when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
3. Require surveyor to replace Project control points which may be lost or destroyed.

    a. Establish replacements based on original survey control.

1.5 PROJECT SURVEY REQUIREMENTS

A. The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.6 RECORDS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

1.7 SUBMITTALS

A. Submit name and address of registered surveyor to Owner for approval.

B. Submit certificate signed by Registered Surveyor certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01090 - REFERENCE STANDARDS

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Abbreviations and acronyms used in Contract Documents to identify reference standards.

B. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

C. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.2 ABBREVIATIONS, NAMES AND ADDRESSES OF ORGANIZATIONS

A. Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents. Documents noted with [*] shall be maintained on site.

AA	Aluminum Association 900 19th Street, N.W., Suite 300 Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 2700 River Road Des Plaines, IL 60018
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219-0150
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction * One East Wacker Drive Chicago, IL 60601-2001
AISI	American Iron and Steel Institute 1101 17th Street NW, Suite 1300 Washington, DC 20005-2701

ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 179l Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers United Engineering Center 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 550 NW 42nd Avenue PO Box 351040 Miami, FL 33126
CRSI	Concrete Reinforcing Steel Institute * 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
FDOT	Florida Department of Transportation Standard Specifications for Road & Bridge Construction 605 Suwannee Street Tallahassee, FL 32399-0450
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407
MCBC	Manatee County Building Code * Building Department 1112 Manatee Avenue West Bradenton, FL 34205
MCPWD	Manatee County Public Works Department * 4422A 66th Street Bradenton, FL 34210

MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
NAAMM	National Association of Architectural Metal Manufacturers 600 S. Federal Street, Suite 400 Chicago, IL 60605
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Assoc. 2101 L Street N.W., Suite 300 Washington, DC 20037
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077
PCI	Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604-9773
PMBNRMCA	Plant Manufacturers' Bureau of National Ready Mix Concrete Assoc.
SBCCI	Southern Building Code Congress International, Inc. 900 Montclair Road Birmingham, Alabama 35213-1206
SBC	Standard Building Code *
SFPC	Standard Fire Prevention Code
SGC	Standard Gas Code
SMC	Standard Mechanical Code *
SPC	Standard Plumbing Code *
SMACCNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Court House Road Tysons Corner Vienna, VA 22182
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01150 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Proposal section of these specifications. Payment will be made based on the specified items supplied and delivered in the description in this section for each bid item.

1.2 GENERAL

A. All contract lump sum prices included in the Bid Proposal section will be full compensation for all labor, equipment and incidentals to construct the wastewater treatment plant expansion and appurtenances as specified in the Contract Documents under this contract.

1.3 WORK OUTSIDE AUTHORIZED LIMITS

A. No payment will be made for work constructed outside the authorized limits of work.

1.4 PAYMENT

A. Lump Sum Items: Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum item within the limits of work shown or specified.

1.5 COSTS INCLUDED IN PAYMENT ITEMS

A. Separate Payment: No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work.

1. Clearing and grubbing.
2. Trench excavation, including necessary pavement and rock removal, except as otherwise specified.
3. Dewatering and disposal of surplus water.
4. Structural fill, backfill, grading, and related transport costs.
5. Replacement of unpaved roadways, grass (sod) and shrubbery plots.
6. Cleanup.
7. Foundation and borrow materials, except as hereinafter specified.
8. Testing and placing system in operation.
9. Any material and equipment required to be installed and utilized for tests.
10. Pipe, structures, pavement replacement, restoration and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
11. Maintaining the existing quality of service during construction, including any required by-pass pumping.
12. Appurtenant work as required for a complete and operable system.

13. Repair of damaged irrigation piping and sprinkler heads.
14. Maintaining access to treatment plant structures with barriers, lights, signage etc.

B. Cleanup: CONTRACTOR's attention is called to the fact that cleanup is considered a part of the work of construction. No payment will be made until cleanup is essentially complete.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BID ITEMS

Bid Item No. 1 - Mobilization/Demobilization

Definition. Mobilization shall be the preparatory work and operations in mobilizing for beginning work on the project, including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site, and for the establishment of temporary offices, storage buildings, safety equipment and first aid supplies, sanitary and other facilities, as required by the Contract Documents and applicable laws and regulations. The costs of bonds, required insurance, permits and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included in this item. Demobilization shall be the work of removing temporary facilities from the site.

Payment. Payment for mobilization/demobilization shall not exceed 5 percent (5%) of the Bid Price. Partial payments for this item will be made in accordance with the following schedule:

Percent of Original Contract Amount Earned	Allowable Percent of the Lump Sum Price for the Item
After Contract Execution	25
10	35
20	45
30	55
40	65
50	70
60	75
70	80
80	85
90	90
Substantial Completion	95
Final Payment	100

These payments will be subject to the standard retainage provided in the agreement. Payment of the retainage will be made after completion of the work and demobilization.

Bid Item No. 2 - Plant Site Work, Paving, Grading and Drainage

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct all site preparation, clearing, grading, drainage, paving, grassing, borrow, excavation, fencing, landscaping, and all other appurtenant work related to this lump sum pay item.

Bid Item No. 3 - Access Road

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct the access road from Lena Road to the plant entrance fence line at Sta 15 + 49 including subgrade preparation, geotextile fabric, leachate collection piping, leachate pumping station, grading, excavation, borrow, paving, signage, lighting, grassing, associated systems, box culvert, potable water main, reclaimed water main and all appurtenances as shown on the plans and specifications.

Bid Item No. 4 - Equalization Tank

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct the equalization tank foundation and structure, access ladders, air diffuser system, re-circulation piping, MCC/blower building #2, air piping, blowers, valves, fittings, air eductors, underdrain piping, piping to 5' outside the structures and all appurtenances as shown on the plans and specifications.

Bid Item No. 5 - Anoxic/Aerobic Tank No. 3

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct a complete anoxic/aerobic tank including the prestressed concrete composite tanks, splash covers, mixers, aerators, stairs and walkways, platforms, gates, overflow weir, piping to 5' outside structures, license fees, and all appurtenances as shown on the plans and specifications.

Bid Item No. 6 - New Clarifiers 3 and 4

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct two new 110' diameter clarifiers with all equipment and mechanisms, piping, platforms, walkways, prestressed concrete composite tanks, subgrade preparation, underdrain piping, piping to 5' outside structure, elevated bridge walkways and stairs, scum ejector system and all appurtenances as shown on the plans and specifications.

Bid Item No. 7 - Sludge Thickener and Storage Tanks 1 and 2

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct a complete sludge storage system including thickeners, polymer feed system, platforms, stairs, walkways, rails , roof system, sludge pumps, piping, two prestressed concrete tanks, blowers, air piping, diffusers, mixer system, MCC/blower building #3, and all appurtenances as shown on the plans and specifications.

Bid Item No. 8 - Filter No. 3 and 4

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct a new traveling hood filter system with concrete tankage, valves, gates, piping, controls package, filter media, backwash system, backwash hood drive system, compressed air system, Blower Building #4, and piping, and all appurtenances as shown on the plans and specifications.

Bid Item No. 9 - Reject Storage and Pump Station

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct the reject storage pond, reject pump station, piping valves, intake and outlet piping and structures, liner, liner QA testing, slope grassing, top stabilization, earthwork, site preparation, and all appurtenances as shown on the plans and specifications.

Bid Item No. 10 - Yard Piping

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to install all piping systems between structures, tankage and buildings from 5 feet beyond the structure including all piping materials specified, testing, fittings, valves, supports, and all appurtenances as shown on the plans and specifications.

Bid Item No. 11 - Electrical Work

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to construct a complete power and control system including switches, panels, switchgear, VFD's, MCC, control panels, duct banks, lighting, power circuitry, generator, fuel storage system and all appurtenances as shown on the plans and specifications.

Bid Item No. 12 - Instrumentation

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to install, set-up, calibrate, program, integrate, and coordinate a complete instrumentation package as specified including all instruments, PLC's, software and programming, fiber optic cable, transmitters, interface panels, programming terminal, and all appurtenances as shown on the plans and specifications.

Bid Item No. 13- All Other Base Bid Items

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to complete all items not otherwise shown in separate lump sum items that are required to complete the project work as as shown on the plans and specifications. These items include but are not limited to the following:

a. Headworks demolition and modifications included mechanical screen.
b. Odor control system
c. Flow splitter box and pump station
d. Clarifier 1 and 2 Sludge Boxes and modifications
e. RAS/WAS pump station modifications

f. Plant Drain Pump Station
g. Effluent pumps and piping
h. Main Electrical Building modifications
i. Modifications to existing filter and chlorine chamber weirs
j. New effluent flow meter
k. Demolition of existing odor control system
l. Repair cracks in existing aerobic tanks 1 and 2
m. Construction staging, facilities, coordination, bypass pumping, etc.

Bid Item No. 14 - Discretionary Work

Payment. Payment for all work under this Bid Item will be made at the agreed upon costs as stated in a field direction work order. No payment will be made unless authorized by the Owner and proper documentation provided.

Additive Alternate Bid Item - Filter Air Scour System

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to install air scour system in new filters No 3 and 4 including blowers, air piping, MCC, controls, and all appurtenances as shown on the plans and specifications.

Additive Alternate Bid Item - Aerators in Basins 1 and 2

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to install new aerators in the existing aeration basins 1 and 2, modifications to structures to accommodate aerators and all appurtenances as shown on the plans and specifications.

Additive Alternative Bid Item - Demolition/Removal Existing DAFT

Payment. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to dewater, disassemble, remove and dispose of the existing sludge thickening, digestion tankage and and all appurtenances as shown on the plans and specifications.

END OF SECTION

SECTION 01152 - REQUESTS FOR PAYMENT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Submit Applications for Payment to Owner in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Agreement between Owner and Contractor: Lump Sum and Unit Prices.

B. Conditions of the Contract: Progress Payments, Retainages and Final Payment.

C. Section 01370: Schedule of Values.

D. Section 01700: Contract Closeout.

1.3 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the Owner with itemized data typed in accordance with the Bid Proposal.

B. Provide construction photographs in accordance with Section 01380.

1.4 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.5 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in Application form as specified for progress payments.

1.6 SUBMITTAL PROCEDURE

A. Submit applications for payment to Engineer at the times stipulated in the Agreement.

B. Number: Six copies of each application all signed and certified by the Contractor.

C. The County will forward application for payments to Engineer for review and approval prior to processing for payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01153 - CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Provide full written data required to evaluate changes.

B. Maintain detailed records of work done on a time-and-material/force account basis.

C. Provide full documentation to Owner on request.

D. Designate the member of Contractor's organization:

1. Who is authorized to accept changes in the work.
2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the work.

E. Change Orders can only be authorized by the Board of County Commissioners.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Agreement: The amounts of established unit prices.

B. Section 01152: Requests for Payment.

C. Section 01370: Schedule of Values.

D. Section 01720: Project Record Documents.

1.3 DEFINITION

A. Change Order: See General Conditions.

B. Work Directive Change: See General Conditions.

1.4 PRELIMINARY PROCEDURES

A. Owner may initiate changes by submitting a Proposal Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time extension for making the change.
4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to Owner, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.5 CONSTRUCTION CHANGE AUTHORIZATION

A. In lieu of Proposal Request, Owner may issue a construction change authorization for Contractor to proceed with a change for subsequent inclusion in a Change Order.

B. Work directive change will describe changes in the work, both additions and deletions, with attachments of revised Contract Documents to define details of the change and will designate the method of determining any change in the Contract Sum and any change in Contract Time.

C. Contractor may sign and date the Work Directive Change to indicate agreement with the terms therein.

1.6 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow Owner and/or Enginer to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.

    a. Recommended source of purchase and unit cost.
    b. Quantities required.

4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information.

1. Name of the Owner's authorized agent who ordered the work and date of the order.

2. Dates and times work was performed and by whom.
3. Time record, summary of hours worked and hourly rates paid.
4. Receipts and invoices for:

    a. Equipment used, listing dates and times of use.
    b. Products used, listing of quantities.
    c. Subcontracts.

1.7 PREPARATION OF CHANGE ORDERS

A. Engineer will prepare each Change Order.

B. Form: Owner's Form.

C. Change Order will describe changes in the work, both additions and deletions, with attachments as necessary to define details of the change.

D. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.8 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Owner initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

B. Once Owner has completed and signed the form, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to Owner for approval. Owner will make distribution of executed copies after approval.

1.9 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. Owner's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as recommended by Owner.
3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between Owner and Contractor.

C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:

1. Owner will sign and date a Work Directive Change as authorization for Contractor to proceed with the changes.
2. Contractor must sign and date the Work Directive Change to indicate agreement with the terms therein.

D. When quantities of the items cannot be determined prior to start of the work:

1. Owner will issue a construction change authorization directing Contractor to proceed with the change on the basis of unit prices and will cite the applicable unit prices.
2. At completion of the change, Owner will determine the cost of such work based on the unit prices and quantities used.

    a. Contractor shall submit documentation to establish the number of units of each item and any claims for a change in Contract Time.

3. Owner will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
4. Contractor will sign and date the Change Order to indicate their agreement with the terms therein.

1.10 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

A. Owner will issue a Work Directive Change directing Contractor to proceed with the changes.

B. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

C. Owner will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

D. Owner will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

E. Contractor will sign and date the Change Order to indicate their agreement therewith.

1.11 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.

1. Revise subschedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Project meetings shall be scheduled as needed throughout the progress of the work. ENGINEER shall be responsible for scheduling the meetings, preparing the agenda, distributing written notice of each meeting not less than four days in advance of the meeting date, making physical arrangements for the meeting, presiding at the meeting, recording the minutes (including all significant proceedings and decisions), and reproducing and distributing copies of the minutes to all participants and all parties affected by decisions made.

B. Representatives attending the meetings shall be qualified and authorized to act on behalf of the entity that they represent.

1.2 PRE-CONSTRUCTION CONFERENCE

A. A pre-construction conference will be held prior to beginning any work under the Contract. ENGINEER will schedule the conference in consultation with OWNER and CONTRACTOR.

B. CONTRACTOR shall be ready to submit his anticipated progress schedule, a preliminary schedule of shop drawing submissions, and a preliminary schedule of values of work.

C. The pre-construction conference will be attended by representatives of OWNER, ENGINEER, utility companies who will be affected by the work, and such of CONTRACTOR's subcontractors as he wishes to attend.

1.3 PROGRESS MEETINGS

A. Regular progress meetings shall be held during the construction period on at least a monthly basis. At these meetings the CONTRACTOR shall submit any updated progress schedules, advise OWNER and ENGINEER of any anticipated delays or problems in the progress of the work, discuss any problems or events which affect the progress and the quality of the work.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The type of submittal requirements specified in this Section include the follcwing:

1. Progress Schedules and Reports

2. Material and Equipment:

   a. Shop Drawings
   b. Manufacturer's Samples Data
   c. Samples

3. General Submittal Requirements:

   a. Shop Drawings Required
   b. Certificate of Compliance

B. Submittals shall be clear and legible, printed or typed. Submittals received that are not so, shall be returned to be resubmitted when in legible form.

1.2 PROGRESS SCHEDULES AND REPORTS

A. Progress schedules shall be prepared in the form as described in Section 01310.

B. Schedules shall show the complete sequence of construction by activity with dates for the beginning and completion of each major element of construction. Projected percentage of completion for each item as of the first day of each month shall be shown.

C. Revised schedules shall be submitted periodically as changes become apparent.

D. Progress Reports. The CONTRACTOR shall prepare and submit a monthly progress report. The report shall indicate the progress at the date of submission of each activity shown on his progress schedule. It shall show changes occurring since previous submissions, activities modified since previous submissions, and revised projections of progress and completion. The submittal shall include a narrative report to define: problem areas, anticipated delays, and the impact on the schedule, and corrective action recommended and its effect.

1.3 MATERIALS AND EQUIPMENT DATA (Shop Drawings, Manufacturer's Data and Samples)

A. Schedules of Shop Drawing submittal's shall note any items which require critical timing for maintaining delivery or construction schedules.

B. Material and equipment data submitted for substitutions shall be handled as specified in Section 01640 - Substitutions and Material and Equipment Options.

C. Definitions. Work-related submittals of this section are categorized for convenience as follows:

1. *Shop drawings* include specially-prepared technical data for this project, including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to several projects.

2. *Material and Equipment data* includes standard printed information on materials, equipment and systems; not specially-prepared for this project, other than the designation of selections from among available choices printed in the information.

3. *Samples* include both fabricated and unfabricated physical examples of materials, equipment and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or, where indicated, for more detailed testing and analysis.

   a. Mock-ups are a special form of samples, which are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals.

D. *Miscellaneous Submittals* related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standard, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

1.4 GENERAL SUBMITTAL REQUIREMENTS

A. Where stated in individual sections, CONTRACTOR shall submit seven copies of Shop Drawings which are to be reviewed by ENGINEER. Upon completion of ENGINEER's review, two copies will be returned to CONTRACTOR.

B. In all other Sections where Shop Drawings are requested, CONTRACTOR shall submit five copies of Shop Drawings which are to be used by ENGINEER in observing installation of materials or equipment and for Record purposes.

C. Certificates of compliance shall be provided with Shop Drawing submittal where requested.

D. Shop Drawings Required. Shop Drawings shall be submitted for only those items listed in the individual Sections of the Specifications. Shop Drawings not required by the Specifications or not having been completely reviewed and corrected by CONTRACTOR will be returned without review or comment.

E. Certificates of Compliance. Certificate of Compliance required to be furnished by CONTRACTOR or Supplier shall be in the form of an affidavit attesting that the materials, equipment or Work covered by the Certificate conform to the specified requirements, that all tests specified or required have been performed and that all test requirements have been met. Certificates shall be subscribed to and executed before a person authorized to administer oaths.

F. Schedule of Values. At the pre-construction conference, or at least 10 days before submitting the first Application for a Progress Payment, the CONTRACTOR shall submit to the ENGINEER a Schedule of Values of the work. This Schedule shall be satisfactory in form and substance to the ENGINEER. The Schedule of Values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the work into component parts in sufficient detail to serve as the basis for Progress Payments during construction. Upon acceptance of the Schedule of Values by the ENGINEER, it shall be incorporated into a form of Application for Payment acceptable to the ENGINEER.

G. Where estimated quantities and unit prices are shown in the Bid proposal as the basis of payment, the quantities shown in the Bid Form are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The OWNER or ENGINEER do not assume any responsibility that the final quantities will remain in accordance with estimated quantities, nor shall the CONTRACTOR claim misunderstanding or deception because of such estimate of quantities. Final payment will be made on the basis of the actual completed quantities of each item.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01310 - CONSTRUCTION SCHEDULE & PROJECT RESTRAINTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Construction under this Contract must be coordinated with the Owner and accomplished in a logical order to maintain utilization and process flow through existing facilities and to allow construction to be completed within the time allowed by Contract Documents.

1.2 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 6:00 P.M. and 7:00 A.M. nor on Sundays or legal holidays without the written permission of the Owner. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the Owner. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, heating, ventilating, air conditioning, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the plans or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper collection and pumping.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

1.3 PROGRESS OF THE WORK

A. The work shall be executed with such progress as may be required to prevent any delay to the general completion of the work. The work shall be executed at such times and in or on such parts of the project and with such forces, materials and equipment to assure completion of the work in the time established by the Contract.

1.4 RELATED REQUIREMENTS

A. Section 00700: Standard General Conditions of Construction Contracts.

B. Section 01010: Summary of Work.

C. Section 01030: Special Project Procedures.

D. Section 01340: Shop Drawings, Project Data and Samples

PART 2 - PROGRESS SCHEDULE SUBMITTALS

2.1 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The CPM schedule shall be submitted by the Contractor within 30 days of receiving the Notice to Proceed.

C. The critical path schedule requirement will consist of estimated and preliminary progress schedules, monthly progress status reports (Monthly Status Reports), a start-up schedule, an as-built schedule report and revisions to the schedules and analyses as prescribed. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow Owner and Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer in evaluating work progress and make progress payments and to allow other Contractors to cooperate and coordinate their activities with those of the Contractor.

D. The current Schedule, if concurred by Owner, shall have legal status as long as it is used by Contractor for planning, organizing, directing, managing and executing the work in accordance with the Contract Documents. Legal status will further imply that Contractor will use the schedule to report progress and, further, that Contractor and Owner will use the schedule for determining delay(s) in achieving the contract date(s) stipulated in the Agreement subject to the requirements of this Section of the General Requirements.

E. Engineer will, upon receipt and review of each schedule submittal, either indicate in writing a recommendation of concurrence and present the submittal to Owner, or return the submittal to Contractor indicating in writing, Engineer's reasons for refusing to recommend concurrence. In the latter case, Contractor will be required to make the necessary corrections and resubmit. If Contractor fails to provide submittals as required, he will be deemed not to have provided a basis upon which progress may be evaluated, which may constitute reasons for refusing to recommend progress payments.

F. Engineer's review of the schedule submittals shall be only for conformance with the information given in the Contract Documents and shall not extend to the

means, methods, sequences and techniques or procedures of construction or to safety precautions or programs incident thereto. Engineer's review of the schedule submittal will be predicated on a Contractor's stamp of approval signed off by Contractor and those subcontractors and suppliers performing work under an appropriate agreement with Contractor. Contractor's stamp of approval on any schedule submittal shall constitute a representation to Owner and Engineer that Contractor has either determined or verified all data on the submittal, or assumes full responsibility for doing so and that Contractor and his subcontractors and suppliers, have reviewed and coordinated the sequences shown in the submittal with the requirements of the work under the Contract Documents.

2.2 FORM OF SCHEDULES

A. Prepare schedules in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Prices. Activity durations shall be in whole working days. In addition, activity man-days shall be shown for each activity or alternatively, tabulated in a accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2-inches by 11-inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.3 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; Contractor's time required for submittals, fabrication and deliveries; the time required by Engineer to review all submittal as set forth in the Contract Document; items of work required of Owner to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other Contractors performing work under separate contracts with Owner.

D. Schedules shall show the complete sequence of construction by activities. Date for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittals schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the Engineer, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternative available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.4 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the quarterly report period and actual start dates for activities commended during the quarterly report period.

2. Anticipated start dates for activities scheduled to commence during the following quarterly report period.

3. Changes in the duration of any activity and minor logic changes.

4. The progress along the critical path in terms of days ahead or behind the Contract date.

5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities

affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.

6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and logic restraints of each activity.

7. The narrative shall, in addition, also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.

8. Original Contract date(s) shall not be changed except by Contract Change Order. A revision, as specified in Article 2.9 below, need not be submitted when the foregoing situations arise unless required by Engineer. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.

9. Should Engineer require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.5 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Instructions to Bidders and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with Articles 2.1, 2.2, and 2.3 above.

C. The finalized progress schedule discussed in Article 2.9 of the General Conditions (Section 00700) shall be included with the first monthly status report and shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include three copies of a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the data date. The finalized schedule, if concurred with by Owner pursuant to paragraph 2.1(C), shall be the work plan to be used by the Contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted in accordance with Article 2.2 above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittal, (2) calendar days prior to substantial completion,

(3) summary activities for the remaining 60 days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. Contractor shall submit monthly progress schedules with each month's application for payment. Engineer will review schedules and return review copy within 10 days after receipt. If required, Contractor shall resubmit within 7 days after return of review copy.

G. Contractor shall submit the number of monthly status reports which the Contractor requires, plus five copies which will be retained by the Engineer.

2.6 MONTHLY STATUS REPORTS

A. Contractor shall submit three copies of detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described in paragraph 2.4. The Monthly Report will be reviewed by Engineer and Contractor at a monthly schedule meeting and Contractor will address Engineer's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal staus shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by Engineer will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.7 STARTUP SCHEDULE

A. At least 90 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion and substantial completion, together with a supporting narrative. Engineer shall have 20 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by Owner, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly status reports, as outlined in Article 2.5 above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the start-up schedule.

2.8 AS-BUILT SCHEDULE

A. After substantial completion, but prior to final payment, Contractor shall submit an as-built schedule report and time-scaled as-built diagram. The documents shall reflect all as-built critical paths. The diagram shall be prepared in accordance with Articles 2.2 and 2.3, in addition to the following:

1. All Contract activities, including all added activities, shall be shown.

2. Activity durations shall be the actual number of separate work days during which work was performed on the activity.

3. Contract milestone completions shall be plotted on the date of the Substantial Completion Reports.

2.9 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer and concurrence by Owner. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review, when required by Engineer, for one of the following reasons:

1. Owner or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.

2. Contractor elects to change any sequence of activities so as to affect a critical path of the current schedule documents.

C. If, prior to agreement on an equitable adjustment to the Contract time, Engineer requires revisions to the schedule in order to evaluate planned progress, Contractor shall provide an interim revised submittal for review with change effect(s) incorporated as directed. Interim revisions to the documents which are recommended to the Owner for concurrence will be incorporated in the next Monthly Status Report.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01340 - SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer for review and approval, such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Within thirty (30) calendar days after the effective date of the Agreement, the Contractor shall submit to the Owner (Manatee County Project Manager) a complete list of preliminary data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items and the date on which each Shop Drawing shall be submitted. Review of this list by the Engineer shall in no way relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawing.

C. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:

1. Submittal description and number assigned.
2. Date to Engineer.
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of Resubmittal and Return (as applicable).
6. Date material released (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contract.
10. Status of O&M manuals submitted.

1.2 RELATED REQUIREMENTS

A. General and Supplementary Conditions.

B. Section 01310: Construction Schedules and Project Restraints.

C. Section 01600: Material and Equipment.

D. Section 01720: Project Record Documents.

E. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed Shop Drawings, Working Drawings and Samples will be needed.

1.3 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

C. The Contractor shall furnish the Engineer a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with no exceptions taken.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and appropriate action from the time the Engineer receives them.

F. The Contractor shall submit seven (7) copies of descriptive or product data and shop drawings for the Engineer. Two copies will be forwarded to the Manatee County Public Works Department and three retained by the Engineer. Two copies will be sent back to the Contractor. All blueprint shop drawings shall be submitted with one (1) set of 3 mil thick polyester film reproducibles. The Engineer will review the blueprints and return to the Contractor the set of marked-up sepias with appropriate review comments.

G. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by Engineer of the necessary Shop Drawings.

1.4 ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor will cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules will be general and shall not be construed:

1. as permitting any departure from the Contract requirements;
2. as relieving the Contractor of responsibility for any errors, including details, dimensions and materials;
3. as approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations per subparagraph 1.5.D and show a departure from the Contract requirements which Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting any exception.

D. When reviewed by the Engineer, each of the Shop Drawings will be identified as having received such review being so stamped and dated. Shop Drawings stamped "NOT APPROVED" and with required corrections shown will be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. The Engineer will review a submittal/resubmittal a maximum of three (3) times after which cost of review will be borne by the Contractor. The cost of engineering shall be equal to the Engineer's actual payroll cost.

H. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor and will be considered not approved until resubmitted.

1.5 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

D. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.

E. Data on materials and equipment include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the Engineer will utilize the color "red" in marking shop drawing submittals.

I. Before final payment is made, the Contractor shall furnish to Engineer five (5) sets of record shop drawings all clearly revised, complete and up to date showing the permanent construction as actually made for all reinforcing and structural steel, miscellaneous metals, process and mechanical equipment, yard piping, electrical system and instrumentation system.

1.6 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and falsework; for underpinning; and for such other work as may be required for construction, but does not become an integral part of the project.

B. Copies of working drawings as noted in subparagraph 1.6A, above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer and shall be submitted at least thirty (30) calendar days (unless otherwise specified by the Engineer) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefor.

1.7 SAMPLES

A. The Contractor shall furnish, for the review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the Engineer.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.
3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project. (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required in subparagraph 1.07B above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the reviewed samples. Samples which failed testing or were rejected will be returned to the Contractor at his expense, if so requested at time of submission.

1.8 SCHEDULE

A. The following includes, but is not limited to, items of equipment for which submittal data must be provided:

1. Steel Sheeting/Shoring Design
2. Concrete Mix Design
3. Reinforced Concrete Pipe
4. Access Hatches
5. Concrete Reinforcement
6. Welded Wire Fabric & Steel Bar
7. Joint Devices, Admixtures, Adhesive Cartridges Anchors
8. Design Analysis Elongated Prestressed Concrete Tank
9. Design Analysis Circular Prestressed Concrete Tank
10. Precast Concrete Manholes And Accessories
11. Roofing Plan & Materials, Lightweight Concrete Design
12. Mortar & Grout
13. Concrete Masonry Units
14. Concrete Brick
15. Structural Steel
16. High Strength Bolts
17. Structural Steel Primer Paint
18. Shrinkage Resistant Grout
19. Steel Joists
20. Deck Panels Anchorage
21. Aluminum Plates, Shapes, Sheets
22. Aluminum Handrails, Erection Details, Fabrication & Accessories
23. Aluminum Floor Plates
24. Aluminum Grating - Load Tables, Dimensions Anchor Details.
25. Wood Treatment Certification
26. Fiberglass Structures, Weir Plates, Effluent Troughs, Drop Box, Closure Plates
27. Fiberglass Grating
28. Fiberglass Treads
29. FRP Covers, Fasteners, Erection Drawings
30. Modified Bituminous Sheet
31. Insulated Deck, Modified Bituminous Membrane
32. Flashing and Sheet Metal
33. Coping Data
34. Sealants

35. Aluminum Doors And Hardware
36. Aluminum Windows
37. Louvers And Vents
38. Fire Extinguishers, Cabinets And Accessories
39. Flow Control Gates
40. Slide Gates
41. Sluice Gates
42. Long Moveable Weirs
43. Submersible Wastewater Pumps
44. Progressive Cavity Pumps
45. Vertical and Horizontal Non-Clog Centrifugal Pumps
46. Raw Sewage Screening Equipment
47. Pneumatic Scum Ejectors
48. Coarse Bubble Air Diffuser System
49. Circular Sludge Collection Equipment
50. Rotary Drum Thickeners And Polymer Feed System
51. Carrousel System Slow Speed Mechanic Aerators
52. Fine Bubble/Draft Tube Aeration
53. Submerged Turbine Mixers
54. Controls And Instrumentation
55. Pipes And Pipe Fittings (HVAC and Plumbing)
56. Steel Pipe
57. Ductile Iron Pipe & Fittings
58. Hose Rack, Hose and Hose Bibbs
59. Valves and Appurtenances
60. Check Valves
61. Piping Specialties
62. Pressure Gages
63. Supports and Anchors (HVAC)
64. Pipe Support Systems
65. Plumbing
66. Potable Water Systems
67. Soil and Water Systems (For Building Only)
68. Sump Pump
69. Compressed Air System
70. Heating, Venting and Air Conditioning
71. PVC Pipe
72. PVC Fittings
73. Plants, Sod, Seed, Fertilizer
74. Erosion Control Plan
75. By-Pass Plans
76. Painting and Coating Systems
77. Control Panel Drawings
78. Field Wiring Diagrams
79. Ultrasonic Level Transmitters
80. Ultrasonic Flow Transmitters
81. Pressure Transmitters
82. Open Nozzle Flow Transmitters
83. Current Transmitter
84. Signal Selectors
85. Signal Isolator
86. Control Console
87. Surge Protector
88. Operator Interface Panel
89. PLC Hardware
90. Modems
91. Programming Terminal
92. Printer
93. Fiber Optic Cables
94. Electric Motors
95. Diesel Engine Driven Generator
96. Aboveground Fuel Storage Tanks, Piping and Feed System
97. Variable Frequency Drives
98. Lighting
99. Motor Control Centers
100. 480 Volt Switchgear

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01370 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Owner a Schedule of Values allocated to the various portions of the work, within 10 days after date of Notice to Proceed.

B. Upon request of the Owner, the Contractor shall support the values with data which will substantiate their correctness.

C. The Schedule of Values, shall be used only as the basis for the Contractor's Applications for Payment.

1.2 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Section 01152: Requests for Payment.

1.3 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on MCPMD Form PMD-2 (see Page 00550-2); Contractor's standard forms and automated printout will be considered for approval by Owner upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the specification.
2. For each line item, list subvalues of major products or operations under item.

D. Follow the bid sheets included in this Contract Document as the format for listing component items for pipelines.

E. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.4 SUBSCHEDULE OF UNIT MATERIAL VALUES

A. Submit a subschedule of unit costs and quantities for products on which progress payments will be requested for stored products.

B. The form of submittal shall parallel that of the Schedule of Values with each item identified the same as the line item in the Schedule of Values.

C. The unit quantity for bulk materials shall include an allowance for normal waste.

D. The unit values for the materials shall be broken down into:

1. Cost of the material, delivered and unloaded at the site, with taxes paid.
2. Installation costs, including Contractor's overhead and profit.

E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

F. Use MCPMD Form PMD-3 (see Page 00550-3) or Contractor's automated equivalent printout may, upon approval, be used.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01380 - CONSTRUCTION PHOTOGRAPHIC RECORD

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Employ a competent photographer to take construction record photographs during course of the work for existing and proposed wastewater treatment plant site and access road.

1.2 PHOTOGRAPHY REQUIRED

A. Provide photographs in print and digital image format taken on the cutoff date for each scheduled Application for Payment, minimum one set per month.

B. Provide photographs taken at each major stage of construction:

1. Before start of work.
2. Completion of excavations.
3. Completion of foundations.
4. Completion of framing.
5. Completion of enclosures of building or structure.
6. Completion of equipment, piping, conduit and wiring installation.

C. Views and Quantities Required:

1. At each specified time, photograph Project from three different views, as approved by Engineer. At least one view shall be an aerial photograph taken from an airplane.
2. Provide three prints and one digital image of each view.

PART 2 - PRODUCTS

2.1 PRINTS

A. Color Prints:

1. Paper: Double weight.
2. Finish: Smooth surface, glossy.
3. Size: 8 in. X 10 in.

B. Identify each print on back, listing:

1. Name of project.
2. Orientation of view.
3. Date and time of exposure.
4. Name and address of photographer.
5. Include negative in negative-envelope for each print.

C. Digital Image

1. Resolution: 300 dpi.
2. Format: JPEG.
3. On a CD.
4. Scanned in color.

PART 3 - EXECUTION

3.1 TECHNIQUE

A. Factual presentation.

B. Correct exposure and focus.

C. High resolution and sharpness.

D. Maximum depth-of-field.

E. Minimum distortion.

3.2 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

B. At successive periods of photography, take at least one photograph from the same overall view as previously. Consult with Engineer at each period of photography for instructions concerning views required.

3.3 DELIVERY OF PRINTS

A. Deliver prints and CD with digital images to Engineer to accompany each Application for Payment.

END OF SECTION

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.1 TESTING LABORATORY SERVICES

A. The OWNER will secure the services of a testing laboratory. The CONTRACTOR shall make arrangements for testing laboratory services and coordinate testing times whenever those services are required by these specifications. Payment for testing to show compliance with specified requirements will be paid for by OWNER. The cost of retesting when materials and workmanship fail to meet specified requirements will be deducted from monies due CONTRACTOR.

1.2 LABORATORY STANDARDS

A. Testing laboratories shall conform to the applicable requirements of ASTM E329-77 (LATEST EDITION) STANDARD RECOMMENDED PRACTICE FOR INSPECTION AND TESTING AGENCIES FOR CONCRETE, STEEL AND BITUMINOUS MATERIALS AS USED IN CONSTRUCTION and shall be inspected and approved by the ELF/FC&PA Joint Technical Committee, Inc., or by an equivalent recognized national authority.

B. Agents of testing laboratories performing field sampling and field testing of concrete shall be certified by the American Concrete Institute as Concrete Field Testing Technicians Grade 1 or by an equivalent recognized national authority for an equivalent level of competence, or shall be licensed Professional Engineers.

1.3 ACCESS FOR INSPECTION

A. OWNER, ENGINEER and their authorized representatives shall be permitted free access and every reasonable facility for the inspection of all Work, materials and equipment. OWNER and his authorized representatives shall also be permitted to inspect payrolls, invoices for materials and equipment. OWNER and his authorized representatives shall also be permitted to inspect payrolls, invoices for materials and equipment and other relevant data and records.

B. Authorized representatives of Federal, State or local agencies shall be permitted access to inspect for compliance with applicable laws, regulations and permit requirements.

C. On projects where Federal or State agency funding is used, authorized representatives of those agencies shall be permitted to inspect all work, materials, equipment, payrolls, records of personnel, invoices for materials and equipment and other relevant data and records.

1.4 INSPECTION OF WORK AWAY FROM SITE

A. When work to be done away from the construction site is to be inspected on behalf of OWNER during its fabrication, manufacture or testing or before shipment, CONTRACTOR shall give notice to ENGINEER of the time and place where such fabrication, manufacturing, testing or shipping is to be done. Such notice shall be in writing and delivered to ENGINEER in ample time so that the necessary arrangements for the inspection can be made.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 01410 - TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Owner will employ and pay for the services of an Independent Testing Laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.

1. Contractor shall cooperate with the laboratory to facilitate the execution of its required services and coordiante testing times.
2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the Contract.

1.2 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Respective section of specifications: Certification of products.

C. Each specification section listed: Laboratory tests required and standards for testing.

D. Testing laboratory inspection, sampling and testing is required for, but not limited to the following:

1. Section 02200: Earthwork
2. Section 03300: Cast in Place Concrete

1.3 REFERENCES

A. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ANSI/ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.4 QUALITY ASSURANCE

A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.

B. Laboratory: Authorized to operate in State in which Project is located.

C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.5 LABORATORY RESPONSIBILITIES

A. Test samples of mixes submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by Engineer.

1.6 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.
4. Stop the Work.

1.7 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Owner and to Contractor.

B. Include:

1. Date issued,
2. Project title and number,
3. Name of inspector,
4. Date and time of sampling or inspection,
5. Identification of product and Specifications Section,
6. Location in the Project,
7. Type of inspection or test,
8. Date of tests,
9. Results of tests,
10. Conformance with Contract Documents.

1.8 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to Work, to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Owner may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, Contractor shall reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the Owner.

H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 SANITARY FACILITIES

A. Contractor shall furnish temporary separate male and female sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1.2 BARRICADES

A. All open trenches and other excavations shall have suitable barricades to provide adequate protection to personnel on site.

1.3 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards and parkings, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

1.4 PARKING

A. Owner shall designate an area for Contractor's employee parking. Such area shall be maintained by the Contractor to provide suitable parking. Parking will be limited to the area designated such that Owner's operations will not be impeded.

1.5 DUST CONTROL

A. Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practicable to prevent blowing.

B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.6 SWEEPING

A. The Contractor shall sweep loose material from the pavement at the end of each workday.

1.7 POLLUTION CONTROL

A. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials form entering any drain or watercourse.

1.8 SAFETY

A. Contractor shall conduct safety meetings with Owner as required, or on a monthly basis as a minimum, to discuss Contractor's work around existing buildings and equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01505 - MOBILIZATION

PART 1 - GENERAL

1.1 DEFINITION AND SCOPE

A. Mobilization shall include the obtaining of all permits, insurance, and bonds; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the WORK. Mobilization shall include, but not be limited to, the following principal items:

1. Move onto the site all CONTRACTOR's plant and equipment required for first month operations.
2. Install temporary construction power, wiring, and lighting facilities.
3. Establish fire protection plan and safety program.
4. Secure construction water supply.
5. Provide field office trailers for CONTRACTOR and PROJECT REPRESENTATIVE complete with all specified furnishings and utility services, including telephones.
6. Provide on-site sanitary facilities and potable water facilities as specified.
7. Arrange for and erect CONTRACTOR's work and storage yard and employees' parking facilities.
8. Submit all required insurance certificates and bonds.
9. Obtain all required permits: Building Permit, Temporary Power Pole Permit.
10. Post all OSHA, Environmental Protection Agency, Department of Labor, and all other required notices.
11. Have CONTRACTOR's superintendent at the job site full time.
12. Submit a detailed construction schedule acceptable to the PROJECT REPRESENTATIVE as specified.
13. Erect project construction sign(s) as specified.
14. Submit a finalized schedule of values of the WORK in the COUNTY's approved format.
15. Submit a finalized schedule of submittals.
16. Construct, maintain, and restore temporary access and haul roads.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01580 - PROJECT IDENTIFICATION AND SIGNS

PART1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification sign.

B. Remove sign on completion of construction.

C. Allow no other signs to be displayed.

1.2 RELATED REQUIREMENTS

A. Section 01010: Summary of Work.

1.3 PROJECT IDENTIFICATION SIGN (COUNTY)

A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of Owner.
3. Names and titles of authorities as per directed by Owner.
4. Names and title of:

    a. Engineer
    b. Professional Consultants

5. Prime Contractor.
6. Major subcontractors.

B. Graphic design, style of lettering and colors: As approved by the Owner.

1.4 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: adequate to resist weathering and fading for scheduled construction period.

PART 2 - PRODUCTS

3.1 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified below.

1. Wood

a. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).
b. Prime: Painted trim and siding - white pigmented non-penetrating alkyd based primer appled at the rate of 3.0 mils dry film thickness.
c. Finish: Painted trim and face - apply two coats semi-gloss modified acrylic latex applied at a rate of at least 2.0 mils dry film thickness per coat.

2. Steel

a. Surface Preparation: Commercial blast according to the Steel Structures Painting Council Specifications SP-6.
b. Prime: One coat of a combination of lead chromate rust inhibitive and synthetic pigmented alkyd resins, minimum 1.5 mils dry film thickness. If shop coat is damaged, reprime base areas in field.
c. Finish: Two coats of semi-gloss medium to long oil alkyd resin coating, 1.5 mils dry film thickness per coat.

3. Use bulletin colors for graphics.
4. Colors for structures, framing, sign surface and graphics: To be furnished by Public Works Department.

PART 3 - EXECUTION

3.1 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, sizes and colors selected.

3.2 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.3 REMOVAL

A. Remove signs, framings, supports and foundations at completion of project.

END OF SECTION

SECTION 01590 - FIELD OFFICES

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. Promptly after starting work, the CONTRACTOR shall provide a field office for his use and, provide and equip a suitable office for the exclusive use of the ENGINEER. The CONTRACTOR shall maintain both offices until the completion of the work to be done under this Contract. The CONTRACTOR's field office shall be the size required for his use plus adequate space to hold project meetings (minimum seating - 6). The ENGINEER's office shall be a separate structure located, as directed, where it will not interfere with the progress of the work. An approved, suitably constructed and equipped trailer of adequate size and designed for the purpose may be furnished as the ENGINEER's office.

B. The CONTRACTOR shall provide office space and facilities for the ENGINEER when the CONTRACTOR moves on the job site.

C. The CONTRACTOR shall furnish, install and maintain storage and work sheds as needed or required for the construction.

D. Should the construction site change, field offices, storage and work sheds shall be moved to a convenient location at the new site.

PART 2 - MATERIALS AND EQUIPMENT

2.1 ENGINEER'S OFFICE

A. The office shall be of a suitable height and of ample size to accommodate the furniture and equipment listed below, without crowding (at least 128 square feet of floor area). It shall be weathertight; insulated and suitably ventilated; the floor shall be tight and of double-thick construction. The office shall have at least two operable, screened, windows which can be locked shut, and one door which shall have a cylinder lock with two keys. The door shall also have a screened door.

B. The office shall have adequate heating and cooling unit(s) for the geographic location.

C. Operating expenses (heating-cooling, electric, water, sanitary and telephone) shall be paid for by the CONTRACTOR.

D. Provide parking spaces for two vehicles.

2.2 OFFICE FURNITURE AND EQUIPMENT

A. The CONTRACTOR shall provide the following:

1. One desk (about 3-feet x 5-feet) with a desk chair.
2. Four side chairs.
3. One plan table or sloping plan shelf (about 3-feet x 5-feet each) with smooth top.
4. Two stools with padded seats.
5. One vertical filing cabinet with four legal size drawers which can be locked.
6. Electric calculator with tape.
7. Plan Rack (as directed by ENGINEER).

B. In addition, the CONTRACTOR shall provide:

1. Electric lights (50 foot candles at desk top height) and outlets (as directed by ENGINEER).
2. Private telephone line.
3. Acceptable toilet facilities (for exclusive use by the ENGINEER).
4. Shelving (as directed by ENGINEER).
5. Fire extinguisher (carbon-dioxide type, minimum 4 lb. capacity).
6. Broom and dust pan.
7. Water cooler with integral refrigerator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fill and grade site for field office to provide surface drainage.

B. Construct field offices on proper foundations, provide connections for utility services.

C. Secure portable or mobile structures against wind and storm.

D. Provide steps and landings at entrance doors.

3.2 CLEANING AND SUPPLIES

A. For the duration of the Contract, the CONTRACTOR shall provide:

1. Supply of drinking water.
2. Paper cups, paper towels, liquid soap, and toilet tissues. Each shall be supplied in a suitable holder and/or dispenser.

3.3 REMOVAL AT COMPLETION OF CONTRACT

A. On the completion of the contract, the CONTRACTOR shall remove the offices, storage, sheds and all such temporary facilities from the site. Remove foundations and debris, grade site to required elevations and clean area.

END OF SECTION

SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.
3. Manufactured and Fabricated Products:

   a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
   c. Two or more items of the same kind shall be identical by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is specified.
5. All material and equipment incorporated into the project shall be new.

1.2 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Section 01010: Summary of Work.

C. Section 01340: Shop Drawings, Project Data and Samples.

D. Section 01710: Cleaning.

1.3 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Engineer.

1. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.4 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.5 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weathertight enclosures.
2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. Exterior Storage

1. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.

D. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.6 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Surfaces of products exposed to elements are not adversely affected.

    a. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer. These instructions shall be carefully followed.
5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
6. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.
7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.7 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Products List: Within 30 days after contract date, submit to Engineer a complete list of major products proposed to be used.

B. Contractor's Options

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions of any product or manufacturer not specifically named.
3. Substitutions of products and "or equal" by the Contractor shall be submitted in a timely manner so as not to adversely affect the construction schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01650 - DISINFECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section covers materials and methods of cleaning, disinfecting, sampling and obtaining approval for placing the different components of potable water systems in operation. Included is work necessary in order to obtain bacteriological clearances as required by law.

1.2 SUBMITTALS

A. The CONTRACTOR shall submit planned procedures to ENGINEER for review prior to beginning work. Submit certificates of compliance with specified standards for all materials to be used. The CONTRACTOR shall obtain sterile sample containers, collect samples and submit to the approved laboratory. Provide six copies of laboratory test reports to ENGINEER.

1.3 QUALITY CONTROL

A. Laboratories used for bactoriological testing of samples shall be certified by the Florida Department of Environmental Protection (DEP) as acceptable to that agency.

B. Methods shall conform to the requirements of the Florida Department of Environmental Protection (DEP).

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS FOR DISINFECTION

A. The disinfecting agent shall be liquid chlorine conforming to AWWA B301 or sodium hypochlorite or calcium hypochlorite conforming to the requirements of AWWA B300.

PART 3 - EXECUTION

3.1 DISINFECTION OF WATER MAINS

A. Flushing. Flush mains prior to application of disinfecting agent. Flushing shall continue until clear water flows from the nearest available point closest to the end of the line.

B. Disinfection. Disinfection of all piping valves and appurtenances shall be by the Tablet Method, Continuous Feed Method or the Slug Method, in accordance with AWWA C651.

1. Tablet Method. Calcium Hypochlorite tablets shall be calcium attached to the inside top surface of the pipe to develop an average chlorine dose of 25 mg/l.

2. Continuous Feed Method. A solution containing not less than 75 mg/l of chlorine shall be applied to all piping, valves, fittings, hydrants and appurtenances. Solution shall remain in the pipelines for a minimum period of twenty-four hours. A free chlorine residual of 10 mg/l is required after the 24-hour holding period.

3. Slug Method. Calcium hypochlorite granules shall be placed in the main. A slug of highly chlorinated water, not less than 100 mg/l, shall be moved through the main. All parts of the main and appurtenances shall be exposed to the highly chlorinated water for a period of not less than 3-hours. If at any time during the 3-hour period the free chlorine residual drops to less than 50 mg/l, chlorine shall be added to restore the free chlorine residual to 100 mg/l.

C. For all three methods of disinfection, valves and hydrants shall be opened and closed several times during the contact period to insure that all parts are contacted by the disinfecting solution.

D. After one of the disinfection methods described above have been completed, the main shall be flushed with potable water until the chlorine residual stabilizes and matches the chlorine residual of the flushing water. Chlorine residual determination shall be made in accordance with Standard Methods using the DPD Colormetric Method.

E. Sampling and Testing. Samples of water shall be collected from the mains by the CONTRACTOR in sterile containers and delivered to an approved laboratory for bacteriological testing. Sampling and testing shall be continued until satisfactory results are obtained on two consecutive days.

F. The interior of pipe, fittings, valves and appurtenances used for cutting into or repairing existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before being installed.

G. Tapping sleeves shall be cleaned and disinfected in accordance with Section 10 of AWWA C651.

3.2 REDISINFECTION

A. If consistently unsatisfactory bacteriological test results are reported, the facilities shall be recleaned and redisinfected.

3.3 DISPOSAL OF HEAVILY CHLORINATED WATER

A. Chlorinated water shall be disposed of in a manner that will not harm the environment. Approval of the Manatee County Public Works Department must be obtained before heavily chlorinated water is discharged to the sanitary sewer at a specified allowable discharge rate.

B. Heavily chlorinated water must be neutralized in a separate vessel or pipe prior to being discharged to the wastewater treatment plant or to a drainage way.

C. One of the chemicals listed in AWWA C651 Appendix B, or C652 Appendix A, shall be used for neutralization.

END OF SECTION

SECTION 01660 - SYSTEMS TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The CONTRACTOR shall be responsible for the testing, adjusting and balancing of all systems prior to placing them in service.

B. The operation, testing, adjustment and balancing shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.

1.2 TESTING PRIOR TO SHIPMENT

A. Where individual sections require certain items of equipment to be tested prior to shipment from the manufacturer's plant, these items shall be operated to the extent necessary to generate certified performance data over the entire operating range of the equipment. The testing shall be conducted on the units which will be shipped to and installed at the construction site.

1.3 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. The CONTRACTOR shall arrange for a qualified service representative from each company manufacturing or supplying certain equipment, as listed on the Drawings, or in the Specifications, to perform the duties described.

B. After installation of the listed equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, adjust and balance the equipment. The inspection shall include, but shall not be limited to, the following points as applicable:

1. Soundness (without cracked or otherwise damaged parts).
2. Completeness in all details, as specified.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing and lubricants.

C. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the ENGINEER a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.

D. After the ENGINEER has reviewed the reports from the manufacturer's representatives, the CONTRACTOR shall make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.

E. The manufacturer's representative shall remain on the job to instruct the OWNER's personnel in proper operation and maintenance and shall remain until the equipment is operating in a satisfactory manner.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

3.1 PRESSURE AND LEAKAGE TESTS

A. Tests shall be conducted in the presence of and to the satisfaction of the ENGINEER and of authorities having jurisdiction over the work. Not less than three days notice shall be given prior to start of test.

B. Field pressure and leakage tests shall be conducted on the following:

1. Process, instrumentation, sampling, chemical and vacuum piping
2. Pressure pipelines
3. Gravity pipelines
4. Valves

C. Plant Pressure Piping: Pressure tests shall be applied at the highest point in piping systems. Pressure piping and valves shall be statically tested at 1-1/2 times normal operating pressure or 150 psig, whichever is greater. Pressure tests shall be for two-hours.

1. Plant pressure piping, except air pressure piping, shall be hydrostatically tested and all joints and other potential leak sources shall be painted with powdered blue chalk and water mixture prior to testing. Leak sources shall be examined during and at the end of the test period.

D. Plant Air Pressure Piping. Plant air pressure piping shall be tested at 1-1/2 times operating pressure. Test pressure shall be maintained for four hours and potential leak sources shall be checked at one-hour intervals by applying a coating of soap suds.

E. Pressure Mains. Pressure mains shall be tested hydrostatically after completion of laying and to the extent practicable before backfilling. Pressure piping and valves shall be statically tested at 150 psig. The test pressure shall be maintained for a period of two hours and be measured at the high point in the line. All air shall be expelled from the line before applying the test pressure. Exposed pipe, joints and other potential leak sources shall be carefully examined for leaks.

F. Force Mains. Force mains shall be subjected to a leakage test. This test measures the amount of water required to be supplied to newly laid pipe to maintain a specific pressure after the pipe has been filled with water and the air expelled. The duration of this test shall be not less than two hours and the test pressure shall be 100 psig as measured a the high point in the line. The maximum allowable leakage shall not exceed the limits specified in AWWA C-600.

1. All force mains shall be thoroughly flushed of all sand and debris. Flushing shall continue until a clear water flows from the available point closest to the ends of the lines.

2. Force mains 12-inches in diameter and larger shall be cleaned during flushing by using a polyurethane plug manufactured of eight lb./cubic foot density blown elastomer with open cell construction. The plug shall have resilient surface that engages the inner surface of the main with a sliding seal. The plug shall be able to reduce itself a minimum of 35 percent of its original cross-sectional area, negotiate mitered bends, short radius elbows, pass through tees, crosses, multiple pipe sizes and valves and shall be abrasion resistant and capable of traveling in either direction.

G. Gravity Sewers. The final inspection of gravity sewer systems shall include visual inspection and testing for infiltration and exfiltration.

1. The visual inspection shall include examination of manholes and televising of the sewer lines. All visible leaks shall be corrected.

2. If, in the opinion of the ENGINEER, infiltration is excessive it shall be measured using a weir or other suitable device. Wherever the leakage into the pipe is found to exceed 50 gallons per day per inch diameter per mile of sewer between successive manholes, that section of sewer shall be reworked or re-laid as required until the leakage is brought below this amount.

3. Where lines are above the groundwater table, the ENGINEER may require an exfiltration test. For this test, the line shall be filled with water under a minimum head of two feet above the top of the pipe and the level maintained throughout the test. The rate of exfiltration shall not exceed the allowable rate for infiltration except that an allowance of an additional 10 percent of gallonage shall be permitted for each two feet of head over the basic two-foot minimum head.

H. Valves. Prior to applying the test pressure, the valves shall be opened and closed a minimum of six (6) times. Valves shall be tested by applying the test pressure upstream of the closed valve with the downstream at zero pressure. The test pressure shall hold for a period of one hour after the source of pressure has been removed.

3.2 TESTING ELECTRICAL SYSTEMS

A. After completion and prior to being energized, all electrical systems shall be tested as specified in Division 16 to the extent necessary to demonstrate that all systems are complete and ready for operation. Motors shall be checked for proper direction of rotation. Circuits shall be checked for proper voltages and currents.

3.3 TESTING PROCESS SYSTEMS

A. Hydraulic and Leakage Testing. Field leakage tests shall be conducted on tanks, channels, and miscellaneous structures.

B. Test Preparation. Backfill shall not be placed around the water containment structure prior to the test. Inspection access points should be open to all piping, channels, and conduits that leave the structure, including any underdrain outlets, When the structure has gained sufficient strength to withstand the test load and after all outlets have been securely sealed, the structure shall be filled with water. During filling, the outlets shall be monitored for watertightness, the underdrain outlet monitored for any increase in flow, and the structure, especially the concrete joints, monitored for any visible leakage from the structure. If any visible leakage from the structure or increase in flow from the underdrain system is observed, the condition may be corrected prior to the start of the test measurements. However, no allowance shall be made in the test measurements for uncorrected point source leakage. When the test preparations are acceptable, the structure shall be kept full of water for a minimum of 3 days prior to starting the test.

C. Test Measurements. The location of the water surface in new structures shall be measured at four points 90 degrees apart, at the start of the test. Measurements taken at these locations will usually minimize the effect of differential settlement of a tank on the computed values. A partially filled, calibrated, open container for evaporation/precipitation measurement should be positioned in uncovered water containment structures and the water level in the container recorded. The measurements should be recorded at 24-hr. intervals. The structure exterior should be inspected daily for indications of leakage.

D. The test shall be continued for a period of time sufficient to produce at least a one-half inch drop in the water surface based on the leakage occurring at the maximum allowable rate.

E. The duration of the test shall be determined by the following formula:

$$D = \frac{0.5 \text{ in.}}{L \times H \times 12 \text{ in./ft.}}, \text{ where}$$

D = duration of test, days
L = allowable leakage rate, in./in./day
= 0.1% for unlined concrete tanks w/sidewater depth ≤ 25 ft.
= 0.06% for lined concrete tank walls w/sidewater depth ≤ 30 ft.
H= sidewater depth, ft.

F. Measurements are taken at 24-hr. intervals; therefore, the test duration shall be rounded up to the next full day.

G. Test Results. At the end of the test period, the location of the water surface shall be recorded at the location of the original measurements. The water surface in the evaporation/precipitation measurement device shall also be recorded. The leakage rate from the tank shall be computed, corrected for evaporation or precipitation as applicable. If the rate exceeds the criteria specified, the structure shall be considered to have failed the test. The structure shall also be considered to have failed the test if water is observed flowing from the structure (other than from the underdrain system) or if moisture, other than from precipitation or condensation, can be transferred to a dry hand from the exterior surfaces.

H. Any structure failing the test shall be repaired and retested. The repair work may include dewatering the structure and inspecting the interior for defects that cause leakage.

3.4 TESTING AND BALANCING HVAC AND VENTILATING SYSTEM(S)

A. After completion of the work of installation, test and regulate all components of the ventilating and air conditioning system to conform to the air volumes shown on the Drawings.

B. Employ the services of a recognized and independent certified testing and balancing consultant who is a member of the Associated Air Balance Council. Forward one copy of all reports of the testing consultant to the ENGINEER.

C. Where necessary, and when directed by the ENGINEER, provide fans with larger or smaller pulleys at no additional cost to the OWNER, sized to drive the fans at the speeds necessary to give the indicated volumes.

D. For each component of the system, where applicable, make the following tests and submit reports to the ENGINEER.

1. Total cfm exhausted by each exhaust fan;
2. Total static of each fan;
3. Motor speed, fan speed, and input ampere reading of each fan;
4. Make all air tests by means of velometer or anemometer readings;
5. Make all static pressure tests by means of pitot tube readings;
6. Make all ampere readings by means of an integrating watt or ampere reading; and
7. Completely balance, including testing and retesting as described above.

3.5 ENGINEER'S RIGHT TO RETESTING

A. Should the CONTRACTOR refuse or neglect to make any tests necessary to demonstrate the integrity of the completed system, the ENGINEER may retain the services of an outside consultant to make all such tests and their resulting adjustments and balance.

B. The costs for such tests shall be deducted from amounts owing to the CONTRACTOR and shall not be borne by the OWNER.

END OF SECTION

SECTION 01670 - SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:

1. This section covers furnishing of all labor, materials, tools, equipment, and performing all work and services for furnishing, submission, processing and handling of requests for substitution and product options. See items as indicated on drawings and as specified. Any substitution or option shall be in accord with provisions of Contract Documents, and completely coordinated with work of other trades.
2. Although such work is not specifically indicated, furnish all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
3. See appropriate sections for specific items specified. See General Conditions for additional information.

B. Procedure.

1. For equipment and materials which are listed in the proposal, observe procedures outlined in Information for Bidders.
2. For products, equipment, and materials which are named in drawings or specifications for which a request for substitution is made, observe procedures outlined in these specifications.

1.2 SUBSTITUTE AND "OR EQUAL" ITEMS

A. The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute of material or equipment may be furnished or used by Contractor if acceptable to the Manatee County Public Works Department and the Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in the following paragraphs.

B. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by ENGINEER under the following circumstances.

1. *"Or-Equal"*: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ENGINEER as an "or-equal" item, in which case review and approval of the proposed item may, in ENGINEER's sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items.

2. *Substitute Items*: If in ENGINEER's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or-equal" item, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The procedure for review by the ENGINEER will include the following as supplemented in the General Requirements and as ENGINEER may decide is appropriate under the circumstances. Requests for review of proposed substitute items of material or equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish additional data about the proposed substitute.

3. *CONTRACTOR's Expense:* All data to be provided by CONTRACTOR in support of any proposed "*or-equal*" or substitute item will be at CONTRACTOR's expense.

4. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to ENGINEER. CONTRACTOR shall submit sufficient information to allow ENGINEER, in ENGINEER's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by ENGINEER will be similar to that provided in subparagraph D.

5. *Engineer's Evaluation:* ENGINEER will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs D and F. ENGINEER will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without ENGINEER's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any "or-equal" or substitute. ENGINEER will record time required by ENGINEER and ENGINEER' s Consultants in evaluating substitutes proposed or submitted by CONTRACTOR pursuant to paragraphs D and F and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ENGINEER accepts a substitute item so proposed or submitted by CONTRACTOR. CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's Consultants for evaluating each such proposed substitute item.

END OF SECTION

SECTION 01690 - STARTING PROCESS SYSTEMS

PART 1 - GENERAL

1.1 PLAN SUBMITTAL

A. Prior to attaining 75 percent completion of construction, the CONTRACTOR shall submit his plan for placing the facility into operation.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 START UP PLAN

A. The plan shall include but not necessarily be limited to:

1. Procedures for inspection of systems, equipment, instrumentation and controls to be carried out prior to their being energized;
2. Schedule for on-site inspections, supervision of installation and start-up by manufacturer's personnel;
3. List of equipment and controls for which a manufacturer's certificate of proper installation shall be submitted prior to energizing; and
4. Sequence of start-up of each system.
5. Start up instruction classes for each different type of equipment with Manatee County Public Works Department personnel.

3.2 MATERIALS, SUPPLIES AND ENERGY

A. In conjunction with start-up, testing, and up to the time of acceptance of the facility by the OWNER, the CONTRACTOR shall furnish all required materials, supplies and energy.

B. The above requirement applies to all expendable items required to operate and test the facility including: chemicals, electric power, diesel fuel, lubricants, and custodial supplies, water and/or wastewater.

END OF SECTION

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Conditions of the Contract. Fiscal provisions, legal submittals and additional administrative requirements.

B. Section 01030: Special Project Procedures.

C. Section 01710: Cleaning.

D. Section 01740: Warranties and Bonds.

1.3 SUBSTANTIAL COMPLETION

A. When Contractor considers the work is substantially complete, he shall submit to the Owner a proposed certificate which includes:

1. A written notice that the work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Engineer and Owner will make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project will be considered substantially complete.

D. Should the Engineer or Owner determine that the work is not substantially complete:

1. Owner will promptly notify the Contractor in writing, giving the reasons therefor.
2. Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the Owner.
3. Owner and Engineer will reinspect the work.

E. When the Engineer finds that the work is substantially complete, he will:

1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with a tentative list of items to be completed or corrected before final payment.

2. After consideration of any objections made by the Owner as provided in Conditions of the Contract and when Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.4 FINAL INSPECTION

A. When Contractor considers the work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
5. Work is completed and ready for final inspection.

B. Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should Engineer consider that the work is incomplete or defective:

1. Owner will promptly notify the Contractor in writing, listing the incomplete or defective work.
2. Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to Owner that the work is complete.
3. Engineer will reinspect the work.

D. When the Engineer finds that the work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

E. Should the Engineer be required to make more than a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse its Owner for the Engineer's fees for any additional inspections.

1.5 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

A. Project Record Documents (Prior to substantial completion).

B. Warranties and Bonds.

C. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

D. Certificate of Insurance for Products and Completed Operations.

E. Operation and maintenance manuals (prior to substantial completion).

1.6 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:

    a. Previous Change Orders
    b. Unit Prices
    c. Penalties and Bonuses
    d. Deductions for liquidated damages
    e. Other adjustments

3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Owner will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.7 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Execute cleaning during progress of the work and at completion of the work, as required by the General Conditions.

1.2 RELATED REQUIREMENTS

A. Conditions of the Contract.

B. Each Specification Section: Cleaning for specific products of work.

1.3 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations and anti-pollution laws.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.2 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Wipe clean all surfaces of buildings, mechanical equipment and electrical equipment, existing or new, that are affected by the construction. Remove all dirt, dust, oil, grease, etc. Use detergents and solvents where necessary.

D. Check all painted surfaces and touch-up those areas that are scratched, cracked, or need additional thickness. Paint existing facilities that are disturbed by construction activities.

E. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the Owner one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Engineer's field orders or written instructions.
6. Approved shop drawings, working drawings and samples.
7. Field test records.
8. Construction photographs.

1.2 RELATED REQUIREMENTS

A. Section 01340: Shop Drawings, Project Data and Samples.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer.

1.4 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.5 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress.

1. Do not conceal any work until required information is recorded.

C. Drawings; Legibly mark to record actual construction:

1. All underground piping with elevations and dimensions. Changes to piping location. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Field changes of dimension and detail.
3. Changes made by Field Order or by Change Order.
4. Details not on original contract drawings.
5. Equipment and piping relocations.
6. Locations of all valves, fire hydrants, manholes, water and force main fittings (excluding bends less that 45 degrees), underdrain cleanouts, catch basins, junction boxes and any other structures located in the work area.
7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; and baffle, weir and invert elevations in control structures. Bench marks and elevation datum shall be indicated.
8. Allowable tolerance shall be $\pm$ 1.0 foot for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of $\pm$ 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of $\pm$ 1/2 inch.
9. The Contractor shall retain a registered land surveyor to lay out the work and keep track of changes.

D. Specifications and Addenda; Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
2. Changes made by field order or by change order.

E. Shop Drawings (after final review and approval):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.6 SUBMITTAL

A. Prior to substantial completion, deliver Record Documents to the Engineer.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01730 - OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.

B. Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

C. Instruct Owner's personnel in maintenance of products and equipment and systems.

D. Provide six (6) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.2 RELATED REQUIREMENT

A. Section 01340: Shop Drawings, Product Data and Samples

1.3 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 inch x 11 inch
2. Paper: 20 pound minimum, white, for typed pages
3. Text: Manufacturer's printed data or neatly typewritten
4. Drawings:

    a. Provide reinforced punched binder tab, bind in with text.
    b. Fold larger drawings to size of text pages.

5. Provide fly-leaf for each separate product or each piece of operating equipment.

    a. Provide typed description of product and major component parts of equipment.
    b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

    a. Title of Project.
    b. Identity of separate structures as applicable.
    c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.4 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.

2. Operating Procedures:

    a. Start-up, break-in, routine and normal operating instructions.
    b. Regulation, control, stopping, shut-down and emergency instructions.
    c. Summer and winter operating instructions.
    d. Special operating instructions.

3. Maintenance Procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Alignment, adjusting and checking.

4. Servicing and lubrication schedule.

    a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    a. List of predicted parts subject to wear.
    b. Items recommended to be stocked as spare parts.

8. As installed control diagrams by controls manufacturer.
9. Each contractor's coordination drawings.

    a. As installed color coded piping diagrams.

10. Charts of valve tag numbers, with location and function of each valve.
11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.

    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards.

    a. Electrical service.
    b. Controls.
    c. Communications.

3. As-installed color coded wiring diagrams.
4. Operating procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

5. Maintenance procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.5 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion.

1. Copy will be returned after substantial completion, with comments (if any).

B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.6 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner.

1.2 RELATED REQUIREMENTS

A. Instructions to Bidders: Bid or Proposal Bonds.

B. Conditions of the Contract: Performance Bond and Labor and Material Payment Bond.

C. Conditions of the Contract: General Warranty of Construction.

1.3 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for Owner's personnel:

    a. Proper procedure in case of failure.
    b. Instances which might affect the validity of warranty or bond.

7. Contractor, name of responsible principal, address and telephone number.

1.4 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch x 11 inch punch sheets for standard 3-ring binder.

   a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:

   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.5 TIME OF SUBMITTALS

A. Make submittals within ten days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.6 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the Owner of all documents required under this section is a pre-requisite to requesting a final inspection and final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01760 - SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

A. The CONTRACTOR shall be responsible for submitting all required spare parts and maintenance materials prior to the completion of the project.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. The CONTRACTOR shall submit spare parts and maintenance materials as defined in the individual equipment sections of these specifications.

PART 3 - EXECUTION

3.1 PACKAGING

A. All materials shall be submitted in separate containers/cartons which shall clearly indicate the specification section and the contents of the containers/cartons.

3.2 SUBMITTAL

A. Submit to the OWNER as soon as possible after receipt has been made by the CONTRACTOR. All spare parts shall be submitted to the OWNER prior to the completion of the project.

END OF SECTION

SECTION 01800 - OPENINGS & PENETRATIONS IN CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, tools, equipment and services for all openings and penetrations in construction as indicated in accord with provisions of the Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

D. See Division 1 for General Requirements.

1.2 QUALITY ASSURANCE

A. Reference standards:

American Welding Society (AWS)
Structural Welding Code DI.I

American Concrete Institute (ACI)
ACI 318-77, Chapter 6 on Embedding of Pipes

National Fire Protection Association (NFPA
NFPA 90A, Standard for Installation of Air
Conditioning and Ventilating Systems

Standard Building Code (SBC)
Southern Building Code Congress International, Inc.
900 Montclair Road, Birmingham Alabama, 35213-1206

N.E.C. Article 501

1.3 SUBMITTALS

A. See Section 01340.

B. Where an opening is required but is not shown on drawings, submit shop drawing, showing location of opening, size, and method to be used for making opening.

C. Submit drawings verifying coordination of openings and penetrations, sizes and locations.

D. Submit details of required seals verifying compliance of methods and materials.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 OPENINGS AND PENETRATIONS - GENERAL

A. Examine drawings to coordinate sizes and locations of openings and penetrations.

B. Set sleeves with ends flush with finished surfaces, unless otherwise specified or indicated.

C. Where pipes or ducts pass through floors in locations where floors can be washed or wetted, set sleeves with top 4 IN above finish floors.

D. For insulated piping or ducts, size sleeves large enough to accommodate full thickness of insulation.

E. Set sleeves or framed openings in advance in order to avoid conflict with other trades.

F. Comply with following for cast-in-place concrete construction unless specifically otherwise approved:

1. Do not cut into nor core drill any beams, joists, or columns.
2. Do not install sleeves in beams, joists or columns.
3. Do not install recesses in beams, joists, columns or slabs.
4. Utilize one of the following installation methods:

    a) Core drill with non impact type equipment (preferred).
    b) Mark opening and drill small 3/4 IN or/less holes through structure following opening outline.
    c) Sawcut opening outline on both surfaces then knock out within sawcuts using impact type equipment using extreme caution not to chop or spall face of surface to remain intact.

5. When any opening larger than 10 IN must be made in completed structure, secure approval before starting work.

G. Comply with following for precast-prestressed concrete construction unless specifically otherwise approved:

1. Do not cut openings nor core drill vertically or horizontally through stems of members.
2. Do not locate or install sleeves or recess sleeves vertically or horizontally through or in stems of members.

3. Openings and sleeves to be cast into flanges of units.
4. Openings larger than 6 IN in diameter or 6 IN maximum dimension shall be cast in units at time of manufacture. Openings smaller than 6 IN in diameter or 6 IN maximum dimensions may be cast in flanges of units at time of manufacture or may be field cut.

H. Where alterations are necessary of where new and old work join, restore adjacent surfaces to their condition prior to start of work.

I. Furnish to precast manufacturer complete information concerning location and placement of openings and penetrations for inclusion in the calculations and shop drawings. Show coordination with work of all other trades.

J. Hot dip galvanize all steel sleeves installed.

3.2 GENERAL SCHEDULE OF PENETRATIONS THROUGH FLOORS, ROOFS, FOUNDATION BASE SLABS, FOUNDATION WALLS, FOUNDATION FOOTINGS, PARTITIONS AND WALLS FOR EQUIPMENT, DUCTWORK, PIPING AND CONDUIT.

A. Provide openings and penetrations in construction where shown on drawings and as described in following listing:

Type A - Block out 1 IN larger than outside dimensions of duct or pipe. Dimension to allow for insulation to pass through opening where insulation is required.

Type B - Schedule 40 black steel pipe sleeve with wall anchor.

Type C - 12 gauge sheet metal sleeve with welded seams integrally incorporated into construction.

Type D - Commercial type casting wall sleeve.

Type E - Schedule 40 steel pipe sleeve with combination anchor and water stop plate.

Type F - Cast in place pipe or conduit.

Type G - Cast in place with (combination anchor and water stop plate) welded to pipe or ductwork.

Type H - Core drill after structure is in place.

B. Provide seals of material and method described as follows unless otherwise noted on drawings. Assure seal material and method are compatible with location and service of seal.

Category 1 - Link - Seal

Category 2 - Not Used

Category 3 - Safing material and sealant. Refer to Specification Section 07900 for sealant types.

Category 4 - Backer rod and sealant. Refer to specification Section 07900 for sealant types.

Category 5 - Backer rod and sealant and escutcheons on both sides of opening.

Category 6 - Backer rod and sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 IN larger than opening.

Category 7 - Safing material and sealant and escutcheons on both sides of opening.

Category 8 - Roof curb and flashing according to SMACNA specifications unless otherwise noted on drawings.

Category 9 - Not used.

Category 10 - Fire rated sealant - Refer to Section 07900.

Category 11 - Conduit seals.

C. Subject to compliance with contract Documents, furnish openings and sealing material in full accordance with drawings and the following schedule:

Location	Media	Opening Type	Sealing Material Category
Through floor with bottom side a hazardous area.	Duct	C	4
	Pipes	E,X	4
	Conduits	F	11
Through floors on grade above water table	Ducts	F	not required
	Pipes	E	4
	Conduits	F	not required
Through slabs on grade below water table	Pipes	D or E	1
	Conduits	F	not required
Through floors in areas with floor drains or hose bibs (wet areas)	Ducts	C	6
	Pipes:		
	2 IN and smaller	A,H or C	5 or 6 at areas subject to wash down
	Larger than 2 IN	E	5 or 6 at areas subject to wash down
	Conduits	F	not required

Through fire rated walls	Ducts Pipe:	A	3 or 10
	2 IN and smaller	B or H	7 or 10
	Larger than 2 IN	B	3 or 10
	Conduits	F	not required
Through walls where one side is a hazardous area	Duct (Round) Pipe Conduit	D or E D or E F	1 1 11
Through exterior wall below grade	Duct Pipe Conduits	D or E D or E H F F	1 1 1 not required not required
Through wall from wet well to dry well	Pipes	D or E F	1 not required
Through exterior wall above grade	Duct Pipe Conduits	A or F B, D or E F	6 1 or 4 not required
Roof penetration	Duct Pipes Conduits	A A A F	8 8 8 not required
Through interior walls unless specifically covered above	Ducts Pipes Conduits	A or C A or C F	4 4 not required

END OF SECTION

SECTION 02010 - SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. A soils investigation report has been prepared for the site of this work by PSI, Inc., hereafter referred to as the Soils Engineer. The soils investigation report may be inspected at the Manatee County Project Management Department office on 66th Street in Bradenton or at the Clearwater office of McKim & Creed. Copies of the soils investigation report may be obtained from the Clearwater Office of McKim & Creed for a handling charge of $10.00 per copy.

B. This report was obtained only for the ENGINEER's use in design and is not a part of the Contract Documents. The report is available for bidder's information, but is not a warranty of subsurface conditions.

1.2 QUALITY ASSURANCE

A. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed under time schedules and arrangements approved in advance by the Owner.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 02050 - DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes demolition and debris removal as indicated on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Accomplish all demolition work so there is no injury to any persons and no damage to adjacent structures or property. All demolition methods shall be in full compliance with municipal, county, state, and federal ordinances. Demolition work shall comply with the requirements of the Occupational Safety and Health Administration (OSHA).

B. The Contractor shall comply with all municipal, county, state and federal ordinances regarding the disposal of rubble, scrap metal, and refuse.

C. Demolition procedures shall provide for safe conduct of the work, protection of property which is to remain undisturbed, and coordination with other work in progress.

1.3 JOB CONDITIONS

A. It shall be the responsibility of the Contractor to visit the site and inspect the nature and condition of the items to be removed and salvaged before submitting his bid.

B. ***Dust Control.*** Control the amount of dust resulting from demolition to prevent the spread of dust to occupied portions of buildings and to avoid creation of a nuisance in the surrounding area. Do not use water when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution.

C. ***Protection of Existing Work.*** Protect existing work. Work damaged by the Contractor shall be repaired to match existing work.

PART 2 - MATERIALS AND EQUIPMENT

2.1 REPAIR AND REPLACEMENT MATERIALS

A. Materials used in the repair or replacement of existing work to remain shall be identical or equal to the materials used in existing work when new.

PART 3 - EXECUTION

3.1 STRUCTURES AND BUILDINGS

A. Remove all parts of existing structures to be demolished.

3.2 EQUIPMENT

A. Completely remove equipment which is designated to be removed.

B. Remove concrete equipment bases if the existing bases are not to be used for new equipment.

C. Completely remove isolated equipment bases.

3.3 PIPING

A. Completely remove piping, conduit, and wiring in structures and buildings which are to be demolished, partially demolished, and where otherwise designated to be removed.

B. Underground piping, conduit, and wiring which are to be abandoned and do not interfere with new work may be left in place, unless otherwise shown on the Drawings. Plug and seal ends of underground piping to be abandoned. Do not leave abandoned branches of piping and wiring "live". Isolate abandoned branches by closing branch valve at main or by disconnecting branch at main. Plug, cap, and seal active branch at isolating valve or point of disconnection.

C. Properly disconnect, seal and plug utility services to structures and buildings which are completely demolished. Properly disconnect, seal, and plug utility lines within structures and buildings which are partially demolished.

3.4 DISPOSAL

A. Equipment, piping, and materials which are designated to remain the property of the Owner shall be moved to a location within the project site designated by the Owner.

B. All removed equipment, piping, and materials not specifically designated to remain the property of the Owner shall become the property of the Contractor and shall be removed from the site.

C. Do not allow debris and rubbish to accumulate on the site. Remove debris and rubbish from the site.

D. If the Contractor uses Manatee County Sanitary Landfill for disposal, the Contractor shall be required to pay a disposal fee when crossing the landfill weighting scales.

3.5 FILLING

A. Backfill excavations resulting from demolition.

B. Backfill excavations which will not be beneath new structures, buildings, piping, or other new work as specified in this paragraph.

C. Backfill excavations more than three feet deep or more than five cubic yards in volume as specified in Section 02200 - Earthwork.

D. Place and compact backfill in other excavations to produce an adequate foundation for grassing.

3.6 CLEAN-UP

A. Clean-up in areas where other work is to be done following demolition shall be as specified in the applicable Sections.

B. Clean-up the job site in areas where no other work is to be done under this Contract following demolition. Remove all debris and rubbish, temporary facilities, and equipment. Level surface irregularities to eliminate depressions. Leave the work in a neat and presentable condition.

END OF SECTION

SECTION 02110 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection: Provide temporary fences, barricades, coverings, or other protection to preserve existing items indicated to remain and to prevent injury or damage to persons or property. Provide protection for adjacent properties as required.

C. Restore damaged work to condition existing prior to start of Work.

D. Protect existing trees and vegetation that are indicated to remain from physical damage. Do not store materials or equipment within tree drip line. Use licensed arborist for tree damage repair. Replace damaged trees that cannot be restored to full growth, as determined by arborist, unless otherwise acceptable to Architect.

E. Existing Services: Locations indicated are approximate; determine exact location before commencing Work. Coordinate with local utility service requirements and comply with their instructions.

PART 2 - MATERIALS AND EQUIPMENT

(Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Site Clearing: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as indicated or that interfere with new construction. Removal includes digging out stumps and roots, together with subsequent off-site disposal.

B. Strip and stockpile topsoil that will be reused in the Work.

C. Remove existing improvements, both above-grade and below-grade, to extent indicated or as otherwise required to permit new construction.

D. Salvable Items: Carefully remove items indicated to be salvaged and store on OWNER's premises where indicated or directed.

E. Control air pollution caused by dust and dirt; comply with governing regulations.

F. Fill depressions and voids resulting from site-clearing operations. Using satisfactory soil materials, place in maximum 6-inch-deep horizontal layers and compact each layer to density of surrounding original ground.

G. Grade ground surface to conform to required contours and to provide surface drainage.

H. Dispose of waste materials, including trash, debris, and excess topsoil, off OWNER's property.

I. Burning waste materials on site is not permitted.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes digging of excavations for structures, piping and roadways; backfilling around structures and piping; shaping and contouring the ground surface to conform to established grades and elevations; compacting of earth or rock materials to specified densities; bracing, sheeting and shoring; dewatering; removal of surplus excavated materials; and related work as shown on the Drawings and as specified.

1.2 DEFINITIONS

A. Excavation. Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping or conduits.

B. Cavity formed by the removal of earth and rock.

C. Earth. Unconsolidated material in the crust of the earth derived by weathering and erosion. Earth includes:

1. materials of both inorganic and organic origin;
2. boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay;
3. materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

D. Rock. A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:

1. limestone, sandstone, dolomite, granite, marble, and lava;
2. boulders 1/3 cubic yard or more in volume;
3. materials which cannot be excavated by equipment which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.

E. Undercutting. Excavation of rock and unsuitable earth below the bottom of a foundation, structure, pipe or conduit to be constructed or installed.

F. Subgrade. Undisturbed bottom of an excavation.

G. Bedding. Earth placed in trench to support pipe and conduit.

H. Backfill and Fill. Earth placed around structures from the bottom of an excavation to finished grade, or to the subbase of pavement.

I. Earth placed in a trench from the top of bedding to finished grade, or to subbase of pavement.

J. Topsoil. Earth containing sufficient organic materials to support the growth of grass.

1.3 JOB CONDITIONS

A. Carefully maintain bench marks, monuments and other reference points, and if disturbed or destroyed, replace as directed.

B. Should the Contractor encounter unusual subsurface and/or latent conditions at the site, he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will promptly investigate the conditions and he will at once make such changes in the Plans and/or Specifications as he may find necessary. Any increase or decrease in cost resulting from such changes will be adjusted in the manner provided in the General Conditions.

1.4 QUALITY ASSURANCE

A. Codes and Standards. Perform excavation and landfilling work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service. The OWNER will retain a Soils Engineer to perform soil testing and inspection service for quality control testing of earthwork operations. Tests revealing satisfactory results will be paid for by the OWNER. The cost of tests revealing unsatisfactory results will be deducted from monies due the Contractor.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. Earth for Fill and Backfill. Earth used for fill or backfill shall be of such gradation and moisture content that it will compact to the specified density and remain stable.

B. Pipe Bedding. Pipe bedding material for Type A-2 and A-3 trenches shall be No. 57 crushed stone with gradation as noted in Table 1 of Section 901 of the FDOT Standard Specifications.

C. Pipe Cover Material. Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to 1-inch) in size, in a substantially uniform combination. Unwashed bank run sand and crushed bank-run gravel will be considered generally acceptable. Bedding material may be used for cover material.

D. Special Backfill. Special backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines

E. Suitable Backfill. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

F. Unsuitable Materials. Materials which are unsuitable for backfill include stones greater than 6-inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, and the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

G. Shell Material. For roadways shall be as specified in Section 913 of the FDOT Standard Specifications.

H. Geotextile Fabrics. For stabilization and reinforcement shall be as specified in Section 985 of the FDOT Standard Specifications.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING FACILITIES

A. Support and protect all poles, fences, utility pipes, wire, conduits, buildings and structures.

B. Proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.

C. Wherever water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes, or similar items, shall be subject to the approval of the Engineer.

D. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Engineer in ample time for the necessary measure to be taken to prevent interruption of the service.

E. The Contractor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work, unless he shall have first obtained the property OWNER's written consent to do so and shall have shown said written consent to the OWNER.

F. All excavated material shall be piled in a manner that will not obstruct driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Drainageways shall be kept clear or other satisfactory provisions made for drainage.

G. Natural watercourses shall not be obstructed, except where specifically permitted for the construction of outfall and subaqueous crossings.

3.2 CLEARING

A. Before excavating, clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.

B. Do not remove or damage trees that do not interfere with the finished work. Completely remove trees required to be removed, including stumps and roots. Replace trees removed unnecessarily. Properly treat damaged trees which can be saved.

3.3 STRIPPING AND STOCKPILING TOPSOIL

A. Strip topsoil and vegetation from the areas to be excavated. Clean topsoil may be stockpiled for reuse.

3.4 EXCAVATING

A. Make excavations to elevations and dimensions necessary to permit bracing, sheeting, erection of forms, inspection of foundation and installation of piping or conduits. Excavate trenches to the required alignment, depth and width. Excavate trenches in advance of pipe and conduit installation only as far as necessary to provide proper alignment and grade. Plan trenching operations to cause a minimum of danger to adjacent property and a minimum of inconvenience to the public.

B. The width of trenches at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and to allow the backfill to be placed and compacted as specified. Maximum trench width shall be such that design loadings on pipe will not be exceeded. Trenches shall be of such extra width, when required, to permit the placement of supports, sheeting, bracing, and appurtenances.

C. Depth of trenches shall be such as to allow installation of pipelines at the grades or elevations shown.

D. Trees, boulders, and other surface encumbrances, located so as to create a hazard to anyone involved in the excavation work or who is in the vicinity of the work at anytime during operations, shall be removed or made safe before excavating is begun.

E. Contractor shall be responsible for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.

F. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.

G. Flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion and slide planes appear.

H. Shore or otherwise support sides of excavations in hard or compact soil when the excavation is more than five feet in depth. In lieu of shoring, the sides of the excavation above the five-foot level may be sloped to preclude collapse, but shall not be steeper than a one-foot rise to each 1/2-foot horizontal.

I. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.

J. Excavations shall be inspected by a competent CONTRACTOR's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

K. Do not store excavated or other material nearer than four feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.

3.5 DEWATERING

A. Keep excavations free from water until foundations, structures, and piping are completed and will safely withstand forces generated by water. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other work. Do not use sanitary sewers for the disposal of water from dewatering operations.

3.6 SHEETING

A. The Contractor has the option of sheeting excavations.

B. Supporting systems, such as piling, cribbing, shoring, and bracing shall be designed by a qualified CONTRACTOR's representative and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, securely anchor the tie rods well back of the angle of repose. When tight sheeting or sheet piling is used, assume full loading due to groundwater table, unless prevented by weep holes or drains or other means. Provide additional stringers, ties, and bracing to allow for any necessary temporary removal of individual supports.

C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning shall be in good, serviceable condition. Timbers shall be sound, free from large or loose knots, and of proper dimensions.

D. Take special precautions in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Pay particular attention to joints and seams of material comprising a face and to the slope of such seams and joints.

E. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above or near an excavation, sheet-pile, shore, and brace the side of the excavation as necessary to resist the extra pressure due to such superimposed loads.

F. If the stability of adjoining buildings or walls is endangered by excavations, provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent CONTRACTOR's representative and the protection effectively maintained.

G. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and other property on the project site as well as on the private grounds.

H. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.7 ROCK REMOVAL

A. Rock, boulders or other hard, lumpy or unyielding materials encountered in trench bottoms shall be removed to a depth at least 12-inches below the bottom of any pipes to be installed. All rock and other hard foundation material under structures shall be freed of all loose material, cleaned, and cut to a firm surface; either level, stepped vertically and horizontally or serrated, as may be directed. All seams shall be cleaned out and filled with concrete or mortar.

B. Blasting of rock or other hard to remove materials will not be permitted on this project.

3.8 SUBGRADES

A. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unstable or unsuitable soil.

B. Fill excess cuts under foundations, footings, and slabs with concrete.

C. Fill excess cuts under piping with compacted bedding as specified in this Section.

3.9 FOUNDATION COMPACTION

A. In areas where building, structure foundations, and precast concrete tanks are located just below the surface, the site shall be proofrolled using a large vibratory roller (Dynapac CA-25 or equivalent). Proofrolling shall consist of at least ten overlapping passes. Water shall be added in order to achieve a moisture content near optimum to facilitate compaction. Purpose of the proofrolling is to detect any areas of unstable or unsuitable soils as well as to density the near-surface soils. Materials which yield excessively during the proofrolling shall be undercut and replaced with well-compacted structural fill.

B. The OWNER will retain a Soils Engineer to be present during proofrolling operations to observe the proofrolling and recommend the nature and extent of any remedial work.

C. In areas where foundations and prestressed concrete tanks are located, the area shall be excavated to the foundation subgrade and then compacted to a minimum of 95% of the modified Proctor maximum dry density as determined by ASTM Specification D-1557, for a depth of 12-inches below the bottom of the foundations.

D. Any fill required to achieve finished grade in structural areas or used as structural backfill shall be inorganic, non-plastic granular soil containing less than 10% material passing a No. 200 sieve. Fill shall be placed in level lifts not to exceed 12-inches loose thickness and compacted to a minimum of 95% of the modified Proctor maximum dry density as determined by ASTM Specification D-1557. In-place density tests will be performed on each lift to verify that the specified degree of compacting has been achieved.

3.10 BACKFILLING FOUNDATION AND STRUCTURE EXCAVATIONS

A. Remove debris and other unstable or unsuitable materials from excavations before backfilling is started.

B. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12-inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Engineer.

C. Backfill excavations not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12-inches in loose depth. Place backfill and fill materials in lifts no greater than four inches in loose depth where hand tampers are used. Backfill and fill shall be within 2% of optimum moisture content. For soils containing less than 5% material passing a No. 200 sieve, moisture content may be increased to within 3% of optimum. Compact backfill

and fill to not less than 95% of the maximum dry density. Tests for determination of maximum dry density shall meet the requirements of ASTM D698 Method C. Use compaction equipment which is suited to the soil being compacted.

D. If suitable, use stored excavated material for backfill and fill. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the OWNER.

E. Do not use the following materials for backfill:

1. Unsuitable materials;
2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.

F. Place the backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.

G. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:

1. to the underside of the respective surfacing for walks and pavement;
2. to finished grade for lawns and planted areas within the project site.

3.11 BACKFILLING PIPING TRENCHES

A. Do not backfill trenches and excavations until all utilities have been inspected by the OWNER's representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.

B. Remove debris and other unsuitable materials from excavations before backfilling is started.

C. Place and tamp bedding and backfilling in a manner which will not damage pipe coating, wrapping, or encasement.

D. Bedding procedures shall be as specified in the particular Section for the applicable pipe material.

E. If bedding does not cover the pipe, place pipe cover material from the top of bedding to 12-inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified.

F. Do not use the following materials for backfilling:

1. Unsuitable Materials;
2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.

G. If suitable, use stored excavated material for backfill and fill. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the OWNER. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12-inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Backfill and fill materials shall be within 2% of optimum moisture content. Do not compact backfill by puddling, unless permitted by the Engineer.

H. Backfill trenches not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12-inches in loose depth and compact to produce an adequate foundation for seeding. The top 4-inches of backfill shall not contain stones or other objects larger than 1-inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill and immediately before restoration of vegetated areas.

3.12 SHELL BASE

A. Construction of a base course composed of shell shall be as specified in Section 250 of The FDOT Standard Specifications.

3.13 GEOTEXTILE FABRIC

A. Installation of geotexilbe fabric for stabilization and reinforcement shall be as specified in Section 514 of the DOT Standard Specifications

3.14 FINISH GRADING

A. Shape the surface of all earthwork to conform to the lines, grades, contours and cross-sections shown on the drawings. Hand dressing may be required in certain areas or in confined areas where equipment operation is restricted.

B. In final shaping of the surface of the earthwork a tolerance of 0.1 foot above or below the plan elevation will be allowed with the following exceptions:

1. Earthwork shall be shaped to slope away from all buildings and structures.
2. Earthwork shall be shaped to match adjacent pavement, curb, sidewalks, and similar appurtenances.
3. Ditch bottoms and swales shall be shaped so that no water will be impounded except in areas designated for impoundment.

3.15 CLEANUP AND MAINTENANCE

A. Cleanup the job site as grading is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction.

B. Maintain the job site until the work has been completed and accepted. Fill excavations which settle when settlement is visible. Restore items damaged by construction or improper restorations. Keep dust conditions to a minimum.

3.16 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.

B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are backfilled.

C. Excavated suitable surplus materials shall remain the OWNER's property and shall be stockpiled at the location(s) designated by the OWNER.

3.17 DUST CONTROL

A. The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity. The Contractor shall have adequate water trucks on the site at all times and water, as necessary, the areas where dust may arise. He shall cooperate fully with the Owner's Representative and water immediately when instructed to do so.

END OF SECTION

SECTION 02211 - STEEL SHEET PILES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish and install steel sheet piles to brace and shore open excavating for workers safety and/or protection of adjacent facilities or as required by these specifications or as shown on the Drawings.

1.2 SUBMITTALS

A. Submit shop drawings, full details of the construction and erection of the steel sheet piling, shoring and bracing and the procedure the Contractor intends to follow in performing the work.

B. Submit complete erection drawings showing bolt locations and details of openings, etc. Erection drawings shall show all necessary secondary steel framing members required to support the steel pilings.

C. Drawings of the sheeting and bracing and design computations shall be submitted to the County and construction shall not be started until such drawings are received. The drawings and computations shall be prepared and sealed by an Engineer and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the substructures.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Steel Sheet Piles

1. Steel Sheet Piles shall conform to ASTM A 328. Steel pile sections shall be the continuously interlocking deep arch equal to PLZ23. The section modulus per linear foot shall not be less than 30.2 cubic inches and the weight shall be not less than 22.6 pounds per square foot of wall. Sheet pile sections shall be not less than 3/8-inch thick.

2. All sheet piles shall be furnished with standard pulling holes located approximately four inches below the top of the pile, unless specified otherwise.

B. Wales and Caps: Structural steel shapes and plates shall conform to ASTM A 36. Bolts shall conform to ASTM A 307.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that is necessary for proper construction, and to protect adjacent structures or roadways from undermining or other damage. If the County's Representative is of the opinion that at any point sufficient or proper supports have not been provided, the County's Representative may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

B. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be directed.

C. The County shall have the right to order sheeting and bracing left in place and this right shall not be construed as creating any obligation on the County's part to issue such orders, and the County's failure to exercise its right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

D. Prior to setting, the sheet piles shall be thoroughly cleaned and inspected for defects and for proper interlock dimensions. The Contractor shall provide a tool for checking the interlock dimensions.

E. Each sheet pile shall have sufficient clearance in the interlocks to slide, under its own weight, in the interlock of the sheet pile previously placed during the setting operation until the top of existing ground is reached by the tip of the sliding pile. In no case during the setting operation shall a vibratory or drive hammer be used to force the interlock of a pile into the interlock of an adjacent pile.

F. Before driving is started, check the sheet piles for position and alignment. Vertical alignment of each sheet pile shall be not more than 1/8 inch per foot from the vertical in all directions. Provide a plumb line or other device for checking vertical alignment.

G. Excavation shall not be carried in advance of the steel sheet piling.

H. Drive sheet piles in rotating stages such that the tip of any sheet pile is not more than 5 feet below the tip of any adjacent sheet pile nor more than 8 feet below the tip of any other sheet pile in the bulkhead.

I. Use a suitable driving head to keep deformation of the driving end to a minimum. If any sheet pile is driven out of interlock, it shall be removed and replaced at the Contractor's sole expense.

J. Piles shall be driven with air, steam, or diesel hammer having sufficient energy to achieve the required penetration. However, the means and methods selected by the Contractor shall be to prevent damage to any nearby structures.

K. Obstructions encountered before the specified penetration for the piles is obtained shall be removed. Damaged piling or one with faulty alignment shall be withdrawn and new piling driven properly in its place. The cost of such additional work shall be considered as part of the pile driving and shall be borne by the Contractor.

L. Cut the tops of the sheet piles on a true horizontal line with a tolerance of plus or minus 1/2 inch by burning or other suitable method that will not damage the pile. For trench sheeting of pipes, no sheeting is to be withdrawn if driven below mid-diameter of pipe.

END OF SECTION

SECTION 02212 - WOOD SHEETING LEFT IN PLACE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish and install shoring and sheeting to brace and shore open excavating for workers safety and/or protection of adjacent facilities or as required by these specifications or as shown on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood for shoring and sheeting shall be 3-inches maximum thickness and green, rough cut hardwood planking, square edges of tongue and groove.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall furnish, install, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that which is necessary for proper construction, and to protect adjacent structures from undermining or other damage. If the Engineer is of the opinion that sufficient or proper supports have not been provided, he may order additional supports be installed at the expense of the Contractor. Compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

B. The Contractor shall leave in place to be embedded in the backfill all sheeting, bracing, and other related items as shown on the Drawings. For trench sheeting of pipes, no wood sheeting shall be cut off at a level lower than 1 foot above the top of the pipe, unless otherwise directed by the County.

C. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property.

D. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on the Owner's part to issue such orders, and the Owner's failure to exercise its right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall receive no payment other than that included in the lump sum price for the project for any timber used for sheeting, bracing, or other related items. The Contractor shall receive no payment for such timber which has actually been left in the trench for the convenience of the Contractor.

END OF SECTION

SECTION 02240 - CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, tools, equipment, and services for all chain link fence and gates as indicated, in accord with provisions of Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

D. See Division 1 for General Requirements.

1.2 QUALITY ASSURANCE

A. Comply with standards of Chain Link Manufacturers. Institute for "Galvanized Steel Chain Link Fence Fabric and Accessories" except as otherwise indicated.

B. Reference standards:

1. ASTM A90 - Test for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
2. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
3. ASTM A121 - Zinc Coated (Galvanized) Steel Barbed Wire.
4. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip.
5. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A239 - Test of Galvanized Coating.
7. ASTM A392 - Zinc-Coated Steel Chain-Link Fence Fabric.
8. ASTM A428 - Weight of coating on Aluminized - Coated Iron or Steel Articles.
9. ASTM A491 - Aluminum-Coated Steel Chain-Link Fence Fabric.
10. ASTM A570 - Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
11. ASTM A572 - High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
12. ASTM A585 - Aluminum-Coated Steel Barbed Wire.
13. ASTM E8 - Tension Testing of Metallic Materials.
14. ASTM F567 - Standard Practice for Installation of chain Link Fence.
15. ASTM F626 - Standard Specification for Fence Fittings.

C. Installer qualifications: Skilled and experienced mechanics.

D. Comply with National Electric Code or code of local agency having jurisdiction. If conflict occurs between these codes, the more stringent shall be adopted.

1.3 SUBMITTALS

A. See Section 01300.

B. In shop drawings include fence layouts, post locations, gates, details illustrating fence height, location and sizes of posts, rails, braces, footings, hardware list and erection procedures.

C. All material is subject to testing. Submit mill certificates.

1.4 WARRANTY

A. Special Warranty. Provide manufacturer's standard limited warranty covering motorized rolling gate and truck assembly against failure resulting form normal use for a period of five years from the date of purchase. Failure is defined as any defect in manufacturing that prevents the gate from operating in a normal manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish and erect fence and gates of the types designated, in reasonable close conformance with lines and grades as shown on the plans or as directed by the Architect/Engineer. Provide a rigid, taut fence.

B. Provide fence produced by one manufacturer.

C. Provide fence and gate(s) 6.0 FT overall in height with a fabric height of 6.0 FT. Provide top rail surmounted by three (3) strands of barbed wire set at 45 degree angle to the fence fabric, except the gates' barbed wire shall be vertical.

D. Gates:

1. Double swing style gate shall be provided with 24 FT clear opening.
2. Pedestrian gates shall be single swing style with 4 FT clear opening.
3. Rolling gate shall be provided with 40 Ft clear opening (two leafs, each 20 ft.).

E. Use only new materials. Pipe sizes indicated are commercial pipe sizes. Roll form section sizes are nominal outside dimensions. Steel "H" section sizes are outside dimensions. Open seam material not allowed.

F. Hot-dip galvanized iron or steel components after fabrication. Use galvanized and aluminized finish complying with following minimum requirements.

1. Pipe: ASTM A123, 2.0 OZ zinc per SQ/FT.
2. Hardware and accessories: ASTM A153.
3. Fabric: ASTM A392, Class 2, 2.0 OZ zinc per SQ/FT.

4. Barbed wire: ASTM A121 Class 3, 0.80 OZ zinc per SQ/FT or ASTM 585 Class II, 0.30 OZ aluminum per SQ/Ft.

G. Test related fence construction materials in accordance with the following standards:

1. Pipe: ASTM A120 standard weight (Schedule 40) except hydrostatic testing requirements is waived.
2. Chain link fence fabric: ASTM E8 Tension Testing of Metallic Materials. Coating Testing per ASTM A90 and A428.

H. Use only one width fabric, unless modified on the plans.

I. Chain link fabric: Provide woven 2 IN mesh of No. 9 gage (0.148 IN) copper-bearing steel wire, galvanized after fabrication. Minimum tensile strength of wire, 90,000 psi after galvanizing.

J. Chain link fabric: Provide woven 2 IN mesh of No. 9 gage (0.148 IN) copper-bearing steel wire, hot-dipped aluminum-coated before weaving.

K. Steel line posts: Provide 2.875 IN o.d. pipe weighing minimum 3.65 LBS per lineal FT. Provide posts of sufficient length to permit 36 IN to be set in concrete footing.

L. Steel top rail: Provide 1.660 IN o.d. pipe weighing 2.27 LBS per lineal FT or 1.625 x 1.25 IN x 1.35 LB/Ft roll form section. Fit rails with expansion couplings of outside sleeve type. Rails continuous for outside sleeve type for full length of fence.

M. Steel terminal, corner and pull posts, referred to herein as terminal posts: Install 4.00 IN o.d.pipe weighing not less than 5.79 LBS per lineal FT. Provide posts of sufficient length to permit 36 IN to be set in concrete footing.

N. Post braces: Provide for each gate corner, pull, and terminal post, and first adjacent line post. Provide 1.660 IN o.d.pipe weighing not less than 2.27 LBS per lineal FT.

O. Gate posts: Install round steel pipe not less than size and weight given below:

1. Double gate, total width 8 FT: 4.00 IN o.d. weighing not less than 9.10 LB/FT.
2. Single gate up to 6 FT wide: 4.00 IN o.d. weighing not less than 9.10 LB/FT.
3. Single gate 6 FT wide up to 13 wide: 4 IN o.d.weighing 9.10 LB/FT.

P. Tension (stretcher) bars: Provide 1/4 IN x 3/4 IN minimum steel bar. Install one piece for full height of fabric.

Q. Ties and clips: Provide either No. 9 gage aluminum wire ties and dips, for securing fabric to line posts and rails. Space bands not greater than 12 IN o.c. for attachment to line posts and 24 IN o.c.for top rail attachment.

R. Post tops: Install steel, wrought iron, or malleable iron, designed as weathertight closure cap, one cap per post.

S. Combination post top cap and barbed wire supporting arm: Install steel, wrought, or malleable iron complete with provisions for anchorage to posts and attaching 3 rows of barbed wire. Provide one cap and angled arm for each post where barbed wire is required. Angled extension arms to accommodate barbed wire shall withstand a 250 pound pull-down load from end of arm.

T. Barbed wire: Install galvanized (0.80 OZ/SQ FT) two strand twisted, 12-1/2 ga wire with 14 ga, 4 point barbs spaced 3 IN o.c.; or aluminum coated (0.30 OZ/SQ FT) barbed wire.

U. Bottom tension wire: when specified, install marcelled (spiralled or crimped) No. 6 gage aluminum-coated, steel wire. Attach to fence fabric at 24 IN o.c.; with No. 9 gage galvanized steel hog rings.

V. Concrete: Furnish portland cement complying with ASTM C150 Type I aggregates complying with ASTM C33. Use clean water. Mix materials to obtain concrete with minimum 28 day compressive strength of 2500 psi. Use not less than 4 sacks of cement per CU YD, 1 IN maximum size aggregate, 3 IN minimum slump, and 2 to 4 percent entrained air.

W. Gates: Swing type gates shall be complete with latches, stops, keepers, hinges, with provisions for three strands of barbed wire above the fabric.

1. Gate frames: Tubular members assembled with fittings. Frame not less than 1.90 IN o.d.and steel pipe weighing not less than 2.72 LB/FT. When barbed wire top is specified, extend the end members of the gate frames 1 FT above the top horizontal member to which 3 strands of barbed wire, uniformly spaced and attach with bands, clips or hooked bolts.

    a) Truss rods; 3/8 IN minimum nominal diameter to prevent sag or twist.
    b) Gate leaves: Space vertical intermediate bracing so that no members are more than 8 FT apart. Brace gate leaves 10 FT or over with a horizontal brace or one 3/8 IN minimum diagonal truss rod.

2. Hinges: Install pressed or forged steel or malleable iron to suite gate size, of non-lift-off heavy duty type, offset to permit 180 degree gate opening. Provide 1-1/2 pair for each leaf over 6 FT nominal height.
3. Latches for single and double gates: Install heavy duty automatically engaging, lockable latch. Latches for double gates with automatic engaging lockable latch on one leaf and drop rod type latch on other leaf. Furnish drop rod complete with suitable casting set in concrete to hold gate leaf in place when drop rod is engaged.
4. Keepers: Provide keepers for all gages to automatically engage gate leaf and hold it in open position until manually released.

X. Motorized Rolling Gates

1. Provide motorized rolling gates with materials as specified in Paragraph W above. Weld members together forming rigid one-piece frame integral with top track. Provide two truck assemblies with each gate leaf.
2. Motorized rolling gate shall have two gate leafs, each covering 20 feet of the 40 foot opening. Each 20 foot leaf shall have a cantilever support overhang of 10'-0".
3. The chain link fence fabric shall be installed with hook bolts and tension bars on all four sides. The fabric shall be attached to the gate frame at the spacing of no more than 15 inches on center.
4. Top Track Rail. Enclosed combination one-piece track and rail withstanding a reaction load of 2,000 pounds.
5. Truck Assembly. Swivel type, zinc die cast, with four sealed lubricant ballbearing rollers, 2 inches in diameter by 9/16 inch in width, and two side rolling wheels to ensure truck alignment in track. Mount trucks on post brackets using 7/8 inch diameter ball bolts with ½ inch shank. Design truck assembly to withstand same reaction load as track.
6. Gate Hangers, Latches, Brackets, Guide Assemblies and Stops. Malleable iron or steel, galvanized after fabrication. Provide positive latch with provisions for padlocking.
7. Bottom Guide Wheel Assemblies. Each assembly shall consist of two, 4 inch diameter rubber wheels, straddling bottom horizontal gate rail, allowing adjustment to maintain gate frame plumb and in proper alignment. Attach one assembly to each guide post.
8. Gate Posts. Galvanized steel 4 inch OD Schedule 40 pipe. Provide one latch post and two support posts for single-slide gates, and four support posts for double-slide gates.
9. Heavy Duty Slide Gate Operator

    a) Provide two heavy-duty sliding gate opertors, one for each leaf for use on overhead roller or cantilever slide gates subject to high cyclage.
    b) Electric gate operator shall be provided with a 115 or 230 volt solid state controller, heavy-duty 460 volts reversing contactor, magnetic brake, adjustable clutch, emergency disconnect, driven limit switches, completely prewired and factory tested, horsepower as required by manufacturer.
    c) Unit shall be completely assembled and include all necessary hardware, including one interior push-button.
    d) Operation. Open/close/stop three button operation, open override, adjustable friction clutch to slip if gate is obstructed; radio will open, close and reverse gate; full system circuitry.
    e) Mechanical features. Belt and chain reduction, heavy-duty cast ball bearings, solenoid brake, adjustable friction clutch, adjustable limit switches, disconnect for manual operation, painted galvanized housing, post or pad mounting.
    f) Electrical Features. Power on/off switch, high starting torque continuous duty motor, solid state controller, easy LH/RH conversion, maximum-run timer, full systems circuitry, master/ slave operation, prewired and factory tested.

10. Provide drive motor operating on 3 phase, 460 volt, 60 Hertz electric power.
11. Provide automatic card reader, CCTV, telephone, and controls per Section 13300 for opening and closing the gate.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of areas to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 ERECTION

A. Do not start fence installation before final grading is complete and finish elevations are established.

B. Install fence in true and correct alignment with posts vertical.

C. Drill holes in firm, undisturbed or compacted soil, not less than 3 IN deeper than bottom of posts.

D. Set all posts in concrete footings with crowned, steel troweled tops of following minimum dimensions:

1. For line posts: 10 IN diameter.
2. For all other posts up to 6 IN diameter: 12 IN diameter.
3. For posts over 6 In diameter: 18 IN diameter by 48 IN deep.

E. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within 7 days after the individual post footing is completed.

F. Install fence tight, free of sags and bulges.

G. Place fence with bottom edge of fabric 1 IN above grade. Correct minor irregularities in earth to maintain maximum 2 IN clearance.

H. Space line posts at equal intervals not exceeding 10 ft on center.

I. Install terminal posts at ends of runs, changes in bracing assemblies between terminal posts and line posts adjacent to terminal posts.

J. Provide expansion couplings in top rails at not more than 20 FT fittings.

K. Anchor top rails to main posts with appropriate wrought or malleable fittings.

L. Install bracing assemblies at all end and gate posts and both sides of corner and pull posts.

1. Locate compression members at mid-height of fabric.
2. Extend diagonal tension members from compression members to bases of posts.
3. Install so that posts are plumb when under correct tension.

M. Pull fabric taut and secure to posts and rails.

1. Install fabric on outside of fence.
2. Secure so that fabric remains in tension after pulling force is released.
3. Secure to posts at not over 15 IN on center, and to rails at not over 24 IN on center, and to tension wire at not over 24 IN on center.
4. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns.
5. Bend ends of wire to minimize hazards to persons or clothing.

N. Construct gate frames with heavy wrought or malleable fittings or be welding, to produce rigid and weatherproof joints and rigid non-sagging, non-twisting gate.

1. Coat weld with a suitable rust preventive paint. Color to match pipe.
2. Use fabric same as fence fabric, similarly attached.

O. Install barbed wire where indicated.

P. Remove and replace all damaged improperly installed fencing components to satisfaction of Architect/Engineer at no additional expense to Owner.

Q. Install sliding gate operator per manufacturer's instructions.

END OF SECTION

SECTION 02260 - FINISH GRADING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall finish grade sub-soil.

B. The Contractor shall cut out areas to receive stabilizing base course materials for paving and sidewalks.

C. The Contractor shall place, finish grade and compact top soil.

1.2 PROTECTION

A. Prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Correct damage at no cost to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. Use topsoil stockpiles on site if conforming to these requirements.

PART 3 - EXECUTION

3.1 SUB-SOIL PREPARATION

A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil which has been contaminated with petroleum products.

B. Cut out areas to sub-grade elevation, which are to receive stabilizing base for paving and sidewalks.

C. Bring sub-soil to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

D. Slope grade away from building minimum 2 inches in 10 feet unless indicated otherwise on the Drawings.

E. Cultivate sub-grade to a depth of 3 inches, where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

F. The Contractor shall not change grades to cause water to flow onto adjacent property.

3.2 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding and planting are to be performed. Place to the following minimum depths, up to finished grade elevations.

1. 6 inches for seeded areas.
2. 4-1/2 inches for sodded areas.
3. 24 inches for shrub beds.
4. 18 inches for flower beds.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours of sub-grades.

D. Remove stone, roots, grass, weeds, debris, and other foreign material while spreading.

E. Manually spread topsoil around trees, plants, building, to prevent damage which may be caused by grading equipment.

F. Lightly compact placed topsoil.

3.3 SURPLUS MATERIAL

A. Remove surplus sub-soil and topsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02270 - CONCRETE SIDEWALK AND STEPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, tools, equipment and services for concrete sidewalk and steps as indicated, in accord with provisions of Contract Documents.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

D. See Division 1 for General Requirements.

1.2 QUALITY ASSURANCE

A. Reference standards:

1. ACI 617 - Specifications for Concrete Pavement and Concrete Bases.
2. ACI 325 - Recommended Practice for the Design of Concrete Pavements.
3. ASTM C33 - Concrete Aggregates.
4. ASTM C150 - Portland Cement.

B. Testing:

1. Concrete testing.

    a. See Section 03300.

1.3 SUBMITTALS

A. See Section 01340.

B. Manufacturer's or supplier's certification of all materials.

C. Concrete mix design: Contractor submit proposed mix design for concrete to be used at least 10 days before concrete placement begins.

1. Indicate water cement ratio, cement factor, sieve analysis of the aggregate to be used, amount of air entraining agent required, slump and 7 and 28 day compressive strength in pounds per SQ IN.
2. Approval of mix design in no way relieves Contractor of responsibility for quality of concrete.

D. Concrete strength tests.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement: ASTM C150, Type I or II. Use same brand and type, from same mill, throughout the work unless otherwise permitted by Engineer.

B. Aggregates: Conform to ASTM C33, of materials approved for bridges by the State within which the work falls.

1. Reactivity: Any aggregate found potentially reactive by ASTM C-295 or C-289, shall be further tested by ASTM C-227. If excess reactivity is noted, use low-alkali cement, provide further that this new combination proves to be not excessively reactive.

C. Mixing water: Fresh, clean and potable.

D. Admixtures: The following types may be used when permitted by the Engineer.

1. Air entraining admixture: ASTM C-260.
2. Water reducing admixture: ASTM C-494.
3. Accelerating or retarding admixtures: ASTM C-494.
4. Chemical admixtures: Sika Chemical Corporation, Master Builders Company, Protex Industries, or WR Grace and Company. Use in strict conformity with manufacturer's instructions.

E. Side forms: Substantial wood, or metal not less than 7/32 IN thick, depth equal to edge thickness of concrete. Flat or rounded top not less than 1-3/8 IN wide, base 8 In wide or equal to height, whichever is less. Use flexible, curved or wood forms on curves. Free from kinks or bends.

F. Welded wire fabric: ASTM A-185.

G. Expansion joint material: Preformed joint filler of nonextruding cork, self expanding cork, sponge rubber or cork rubber, AASHTO M-153 or M-213.

H. Sidewalk joint sealant: Two compound, Polyurethane Sealant, Class A, Type 1 Self leveling, nontracking type, F.S.TT-S 00227 E (3).

I. Cover materials for curing.

1. Burlap: AASHTO M-182, not less than Class 2, 8 OZ material (1 YD x 42 IN). Free of contaminants.
2. Polyethylene film: AASHO M-171.
3. Liquid Membrane Forming Compound: AASHTO M-148, Type 2, white pigmented.

J. Subgrade cover: Paper, AASHTO M-74 or polyethylene film, AASHO M-171.

K. Forms: Steel or wood.

1. Of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment.
2. Use forms free of distortion and defects.
3. Extend forms full depth of concrete.
4. Use flexible spring steel forms or laminated boards to form radius bends.

2.2 CONCRETE PROPERTIES AND PROPORTIONING

A. Proportion ingredients so as to produce necessary placability, finishability, durability, strength and other required properties. Concrete for all parts of the work shall be homogeneous and when hardened, have required abrasion resistance, water tightness, appearance, and other specified properties.

1. Have mix design prepared by a person qualified and experienced in such work. Establish proportions on basis either of laboratory trial batches or of field experience with materials to be employed. Average 28 day compressive strength; 4,000 psi, tested and evaluated per ASTM C-192 and C-39, and ACI 214.
2. A mix design used successfully on a previous project under conditions as anticipated and with same ingredients proposed for use may be used when approved by Engineer.
3. When proposed mix designs are not established by other allowed methods, base them on results obtained from tests of trial mixes made with same materials as will be used in concrete supplied for project, by a testing laboratory or agency approved by Engineer, in accord with procedures given in ACI-211.

B. Durability:

1. All concrete used shall contain entrained air. Total air content 10 percent plus 1 of mortar fraction of mix, where mortar fraction is defined as that passing No. 4 screen.
2. Regardless of other design criteria, do not exceed water cement ratio of 6 gallons per sack.

C. Slump, ASTM C-143, not exceeding 3 IN.

D. Admixtures, previously described, may be used with approval of Engineer. Use in proportion recommended by manufacturer. Dispense in liquid or solution form. Calcium chloride must never exceed 2 percent of weight of cement.

2.3 PRODUCTION OF CONCRETE

A. Batching and mixing:

1. Batch, mix, and transport in accord with ASTM C-94.
2. Batch plants truck mixers, agitators and nonagitating units used for ready mixed concrete to comply with standards set forth by Plant Manufacturers Bureau of National Ready Mix Concrete Association.

3. Ready mixed concrete production facilities shall have been recently certified by National Ready Mixed Concrete Association.

B. Admixture control:

1. Incorporate air entraining and chemical admixtures, when used, in amounts and manner recommended by manufacturer. Accuracy of measurement of admixture within plus 3 percent.
2. Two or more admixtures may be used in same concrete provided such admixtures are added separately and that combination is compatible and has no deleterious effect on concrete.

C. Mixing time. Deliver concrete to site and discharge within 1-1/2 hour or before 300 revolutions of mixer drum, after introduction of mixing water to cement and aggregates or cement to aggregates.

D. Control of mixing water:

1. Mix concrete only in quantities for immediate use. Discard concrete which has set.
2. When concrete arrives at job site with slump below specified maximum:

   a. Water may be added only if neither maximum water-cement ratio nor maximum slump is exceeded. Add cement to maintain water-cement ratio as required.
   b. Incorporate by additional mixing by 30 drum revolutions at 8-12 rpm.
   c. Record additions on delivery ticket, signed by driver, concrete superintendent and Engineer's representative.
   d. Maintain file of all delivery tickets.

E. Testing. Test during construction as directed by Engineer will be at Contractor's expense up to an amount equal to 1/2 of 1 percent of final contract price. (Cost of mix designs does not fall under construction testing nor percentage limitation).

1. At various times, but as least once a day, prepare at least 3 test specimens. Job cure one in a manner similar to pavement, the other two protect and laboratory cure. Break job cured cylinder at about 7 days. Break others at 28 days.

PART 3 - EXECUTION

3.1 GENERAL

A. Ramps and steps:

1. Construct reinforced concrete steps and ramps as detailed in the drawings. Furnish and install handrails where required.

2. Raise and adjust to grade existing sidewalks. Exercise care in doing this work to avoid damage. Replace with new sidewalks if irreparable damage occurs.

B. Preparation of subgrade.

1. After necessary grading, scarify and recompact top 5 IN of subgrade. If cohesive soil, resultant compaction shall be 100 percent standard proctor, AASHTO T-99. If noncohesive soil, resultant compaction shall be 75 percent relative density, ASTM D-2049. Control moisture content as necessary.
2. Following compaction, strike off and roll to exact cross section. Check with accurate template or other method approved by Engineer.
3. Density tests. A sufficient number of subgrade density tests may be ordered by Engineer to determine that subgrade complies with specification. Tests from an approved testing laboratory, paid for by Contractor.

3.2 FORMS

A. Form support. Compact soil foundation and cut to grade to support forms. Use bearing stakes driven flush with bottom of form to supplement support as necessary. Do not use earth pedestals.

B. Staking forms. Joint forms neatly and tightly. Stake and pin securely.

C. Clean and oil forms prior to placement of concrete.

D. Set forms sufficiently in advance of work (2 hours) to permit proper inspection.

E. Previously finished pavement or curb and gutter contiguous with new work may serve as side form when specifically approved by the Engineer.

3.3 REINFORCING

A. Provide reinforcement of welded fabric flat, clean, free from foreign matter or rust.

B. Lap mats one full space, with end transverse member of upper mat tied securely to prevent curling. Bars not welded shall lap 12 IN minimum.

C. Place fabric on first of two-course pour. Cover promptly with final pour. Light mesh may be placed by fabric placer, if specifically approved in writing in advance by Engineer.

3.4 JOINTS

A. General: Provide joints of types indicated. Hold locations and alignment to within plus 1/4 IN. Finish concrete surface adjacent to previous section to within plus 1/8 IN, with tooled radius of 1/4 IN.

B. Metal keyway joints: Form by installing metal parting strip, left in place. Stake and support like side form. Provide dowels or tie bars where indicated.

C. Weakened plane joints:

1. Tooled joints: Tool groove in freshly placed concrete. Groove dimensions: 3/8 IN at surface and 1/4 IN at root.

D. Construction joints: Install at end of day's work or wherever concreting must be interrupted for 30 minutes. Place timber bulkhead full depth of slab, securely staked.

E. Expansion joints: Place 3/4 IN preformed expansion joints at intervals as indicated and at all junctions with previously placed sidewalks, curb or other structures. Seal sidewalk joints with polyurethane sealant.

3.5 PLACING

A. Preparation:

1. Remove all debris, dirt, ice and water from forms and subgrade.
2. Clean all mixing and transporting equipment.
3. Sprinkle semi-porous subgrade, seal porous subgrades.
4. Test any buried piping, systems.
5. Obtain Engineer's approval.

B. Depositing:

1. Avoid segregation of concrete. Do not move concrete by use of vibrators.
2. Maintain rate of deposition so that concrete is at all times plastic. Use no concrete that has partially hardened, been contaminated by foreign materials, or retampered.
3. Once started, carry on as a continuous operation until placing of panel or section is completed.
4. Consolidate all concrete by vibration, spading, rodding or forking. Eliminate air or stone pockets. Blend new concrete into that previously placed.
5. At preplaced joints, hand place concrete against both faces simultaneously avoid disturbing load-transfer devices. Manipulate screeds to minimize lateral pressures.

3.6 FINISHING

A. As soon as placed, strike off and screed to crown and cross section, slightly above grade so that consolidation and finishing will bring final plan elevations. First pass of fist screed should maintain uniform ridge full width.

B. Consolidate by vibrating screeds, internal units or a combination.

C. Test with 6 FT straightedges, equipped with long handles and operated from sidewalk. Draw excess water and laitance off from surface.

D. Float finish so as to leave no disfiguring marks, but to produce a uniform granular or sandy texture. Exterior sidewalks at buildings shall receive light broom finish.

E. Tool pavement edges with suitable edger.

3.7 CURING

A. Cure for 7 days by method applicable to ambient conditions. Apply curing medium as soon as possible. Maintain to prevent detrimental loss of water from surface and edges of concrete during entire curing period.

B. Burlap curing: Cover entire surface and edges. Keep continuously wet. After removal of forms, fold burlap over back of curb on slab, to subgrade.

C. Curing compound: Spray on white-pigmented membrane forming compound. Use power driven spraying equipment, and spread at rate not to exceed 200 SQ FT/GAL. Concrete surfaces must be moist before application. Recoat, if directed by the Engineer, to eliminate pinholes or holidays. Do not use compound on surfaces to which new concrete is to be bonded.

3.8 FIELD QUALITY CONTROL

A. Cold and hot weather concreting:

1. Cold weather (comply with ACI-306).

   a. Cease concrete placing when descending air temperature in shade falls below 40 degF. Do not resume until ambient temperature has risen to 40 degF.
   b. If placing is authorized maintain temperature of mix between 60 and 80 degF. Heat aggregates or water or both. Water temperature may not exceed 175 degF; aggregates, 150 degF.
   c. When average daily temperature is below 50 degF provide insulative protection of 12 IN minimum thickness loose dry straw or equivalent, for 10 days.
   d. Remove and replace all frost injured concrete.
   e. Never use salt or other antifreeze.

2. Hot weather (comply with ACI-305).

   a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 degF.
   b. Aggregates or water or both may be cooled. Cool water with crushed ice; aggregates by evaporation or water spray.
   c. Never batch cement hotter than 160 degF.

B. Protection of concrete:

1. Protect new sidewalk and its appurtenances from traffic damage.
2. Repair or replace any part of sidewalk damaged prior to final acceptance at Contractor's expense.

C. Opening to traffic:

1. Engineer will decide when sidewalk may be opened to traffic the decision will be governed by compressive strength of concrete and other factors. Sidewalk will not be opened to traffic until job cured cylinders have attained a compressive strength of 200 psi when tested in accord with ASTM methods.
2. Clean sidewalk prior to opening to traffic.

D. Clean up:

1. Complete clean up work within two weeks after sidewalk has been opened to traffic. No new work will begin until delayed clean up work has been completed.

END OF SECTION

SECTION 02276 - TEMPORARY EROSION & SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work specified in this Section consists of designing, providing, maintaining, and removing temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering, and reseeding on-site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner.

C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

PART 2 - PRODUCTS

2.1 EROSION CONTROL

A. Sod specified in Section 02485.

B. Netting - fabricated of material acceptable to the Owner.

2.2 SEDIMENTATION CONTROL

A. Bales - clean, seedfree cereal hay type.

B. Netting - fabricated of material acceptable to the Owner.

C. Filter stone - crushed stone conforming to Florida Dept. of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 - EXECUTION

3.1 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.2 SEDIMENTATION CONTROL

A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stones which are dislodged shall be replaced.

3.3 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of Florida, Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02281 - SOIL TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes engaging a professional pest control operator, licensed in the State of Florida, to provide and apply soil treatment as specified.

1.2 SUBMITTALS

A. Submit certification of compliance with the specifications and application instructions.

1.3 JOB CONDITIONS

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To insure penetration, do not apply soil treatment to excessively wet soils or during inclement weather.

1.4 GUARANTEE

A. Provide guarantee for a period of 5-years, signed by the Applicator and the Contractor.

B. Provide two copies of written guarantee certifying that the soil poisoning treatment will prevent the attack by subterranean termites, and that, if subterranean termite activity is discovered during the guarantee period, the Contractor will retreat the soil and also repair damage caused by termite infestation.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. Provide water-based emulsion specially formulated to prevent infestation by termites; fuel oil will not be permitted. Provide a working solution of one of the following chemical elements and concentrations.

Organophosphate:	Chlorpyrifus @ 42%
	Inert ingredients @ 58%
Mix:	2 gal. of chemical/100 gal. water

Other solutions may be used as recommended by Applicator and if acceptable to the Engineer. Provide only soil treatment solutions which are not injurious to plantings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which soil treatment for termite control is to be applied. If conditions are detrimental to the proper and timely completion of the work, do not proceed with the work until conditions have been corrected in a manner acceptable to the Applicator.

3.2 APPLICATION

A. Surface Preparation. Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fills under slabs, if acceptable to the Engineer.

B. Application Rates. Apply soil treatment solution as follows:

1. Within building area, with or without slabs-on-grade, at the rate of one gal. per 10 sq. ft.

2. Under foundations and footings, including horizontal and vertical surface of excavations, at the rate of one gal. per 10 sq. ft.

3. Outside building perimeter in a strip at least 2-feet wide and under aprons, pads, or paved extensions, at a rate of one gal. per 5 sq. ft.

4. In absorbent soil or fill (sand, sand and gravel mix, etc.) increase the application rate to 1-1/2 gal. per sq. ft. where one gal. to 10 sq. ft. is specified.

5. At expansion joints, control joints, and areas where slabs will be penetrated, at the rate of two gals. per 5 lin. ft. of penetration.

6. At hollow masonry foundations or grade beams, treat the voids at the rate of one gal. per 5 lin. ft. poured directly into the hollow spaces.

C. Allow not less than 12-hours for drying after application before beginning concrete placement or other construction activities.

D. Post signs in the areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION

SECTION 02580 - ROADWAY AND PARKING MARKING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of roadway and parking marking is shown on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lane Marking Paint: Chlorinated rubber-alkyd type, FS TT-P-115, Type III. Factory mixed, quick drying, and non-bleeding.

1. Color: White

PART 3 - EXECUTION

3.1 MARKING

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Application: Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommend rates (min. wet film thickness of 15 mils).

C. Width of Stripe: Width shall be 4-inches unless shown otherwise.

END OF SECTION

SECTION 02611 - REINFORCED CONCRETE PIPE FOR GRAVITY SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing Reinforced Concrete Pipe for gravity service as shown on the Drawings and as specified.

1.2 HANDLING AND STORAGE

A. Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Under no circumstances shall such material be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the pipes.

B. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.

C. Gaskets for joints shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

D. Inspection. Pipe and appurtenances shall be inspected at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard may be performed to ensure conformance with the standard.

PART 2 - MATERIALS AND EQUIPMENT

2.1 CIRCULAR PIPE

A. Pipe shall be cast vibrated, machine-made or flat bed concrete pipe that is designed, manufactured, cured, tested and marked in accordance with the requirements of ASTM Designation C-76. Pipe shall be equivalent to Class III, IV or V, Wall B or C of the proper strength for the depth of cover required. Pipe shall be manufactured in lengths no longer than 16-feet nor shorter than 8-feet, except that shorter lengths as required at closures or junctions of structures will be permitted. Pipe with elliptical reinforcing shall be adequately marked to prevent improper placement in the trench. Lift holes or eyes may be provided in each pipe for the purpose of handling.

B. Joints shall be of either a bell and spigot or double spigot and sleeve design using round rubber gaskets. The joint shall be so designed and fabricated that when the pipe is laid it shall be self-centering, and when the joint is completed, the gasket will be enclosed on all four surfaces. The gasket shall not be required

to support the weight of the pipe, but shall keep the joint tight under all normal conditions of service, including expansion, contraction and earth settlement.

C. Joints and gaskets shall conform to the requirements of ASTM C443.

2.2 ELLIPTICAL PIPE

A. Pipe shall be cast vibrated, machine made or flat bed elliptically shaped concrete pipe designed, manufactured, cured, tested and marked in accordance with ASTM C507.

B. Pipe shall be of the proper strength for the depth of cover involved and shall be manufactured in lengths not longer than 16-feet nor shorter than 8-feet, except that shorter lengths as required at closures or junctions with structures will be permitted.

C. Pipe designed for placement with the major axis horizontal shall be designated as "Vertical Elliptical" and shall be so marked.

D. Joints for elliptical pipe shall be cold adhesive, preformed plastic gaskets conforming to Standard Specifications for Road and Bridge Construction of Florida Department of Transportation, Section 942, paragraph 942-2.

PART 3 - EXECUTION

3.1 UNDERGROUND STRUCTURES AND CONFLICTS

A. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of work and interfere so that an alteration of the plans is required, the Engineer will alter the drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions.

B. When crossing existing pipelines or other structure, alignment and grade shall be adjusted as necessary, with the approval of the Engineer to provide clearance as required by federal, state or local regulations or as deemed necessary by the Engineer to prevent future damage or contamination of either structure.

3.2 ALIGNMENT AND GRADE

A. The pipelines shall be laid and maintained to the lines and grades established by the drawings and specifications, with manholes, service connections, fittings, and appurtenances at the required locations unless otherwise approved by the Engineer.

3.3 TRENCH CONSTRUCTION

A. The trench shall be excavated to the required alignment, depth, and width. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified. Trenches shall be of such extra width, when required, to permit the placement of timber supports, sheeting, bracing and appurtenances.

B. Provide, install and compact bedding and backfill per Manatee County standard detail for Type A-1 Pipe Bedding.

C. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

D. When excavation of rock is encountered all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe for pipe sizes 24-inches or smaller, and 9-inches for pipe sizes 30-inches and larger. When excavation is completed, a bed of sand, crushed stone, or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation. This installation procedure shall be followed when gravel formation containing loose boulders greater than 8-inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point or rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.

E. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

F. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

G. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer, it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

H. Pipe cutting for the insertion of fittings, or closure pieces shall be done in neat, workmanlike manner without creating damage to the pipe or lining.

3.4 TESTING

A. After completion of installation, perform testing for gravity sewers in accordance with requirements of Section 01660 - Testing, Adjusting and Balancing.

END OF SECTION

SECTION 02622 - PLASTIC PIPE FOR GRAVITY SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing Plastic Pipe and Fittings for gravity service as shown on the Drawings and as specified.

1.2 SUBMITTALS

A. Provide manufacturer's Certificate of Compliance with specified requirements.

1.3 HANDLING AND STORAGE

A. All pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.

B. Materials, if stored, shall be kept safe from damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.

C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered with canvas or other opaque material. Air circulation shall be provided under covering.

D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PVC PIPE

A. PVC pipe and fittings for gravity service 12-inch and under shall meet the requirements of ASTM D 2241 for SDR 26(160).

B. Solid wall PVC pipe and fittings for gravity service 15-inches and larger shall meet the requirements of ASTM F-679.

C. Perforated PVC pipe and fittings for underdrains 8 to 10-inches in diameter shall meet the requirements of ASTM D3034 for SDR35 PVC pipe and of AASHTO M36 and M196 for perforations.

D. Joints. Pipe and fittings shall have integral wall bell and spigot joints with flexible single rubber gasket conforming to ASTM F-477. Joints shall provide a permanent seal against exfiltration or infiltration. The gasketed joint shall be designed so that when assembled the elastomeric gasket located within the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be designed to avoid displacement of the gasket from the joint during assembly and when in service. If a lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe.

E. Gaskets. Gaskets shall be molded into a circular form or extruded to the proper section and then spliced into circular form. They shall consist of a properly processed high grade elastomeric compound of natural rubber, a synthetic elastomer or a blend of both. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to affect a positive seal under all combinations of joint tolerances. The gasket shall be the only element depended upon to make the joint flexible and water-tight.

2.2 PERFORATED HDPE PIPE

A. Perforated HDPE pipe and fittings for leachate underdrains shall be fabricated from PE 3408 high density, high extra molecular weight polyethylene. The cell classification shall be PE345434C as specified by ASTM D3350. Dimensions and workmanship shall be as specified by ASTM F714. The dimension ratio shall be SDR 17.

B. Connection of HDPE pipes shall be by butt fusion.

C. Perforations shall be provided by 3 rows of ¼-inch holes spaced 120 degrees apart and 3 inches on center for the full length of the pipe.

PART 3 - EXECUTION

3.1 EXAMINATION

A. All pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard may be performed to ensure conformance with the standard.

3.2 TRENCH CONSTRUCTION

A. Alignment and Grade. The pipelines shall be laid and maintained to the lines and grades established by the Drawings and Specifications, with fittings, service connections, manholes and appurtenances at the required locations unless otherwise approved by the Engineer.

B. Underground Conflicts. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of work and interfere so that an alteration of the plans is required, the Engineer will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Engineer, to provide clearance as required by the Engineer to prevent future damage or contamination of either structure.

C. Trench Construction. The trench shall be excavated to the required alignment, depth, and width. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified. Trenches shall be of such extra width, when required, to permit the placement of timber supports, sheeting, bracing and appurtenances.

D. Material for use in the pipe bedding zone shall be provided and installed per the Manatee County Standard Detail for Type A-2 Pipe Bedding.

E. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

F. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe and fittings. When excavation is completed, a bed of sand, crushed stone, or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris of subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.

G. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

H. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3-inches, or to the depth ordered by the Engineer and

replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

I. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.3 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe and fittings shall be lowered carefully into the trench by means of suitable tools or equipment in such a manner as to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

B. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

C. The outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

D. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

E. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

F. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

G. Joint Assembly. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

H. Pipe Deflection. Vertical deflection shall be monitored by the use of a rigid "Go-No-Go" mandrel device. The device shall be pulled by hand through each section (manhole to manhole). The pulling motion shall be smooth and easy so as to avoid jamming the device if an obstruction is encountered in the line. When the device is not able to go forward, the distance shall be measured from the last manhole and recorded. The device shall then be pulled backwards and that section of sewer main uncovered and recompacted according to these specifications. The "Go-No-Go" mandrel device shall be constructed to measure a maximum 5.0-percent deflection.

I. Pipe Cutting. Cutting pipe for the insertion of fittings or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis. Burrs shall be removed

from spigots and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

J. Manhole Connections. Plastic pipes shall be connected to manholes in accordance with the details shown.

K. Gravity sewers shall be required to pass a leakage test by the infiltration test, exfiltration test, or the low pressure air test per Manatee County Standard Specifications.

L. Gravity sewers shall be lamped between manholes, and a minimum 75 percent image shall be visible.

END OF SECTION

SECTION 02623 - PLASTIC PIPE FOR PRESSURE SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes materials and methods of installation of Plastic Pipe for pressure service used in Piped Utility Systems, including potable water mains, reclaimed water mains, and force mains for wastewater reject, activated sludge, and thickened sludge.

1.2 SUBMITTALS

A. Three certified copies of the tests made by the manufacturer or by a reliable commercial laboratory shall be submitted to the Engineer with each shipment of pipe.

1.3 HANDLING AND STORAGE

A. All pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.

B. Materials, if stored, shall be kept safe from damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage or freezing.

C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered with canvas or other opaque material. Air circulation shall be provided under covering.

D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PLASTIC PIPE

A. Pipe for pressure service shall be Class 12454-A or B rigid PVC compound in accordance with the requirements of ASTM D1784. Pipe and appurtenances for use in potable water systems shall bear the seal of approval for potable water use of the National Sanitation Foundation or other accredited testing laboratory. All pipe shall have markings indicating pipe size, manufacturer's name, AWWA and/or ASTM specification number, working pressure, and production code.

B. PVC pipe having a nominal diameter less than 2-inches. See Section 15064 of these specifications.

C. PVC pressure rated pipe having a nominal diameter 2-inches or greater, but less than 4-inches, shall be made of 2000 psi hydrostatic design stress compounds designated PVC 1120 and shall conform to ASTM D2241. PVC pipe shall be furnished in 20-foot lengths unless otherwise noted. PVC pipe shall have a standard dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe couplings shall have a dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe shall have both ends beveled for use with gasketed couplings or one end beveled and one end with a bell. Couplings and gaskets shall be furnished with each length of pipe. Rubber ring gaskets shall conform to ASTM D3139 Nontoxic gasket lubricant shall be as specified by the manufacturer.

D. Pressure pipe 4-inches through 12-inches in diameter shall conform to the requirements of AWWA C900 for PVC pipe with cast iron pipe equivalent outside diameters. Pipe shall be pressure class 150 unless otherwise shown. Pipe shall have a minimum wall thickness equivalent to a dimension ratio of DR 18 unless otherwise shown. Pipe may be furnished with plain ends for use with elastomeric-gasket couplings or with one end plain and one end with a gasket bell. Couplings and gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM D3139. Nontoxic gasket lubricant shall be as specified by the pipe manufacturer.

E. Pressure pipe 14-inches through 36-inches in diameter shall conform to the requirements of AWWA C 905 for PVC pipe with cast iron pipe equivalent outside diameters. Pipe 16-inch through 24-inch shall have a minimum wall thickness equivalent to a dimension ratio of DR 18 unless otherwise shown. Pipe shall be pressure Class 235 unless otherwise shown. Pipe 30-inch through 36-inch shall have a minimum wall thickness equal to a dimension ratio of DR 21 unless otherwise shown. Pipe shall be pressure Class 200 unless otherwise shown. Pipe may be furnished with plain ends for use with elastometric gasket couplings or with one end plain and one end with a gasket bell. Couplings and gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM 1869. Non-toxic gasket lubricant shall be as specified by the pipe manufacturer.

2.2 FITTINGS

A. Fittings for use with PVC pipe 3-inches through 24-inches in diameter shall be mechanical joint ductile-iron fittings conforming to the requirements of ANSI/AWWA C153/A21.53. Fittings for use with pipe 30-inch and larger shall be mechanical joint gray iron or ductile-iron conforming to the requirements of ANSI/AWWA C111/A21.11a. Bolts for use with mechanical joints shall conform to the requirements of the joint standard. Fittings shall be suitable for a working pressure of 150 psi.

B. Exterior Coating. Fittings for buried service and fittings for installation in exposed locations which are not to be painted shall be coated with a bituminous coating approximately 1 mil thick. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adherent to the pipe.

C. Fittings in exposed locations which are to be painted shall be primed with a universal shop primer suitable for use under the finish paint specified.

D. Linings. Fittings shall have a cement-mortar lining conforming to the requirements of ANSI A21.4/AWWA C104 or a Protecto 401 ceramic epoxy depending upon the type of fluid being conveyed. Cement mortar linings shall be used for all ductile iron fittings conveying potable water and reclaimed water. Protecto 401 shall be used for all ductile iron fittings conveying wastewater sludge, backwash water, leachate, mixed liquor, sludge thickening water, and plant drain water.

2.3 LOCATOR TAPE

A. Locator tape for use with plastic pipes shall be a three-inch wide tape consisting of polyethylene film with a metallic film to allow detection by electronic means. The tape shall be non-corrodible and shall be continuously marked to identify the use of the pipeline which it protects. The tape shall be installed directly above the pipe at a depth of twenty-four inches below finished grade.

2.4 RESTRAINED JOINTS

A. Restrained Joints. Restrained joints for use with PVC pipe shall consist of retainer glands fabricated of ductile-iron conforming to ASTM A536. The gland shall be such that it can replace the standard mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21-53/C153. The retainer glands shall have a pressure rating equal to that of the PVC pipe on which it is used.

B. PVC push-on joints adjacent to restrained fittings shall be restrained using harness restraint devices. This harness restraint shall be split to enable installation of the restraint after the spigot has been installed into the bell. The restraint shall consist of a split ring that fits behind the bell, a split restraint ring that installs on the spigot and a number of tie bars to connect the other two parts. Restraint components shall be of ductile-iron conforming to ASTM A536. The restraint ring shall consist of a plurality of individually activated gripping surfaces to hold the spigot and maximize restraint capability.

C. Twist off nuts, sized same as the tee-head bolts shall be used to insure proper actuating of restraining devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Excavation. Excavate trenches as specified in Section 02200.

B. All pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard may be performed to ensure conformance with the standard.

3.2 TRENCH CONSTRUCTION

A. Alignment and Grade. The pipelines shall be laid and maintained to the lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.

B. Underground Conflicts. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of work and interfere so that an alteration of the plans is required, the Engineer will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Engineer, to provide clearance as required by the Engineer to prevent future damage or contamination of either structure.

C. Trench Construction. The trench shall be excavated to the required alignment, depth, and width. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.

D. PVC pipe shall be installed with pipe bedding and backfill as shown in the Manatee County Standard Details for Type A-2 Pipe Bedding as shown on the drawings.

E. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

F. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves and fittings. When excavation is completed, a bed of sand, crushed stone, or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentioned depths; leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris of subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8-inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point or rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.

G. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

H. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 4-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

I. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.3 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves, and hydrants shall be lowered carefully into the trench by means of suitable tools or equipment in such a manner as to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

B. The sealing surface of the pipe, the inside of the bell and the gasket shall be cleaned immediately before assembly.

C. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

D. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

E. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

F. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

G. Joint Assembly. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

H. Pipe Deflection. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that recommended by the manufacturer.

I. Pipe Cutting. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis.

J. Burrs shall be removed from spigots and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

K. Locator Tape. Install all plastic pipe with a locator tape of the type specified.

L. Electronic Marker. Install electronic markers of the type specified for all buried piping at 24-inches below grade.

M. Thrust Restraint. All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with reaction backing, or restrained joints as specified.

N. Thrust-restraint design pressure shall be equal to 1.5 times the design pressure of the line.

3.4 TESTING

A. After completion of installation, flush and clean all plastic pipes for pressure service.

B. All pressure pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipelines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 150 psi. All leaks shall be repaired and pipe retested as approved by the Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

C. Allowable leakage shall be in accordance with AWWA C600, Installation of Ductile Iron Water Mains and their appurtenances.

3.5 DISINFECTING POTABLE WATER PIPELINES

A. Before being placed in service, all potable water pipelines shall be chlorinated in accordance with AWWA 651, "Standard Procedure for Disinfecting Water Mains." The procedure shall be approved by the Engineer. The location of the chlorination and sampling points will be approved by the Engineer in the field. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.

B. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for at least 24 hours.

C. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water shall then be made by the Engineer in full accordance with the AWWA Manual C651. The Contractor will be required to re-chlorinate, if necessary. The line shall not be placed in service until the requirements of the State and County Public Health Department are met.

D. Special disinfecting procedures shall be used in connections to existing mains and where the method outlined above is not practical as approved by the Engineer.

END OF SECTION

SECTION 02700 - ACCESS HATCHES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing metal access hatches as shown on the Drawings and as specified.

B. The types of hatches required include the following:

1. Single leaf aluminum hatch
2. Double leaf aluminum hatch
3. Units shall be non-drainable

1.2 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, provide the following:

1. Foundry & Manufacturing Corp.
2. Bilco
3. Halliday Corporation
4. Nystrom Products Co.

1.3 SUBMITTALS

A. Provide manufacturer's Certificate of Compliance with specified requirements.

B. Obtain shop drawings for fabrication and erection. After verifying details and dimensions, provide final drawings and installation instructions to Engineer for use in observing installation and for Record Drawings.

PART 2 - MATERIALS AND EQUIPMENT

2.1 ACCESS HATCH

A. Each unit, single leaf or double leaf, shall be fabricated with a 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners. Stainless steel hinges shall be bolted to the underside and shall pivot on torsion bars that counter balance the door. The door(s) shall open 90 degrees and lock in that position. A handle shall be provided to release the door(s) for closing. Door(s) shall withstand a live load of 300 psf and shall be equipped with a slam lock and removable handle.

B. Frame shall be extruded aluminum, mill finish, with a bituminous coating on the frame exterior.

C. A neoprene cushion shall be a part of the frame.

D. Hardware shall be stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions.

END OF SECTION

SECTION 02800 - UNDERGROUND SPRINKLER IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. To construct a multi-zone underground sprinkler irrigation system or systems to serve the general areas delineated on Drawing No. G-5 compatible to the landscaping design as shown in the Drawings and Specifications. Existing reuse water supply shall be used as the water source. The existing reuse plant water distribution system is shown on the yard piping drawings. The proposed general areas for installation of underground sprinkler irrigation system are shown on Sheets L-1 and L-2. The system shall be equipped with a moisture sensing shut off device.

B. Furnish all labor, materials, equipment and incidentals required and install the complete irrigation system.

C. The work shall include, but not necessarily be limited to, excavation and backfilling, and furnishing all piping, valves, controls and electrical work required.

D. It shall be the responsibility of the Contractor to prove performance of any equipment substituted for that listed on the plan.

E. It shall be the responsibility of the Contractor to install sprinklers so as to obtain 100% overlap coverage under normal wind conditions.

F. Rerouting of pipe over, under and around pavement, conduits, pipe, trees, or any other obstruction shall be at the expense of the Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02110 - Clearing and Grubbing.

B. Section 02200 - Earthwork.

C. Section 02260 - Finish Grading.

D. Section 02623 - Plastic Pipe for Pressure Service.

E. Section 02900 - Seeding and Sodding.

F. Section 02950 - Landscaping.

G. Division 16 - Electrical.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers:

1. Rainbird
2. Toro
3. Nelson

4. Or Approved Equal

1.4 SUBMITTALS

A. The Contractor shall submit six (6) copies of sprinkler system design drawings and a detailed system description prepared by a Landscape Architect duly registered in the State of Florida for Engineer's review and approved prior to installation.

B. Standard Details: Submit for following items:

1. Controllers.
2. Sprinkler Heads.
3. Automatic Valves.
4. Pressure Control Valves
5. Direct Bury Control Wires.

Automatic valves and pressure control valves may be integrated units but must meet the criteria of this specification.

C. Manufacturer's Data: Submit each manufacturer's catalog of parts.

D. Installation Instructions: Submit installation instructions, including mounting details for automatic controllers.

E. Operating Instructions:

1. Submit written operating instructions.
2. Submit a schedule indicating length of time each valve is to be open to produce a given amount of precipitation.

F. Certificate of Qualification: Submit certification of installer's experience identifying previous projects with names of Owners and Engineer.

G. Maintenance Instructions: Submit maintenance instructions on all items requiring manufacturer's standard detail submittal.

H. Extra Stock:

1. In addition to installed system, provide Owner with: twenty sprinkler heads of each size and type.
2. Two wrenches for each type of head cover.
3. Two wrenches for removing and installing each type of head.
4. Total of four remote control radio units for system remote control and programming.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to system components during loading, transporting and unloading.

B. Store components in a dry, clean location.

1.6 EXAMINATION AND VERIFICATION OF DRAWINGS AND SITE

A. It shall be the Contractor's responsibility to report to the Engineer any conflicts or proposed deviations from the Contract Drawings, or Specifications. Failure to do so prior to the installation of equipment which results in its being replaced, and/or relocated, shall be done at the Contractor's expense.

1.7 RECORD DRAWINGS

A. The Contractor shall provide and keep up-to-date a complete set of as-built drawings which shall be corrected daily to show changes in sprinkler locations, controller locations, pump locations, piping locations, and other deviations from the other original irrigation design drawings as provided to him. All valve locations shall be shown with actual measurements to reference points so they may be located easily in the field.

B. Upon completion of the work, the Contractor shall furnish the Owner with a complete set of reproducible record drawings (sepias or mylars) showing the sprinkler system as installed. This is the responsibility of the Contractor and shall not be construed to be the responsibility of any other party. Acceptance of the system is based on the furnishing a completed record plan in accordance with Section 01720 which is acceptable to the Owner or Engineer.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Polyvinyl Chloride Pipe:

1. All lines on the downstream side and upstream side of the automatic control valves shall be polyvinyl chloride (PVC) pipe, PVC 1120, SDR 21 domestic, extruded, unplasticized, rigid polyvinyl chloride pipe in conformance with ASTM D2241 and Section 02623 of these specifications.
2. All irrigation pipe shall be lavender (Pantone 522C) color to indicated the use of reclaimed water.

B. Polyvinyl Chloride Pipe Fittings and Connections:

1. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections. No fittings made of other material shall be used except galvanized fittings as hereinafter specified. Fittings and connections shall be in conformance with Section 02623 of these Specifications.
2. Slip fittings socket taper shall be so sized that a dry, unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be

permitted. Only Schedule 80 pipe may be threaded.

3. When connection is plastic to metal, male adapters shall be used. The male adapter shall be hand tightened, plus one turn using a strap wrench. Joint compound shall be Permatex Type II, or equal.

C. Part Circle Impact Type Sprinkler:

1. The part circle impulse sprinklers shall be as manufactured by Rain Bird, Nelson, Toro, or equal.
2. The nozzle shall be the adjustable pin type, and the horizontal oscillating alarm shall be the Precision-Jet non splash type. The sprinkler bearing shall be sealed "TNT" type bearing.
3. Where indicated, the sprinkler shall be capable of being operated as a full circle sprinkler and shall be capable of being adjusted by hand to operate in any part of a circle.

D. Full Circle Impact Type Sprinkler:

1. The full circle impulse sprinklers shall be as manufactured by Rain Bird, Nelson, Toro, or equal.
2. The nozzle shall be the adjustable pin type, and the horizontal oscillating arm shall be the Precision-Jet non-splash type. The sprinkler bearing shall be sealed "TNT" type bearing.

E. Automatic Remote Control Valves, Electric Solenoid Type:

1. The automatic remote control valves shall be Rain Bird "PES-B" or "EFB-CP" Series, slow acting diaphragm type electric solenoid operated valves or equivalent. The valves shall be solenoid actuated, hydraulic operating valves. The solenoid shall be for a 24 volt, 60 cycle operation with running current of two (2) watts. The solenoid shall be completely epoxy encapsulated for positive waterproofing with a stainless steel shunt band. The valve shall be slow opening and closing by means of potential fluid resistor to avoid damage of surge pressures. Opening and closing speed shall be not less than five (5) seconds.
2. The valve body and bonnet shall be constructed of heavy cast bronze (three inch (3") diameter and smaller) with threaded female connections or cast iron (four inch (4") diameter and larger) with flanged connections all with accurately machined valve seat surfaces and internal parts. The inlet port of the diaphragm chamber shall have removable screen, for easy cleaning, and shall be accessible without removing bonnet from the valve body. The outlet port from the diaphragm chamber shall discharge into the downstream side of the valve. The solenoid plunger shall be spring loaded so that valve may be operated when installed in any position and shall be constructed of stainless steel with wear resistant neoprene seat and exclusive grit-filter protection against solenoid plunger "hang-up". The diaphragm shall be durable nylon reinforced neoprene. Valve bonnet shall be equipped with a slotted plug or a bleed screw for manual operation of the valve at any time. Valve bonnet shall be secured to the valve body by corrosion resistant stainless steel bolts.
3. All control valves shall be furnished with a separate manual shut-off gate valve, similar or equal to those as described in Section 15100 of these Specifications.

4. All valves shall have a flow control mechanism, be capable of manual operation, and have slow opening and closing capabilities.
5. In all cases where threaded connection valves are used, they shall be preceded by a union. Flanged connection valves shall be preceded by a flanged adapter coupling.
6. All valves shall be installed in accordance with all manufacturer recommendations and shall be fully warranteed by Contractor.

F. Pressure Regulators: Pressure regulators shall be Toro 216 Series or equivalent (or better) in function and performance. Pressures shall be adjusted at time of installation to provide optimal performance. Pressures shall not exceed the highest pressure rating of any in-line component per manufacturer data.

G. Valve Boxes:

1. Boxes for valves for 3 in. and larger: 12 in. diameter barrel with cast iron cover.
2. Boxes for valves 2-½ in. and smaller: 6 in. diameter cast iron barrel with cast brass cover.
3. Marking: Mark valve box covers with "Lawn Valve," or "Control Valve" as applicable.

H. General Valve Requirements: Division 15.

I. Gate Valves: Division 15.

J. Hose Bibbs: Division 15.

K. Ball Valves: Division 15.

L. Flexible Couplings: Division 15.

M. Flange Adapter Couplings: Division 15.

N. Concrete: Division 3.

O. Miscellaneous Metals: Division 5.

P. Stainless Steel: Division 5.

2.2 AUTOMATIC CONTROLLERS

A. Housing: 16 gauge steel, weatherproof construction.

B. Door: Lockable door access to control dials.

C. Drive: Controller shall be electronically controlled with the capability to perform programming tasks as specified in this section.

D. Stations: Control station as required for each zone or system.

E. Station Timing: Independent for each station with each infinitely adjustable from 0-60 minutes.

F. Day Programming: Programming dials encompassing 14-day cycle.

G. Operation: Automatic, or manual, at discretion of operator. Programming must be capable through remote radio control units. A moisture sensing shut off device shall be capable of system shut down during rainfall events.

H. Power Requirements:

1. Input: 120 volt a.c.
2. Output to valves: 24 volts a.c.

I. Remote Radio Control Units: Units must be programmable and fully programmed at completion of construction. Units must be capable of performing program functions of central control panel from all irrigation zones. Units must be equal to or better than Motorola units provided with Toro OSMAC field hardware in quality and performance.

J. Moisture Sensing Shut Off Device: The moisture sensing device shall be compatible with the control system and produced by the same manufacturer with the intent of being used with the chosen control system. It shall be capable of shutting down the irrigation system in the event of rain but must allow for by-pass of function at the discretion of the system operator.

2.1 ELECTRIC CONDUIT AND FITTINGS

A. Underground Plastic Conduit: Class III, FS W-C-1094, or as acceptable per local code.

B. Above ground Conduit: Aluminum, FS WW-6-540, or as acceptable per local code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: The sprinkler system may be installed after completion of either rough or final grading with the Contractor taking full responsibility for any damage occurring during construction.

B. Excavating and Trenching:

1. Trenching:

a) Excavate trench to required depth.
b) Make width of trench at least 6 in. or 1-½ times the diameter of pipe, whichever is wider.
c) Backfill and hand tamp any over-excavation prior to installing piping.

d) In soils containing rock or other hard material that might damage pipe, excavate trenches deeper than required; and then backfill to pipe grade with selected fine earth or sand.

e) Keep trenches free of obstruction and debris that would damage pipe.

f) Do not mix subsoil with topsoil.

2. Provide schedule 40 PVC sleeves under walks, drives and other obstacles.

C. Piping System:

1. Cover: Install horizontal underground piping with not less than 12 in. of cover.
2. Clearances: Maintain six (6) inches minimum clearance vertically and horizontally between pipes.
3. Connections: Connections will be made to 2 in., 6 in. and 8 in. existing reclaimed water lines as required. Tapping sleeves will not be used. Tees shall be used for connections with intermittent shut down of reclaimed lines as to not disturb plant operations.

D. Piping Erection:

1. Threaded Plastic Pipe:

a) Thread Schedule 80 PVC pipe with conventional thread cutting equipment.

b) During threading, place a round metal or wood plug in bore to prevent distortion of pipe.

c) Do not use solvent cement on threaded joints.

d) Wrap male end of joints with teflon tape.

2. Cemented Joints for PVC Pipe: Make cemented joints for PVC bell end pipe and PVC pipe with socket fittings: ASTM D 2855.

E. Pressure Regulators: Pressure regulators shall be installed per manufacturer's instructions. Adjustments may be made to operating pressure by the installer. Each sprinkler head shall be controlled by a pressure regulator.

F. Valves:

1. Manual Valves: Install manual valves in a valve box extending from grade to valve body, with a minimum of 4 in. cover measured from finish grade to top of valve stem.
2. Automatic Valves: Install automatic valves plumb to within 1/16 in., in a valve box extending from grade to valve body, with a minimum of 4 in. cover measured from grade to top of valve.

G. Sprinkler Assemblies:

1. All sprinkler assemblies shall be pop up rotor type to allow for mowing without damage to sprinkler heads.
2. Sprinkler assemblies shall be installed plumb to within 1/16 inch.

H. Control Wire:

1. Bury wires next to pipe in same trench.
2. Bundle multiple wires and tape together at not over 10 foot intervals.
3. Provide a 10 in. 360° loop in wire at each valve where controls are connected.
4. Snake wires in trench to allow for settlement.
5. Make all electrical splices waterproof.

I. Automatic Controller: Mount automatic controller in accordance with manufacturer's recommendations at the location to be designated by the Engineer.

J. Remote Radio Control Units: Provide fully programmed units compatible with and ready to use with the central control unit.

K. Moisture Sensing Shut Off Device: The device shall be installed on the roof of the Administration Building in an area which will not interfere with its intended operation and will allow for easy maintenance access. The installation method shall not result in damage to the building or result in water accessible holes in the roof.

L. Backfill:

1. Do not backfill until system has been tested and accepted.
2. For first 3 in. over pipe, backfill with dirt or sand fine enough to pass ¼ in. sieve, and compact by water method.
3. Fill remainder of trench to within 3 in. of top with excavated soil, and water to compact soil.
4. Fill top 3 in. with topsoil and wheel roll until compaction of backfill is same as surrounding soil.

3.2 INSPECTION

A. Do not enclose or cover any work until it has been inspected and tested. If any portion of the work fails the test, the Contractor shall replace it and retest the system to the satisfaction of the Engineer.

3.3 TESTING AND FLUSHING

A. Flushing:

1. After all piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies and hose valves, thoroughly flush piping system under a full head of water.
2. Maintain flushing for thee minutes through furthermost valve.
3. After flushing all risers install sprinkler heads.
4. Flushing water shall be provided by the Contractor. Reclaimed water may be used when available on the treatment plant site.

B. Testing: Conduct tests in presence of the Engineer.

1. Pressure Test:

   a) Hydrostatically test the piping system in place before backfilling.
   b) Maintain a minimum test pressure of 100 psi without pumping for period of not less than one hour.
   c) Test is acceptable if no leakage or loss of pressure is evident during test period.
   d) Detect and repair all leaks.
   e) Retest the system until test pressure can be maintained for duration of the test.

2. Operation Test::

   a) At conclusion of pressure test, install sprinkler heads and test entire system for operation under normal operating pressure.
   b) Test is acceptable if system operates in a satisfactory manner, with uniform converge of areas to be sprinkled.

3.4 RESTORATION

A. After installation has been completed, return area to its original condition.

B. Replace all permanent features disturbed by installation of the system.

END OF SECTION

SECTION 02900 - SEEDING AND SODDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations to produce a uniformly smooth lawn for not less than the following:

1. Seeded Lawns: 60 days after date of Substantial Completion.
2. Sodded Lawns: 30 days after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.

1. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated.

2.2 SOD

A. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, and mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

1. Species: Provide sod of grass species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated.

2.3 SOIL MATERIALS

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
2. Topsoil Source: Amend existing surface soil to produce topsoil. Supplement with imported topsoil when required.

2.4 SOIL AMENDMENT MATERIALS

A. Lime: ASTM C 602, Class T, agricultural limestone.

B. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

C. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.

E. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.

F. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea-form, phosphorous, and potassium in the following composition:

1. Composition: 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

G. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 10 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

PART 3 - EXECUTION

3.1 PREPARATION

A. Planting Soil Preparation: Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth. Mix soil amendments and fertilizers with topsoil at rates indicated.

B. Lawn Planting Preparation: Loosen subgrade to a minimum depth of 4 inches (100 mm). Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials.

1. Spread planting soil mixture to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
2. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

C. Grade lawn areas to a smooth, even surface with loose, uniformly fine texture. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

D. Moisten prepared lawn areas before planting when soil is dry and allow surface to dry before planting.

3.2 SEEDING

A. Seeding Lawns: Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray.

1. Seeding Rate:

   a. 1/3 Argentine Bahia
      1/3 Common Bermudagrass
      1/3 Rye
      10 lbs/1,000 S.F.

2. Protect seeded areas with slopes less than 1:6 against erosion by spreading straw mulch after completion of seeding operations and anchor by crimping into topsoil. Spread uniformly at a minimum rate of 2 tons per acre (45 kg per 100 sq. m).

3.3 SODDING

A. Sodding Lawns: Lay sod to form a solid mass with tightly fitted joints within 24 hours of stripping. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Sod: Floratam
2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer.
3. Saturate sod with fine water spray within 2 hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below the sod.

3.4 FERTILIZATION

A. Seeding and Sodded Lawns

1. Initial Rate=500 lbs/Acre (12-8-8)
2. Maintenance=500 lbs/Acre (12-8-8)

3.5 DISPOSAL

A. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 02950 - LANDSCAPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Topsoil bedding.

B. New trees, plants, and ground cover.

C. Mulch and fertilizer.

D. Maintenance.

1.2 RELATED SECTIONS

A. Section 02260 -Finish Grading

B. Section 02800 - Underground Sprinkler Irrigation System

C. Section 02900 - Seeding and Sodding.

1.3 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

B. ANSI Z60.1 - Nursery Stock.

1.4 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle. Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Broome Grass.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.5 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating the plants with three years experience.

B. Installer: Company specializing in installing and planting the plants with five years experience.

1.6 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants.

C. Plant Materials: Described by ASTM Z60.1; free of disease or hazardous insects.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site in a manner which prevents stress to plant materials.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Protect plants until planted.

D. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 95 degrees F.

B. Do not install plants when wind velocity exceeds 30 mph.

1.9 COORDINATION

A. Coordinate work with other applicable trades.

1.10 WARRANTY

A. Provide twelve month warranty.

B. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

PART 2 - PRODUCTS

2.1 ACCEPTABLE NURSERIES

A. Suppliers which meet Qualifications per 1.5.

2.2 TREES, PLANTS, AND GROUND COVER

A. Trees Plants and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.3 SOIL MATERIALS

A. Topsoil: Original surface soil typical of the area, capable of supporting native plant growth.

1. Stockpiled topsoil from clearing activities may be used.
2. If amount of topsoil stockpiled is insufficient to complete work, additional topsoil must be provided by the Contractor to complete work to the satisfaction of the Owner's Representative.

2.4 SOIL AMENDMENT MATERIALS

A. Fertilizer: FS O-F-241, Type I, Grade A; with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil.

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of plants.

2.5 MULCH MATERIALS

A. Mulching Material: Shredded pine bark, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

2.6 ACCESSORIES

A. Stakes: Hardwood lumber, pointed end.

B. Cable and Wire: Non-corrosive, of sufficient strength to withstand wind pressure and resultant movement of plant life.

C. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

D. Weed Fabric: Water permeable polyolefin fabric.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that prepared subsoil and planters are ready to receive work.

B. Verify that required underground utilities are available, in proper location, and ready for use.

3.2 PREPARATION OF SUBSOIL

A. Dig pits and beds six inches larger than plant root system.

3.3 PLACING TOPSOIL

A. Install topsoil mix into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

3.4 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper two inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.5 PLANTING

A. Place plants for best appearance for review and final orientation by Contracting Officer.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth of six inches as indicated on drawings under each plant. Remove ropes and wires from the root ball.

E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in six inch layers. Maintain plant materials in vertical position.

F. Saturate soil with water when the pit or bed is half full of top soil and again when full.

3.6 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch	1 stake with one tie
1 - 2 inches	2 stakes with two ties
2 - 4 inches	3 guy wires with eye bolts and turn buckles
Over 4 inches	4 guy wires with eye bolts and turn buckles

3.7 FIELD QUALITY CONTROL

A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.8 SCHEDULE - PLANT LIST

A. Refer to Plans.

END OF SECTION

SECTION 02960 - REJECT POND LINER

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install the liners in the stormwater treatment ponds as shown on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 02200 - Earthwork
2. Section 03300 - Concrete

1.2 QUALITY ASSURANCE

A. The membrane liner shall be furnished and installed by a manufacturer who is fully experienced, reputable and has at least 30,000,000 ft.^{2} of previous experience in the manufacture and installation of liner material for similar applications.

B. The liner shall be installed by the manufacturer under the direction of a field engineer or supervisor who has at least 5,000,000 ft.^{2} of experience in the liner installation, and who shall be in absolute charge of this installation and responsible for the work performed.

C. All technicians who shall be involved in the field installation shall have at least 1,000,000 sq.ft. of field seaming experience.

D. The contractor shall submit the resumes of the field engineer and technicians stating the name, position and experience including the list and size of previous projects involved.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Watersaver Company, Inc.
2. Gundle Lining Systems, Inc.
3. National Seal Co.
4. Environmental Protection, Inc.
5. or approved equal.

1.3 REFERENCES

Thickness	ASTM D-5199
Specific Gravity	ASTM D-793
Tensile Strength	ASTM D-638
Tear Resistance	ASTM D-1004
Low Temperature	---

Dimensional Stability	NSF D1024, NSF mod.
Volatility	---
Burial Resistance	---
Hydrostatic Resistance	---
Factory Seam Requirements	ASTM D-3083

1.4 SUBMITTALS

Include at least the following:

A. Samples of liner material for Engineer's review;

B. A specification sheet showing raw material, minimum physical properties of the liner material and test methods to be employed for factory quality control and on-site quality control conforming with those defined in this Specification;

C. Resumes of personnel to be involved in the field installation;

D. A set of installation drawings indicating the layout of the liner, as well as any variance or additional details which deviate from the Drawings;

E. A schedule for the liner fabrication and installation; and

F. In the event that it is impossible to conform with certain details of these Specifications due to different manufacturing techniques, submit a written description with all nonconforming aspects clearly indicated.

1.5 PRODUCT HANDLING

A. The rolls or panels of liner shall be packaged and shipped by appropriate means so that no damage is caused. Transportation shall be the responsibility of the Contractor.

B. Materials shall be shipped in a closed trailer or on a flat bed trailer and delivered to the site only after the required submittals have been received and approved by the Engineer. Off-loading and storage of the liner is the responsibility of the Contractor. The Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner. No off-loading shall be done unless the Inspector is present. Damage during off-loading shall be documented by the Inspector or Contractor. The Engineer shall be the final authority on determination of damage.

C. The liner shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud mechanical abrasions, excessive heat, or other damage.

D. The Contractor will be allocated sufficient space by the Owner to store the liner upon its arrival. On-site handling of the liner is the responsibility of the Contractor. Appropriate handling equipment shall be used when loading or moving rolled liner from one place to another. Appropriate equipment includes spreader and roll bars for deployment, cloth chokers and spreader bar for off-loading. Procedures for handling the liner shall be approved by the Inspector.

E. The method used to unroll the panels shall not cause scratches or crimps in the liner and shall not damage the supporting soil.

F. The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels). Wrinkles shall be identified as to proper location and compensation shall be identified on the Contractor's and Inspector's drawings. Ballast shall be used to prevent relocation of the compensating wrinkles by wind.

G. Adequate loading (i.e., sand bags, tires, or similar items that will not damage the liner) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

H. Direct contact with the liner shall be minimized, i.e., in traffic areas is protected by extra liner or other suitable materials.

I. If the above conditions are not fulfilled, the Inspector will identify the involved areas and immediately inform the Engineer.

J. Liner damaged during transit, off-loading, handling, etc., shall be so identified and set aside. During the unrolling of the liner, the Contractor shall visually inspect the sheet surface in the presence of the Inspector. Faulty or suspect areas shall be marked for testing and/or repair, as determined by the Inspector. Liner stock that is faulty (requires more than one patch per 5,000 square feet), shall be replaced by the Contractor at the Contractor's expense.

1.6 WARRANTY

A. A written warranty shall be obtained from the contractor as part of the contract documents. This document shall warrant both the quality of the material and workmanship. The Contractor shall certify in writing that the installed liner product meets the requirements of these specifications and the project plans and under normal weathering the sheet material is warranted for a period of 20 years and that the sheet will not fail due to seam failure, environmental stress cracking or flex fatigue within 20 years of installation.

PART 2 - PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. Liner Material:

1. The membrane liner shall comprise 60 mil HDPE material manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.
2. The Contractor shall, at the time of bidding, submit a certification from the manufacturer of the sheeting, stating that the sheeting meets the physical properties specified.

3. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired using the extrusion welding technique in accordance with the manufacturer's recommendations.
4. The lining material shall be manufactured a minimum of 22.0 ft. width. Labels on the roll shall identify the thickness, length, width, and manufacturer's mark number.
5. The liner material shall meet the following minimum physical characteristics:

Specific Gravity	0. 94
Melt Index	<1.1 G/10 mi
Tensile Strength (Yield)	> 2000 psi
(Break)	> 3900 psi
Elongation at Yield	>10%
Elongation at Break	>200%
Modulus of Elasticity	>80,000 psi
Tear Resistance, Min.	>700 ppi
Puncture Resistance	>1800 psi
Resistance to Soil Burial Max. change	±10%
Dimensional Stability	± 3%
Environmental Stress	1500 hours
Low Temperature	-40°F
Carbon Black Content	2-3%
Sheet Thickness	±10%

6. The fabricated seams (if applicable) and field seams shall meet the following specifications:

Seam Strength	(ASTM D3083)	Minimum 90% of Sheet Strength
Peal Strength	(ASTM D413 or ASTM D638)	Film Tear Bond and Minimum of 50% of Sheet Strength

B. Extrusion Resin: Resin used for extrusion welding shall be produced from and the same as the liner material resin. Physical properties shall be the same as those of the resin used in the manufacture of the Liner. Extrusion resin shall be supplied in black.

2.2 FACTORY QUALITY CONTROL

A. Raw Material

1. The manufacturer/installer shall test the resin to ensure the consistency of the raw material quality. The manufacturer/installer shall test for the following properties:

a)	Density	(ASTM D792)	1/resin batch
b)	Melt Index	(ASTM D1238)	1/resin batch
c)	Low temperature Brittleness	(ASTM D748)	1/resin batch

2. The results of this testing shall be evaluated and, if the physical specifications are not satisfied, the resin batch in question shall not be accepted for extruding the liner. As a result of this testing, the manufacturer/installer shall be prepared to certify as to the quality of the raw material as defined by the physical specifications.

B. Fabrication:

1. The carbon black for ultraviolet protection shall be added to the otherwise pure HDPE resin as part of the sheet extrusion process. The manufacturer/installer shall perform testing to maintain the specific carbon black content and to determine if adequate dispersion is being achieved.
2. Automatic monitoring of controlling parameters shall be an integral part of the extrusion process. Surface appearance and sheet thickness shall be monitored continuously during the extrusion process. The sheet thickness shall be continuously monitored by electronic methods and/or periodically inspected manually. An acceptable sheet thickness shall be ±10% of the specified thickness. Sheets in excess of +10% of the specific thickness shall be acceptable; those in excess of -10% of the specified thickness shall be rejected.
3. Finished goods shall be periodically tested to evaluate its stress-deformation characteristics.
4. The following test program shall be conducted at least twice per shift:

    a) Tensile and Elongation property
    b) Thickness of Material
    c) Carbon Black content
    d) Puncture Resistance

5. The above test shall be conducted in accordance with ASTM methods as listed in Paragraph 2.1 - MATERIAL SPECIFICATIONS, to ensure that the finished products meet the minimum Specifications. Finished products shall be sampled at least twice per shift. Samples shall be taken even if they cannot be tested until a later date. Sampling shall be done by production personnel.
6. All factory control tests shall be properly recorded and shall be made available to the Engineer for his review, if required.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Surfaces and anchor trench shall be prepared by the Contractor. Surfaces and anchor trench to be lined shall be smooth and free of all rocks, stones, sticks, roots, sharp objects or debris of any kind. The surface shall provide a firm, unyielding foundation for the liner with no sudden sharp or abrupt changes or breaks.

B. The manufacturer shall certify in writing that the surface on which the liner will be installed is acceptable. After the supporting soil has been accepted by the manufacturer, it shall be the manufacturer's responsibility to indicate to the Engineer any change in the supporting soil condition caused by natural conditions or occurrences that may require repair work. The general contractor shall provide for dewatering and for drying of the subgrade, as required during construction. Special care shall be taken to maintain the prepared soil surface. Any damage to the subgrade caused by this installation shall be required at the manufacturer's expense in accordance with the requirements of the applicable Earthwork specifications.

3.2 INSTALLATION

A. Installation of liner shall be performed by the liner manufacturer. The manufacturer shall be responsible for inspection of the panel rolls at the jobsite. Should rolls show damage from transit, they will be so identified by the manufacturer and set aside. During the unrolling of the panel rolls, the manufacturer shall visually inspect the sheet surface. Any faulty areas shall be marked and repaired in an approved manner by the manufacturer.

B. Liner Placement and Layout:

1. The panels shall be laid out according to approved engineering plans and shall not deviate from the approved plans except with the prior approval of the Owner and the Engineer. Panels shall be overlapped sufficiently to permit welding without having to splice small sections of materials into the general plan layout.
2. The number of panels to be deployed in any day shall be limited to the number of panels to be seamed in the same day.
3. No equipment used shall damage the liner by handling, trafficking, leakage of hydrocarbons, or other means.
4. No personnel working on the liner shall smoke, wear damaging shoes, or engage in other activities that could damage the liner.
5. Liner clamps or other metal tools must have rounded corners, and shall never be tossed or thrown.

C. Field Seaming:

1. All areas to be seamed shall be cleaned of dust and dirt and completely dry prior to seaming.
2. All sheeting shall be welded together by means of extrusion welding process. The composition of extrudate shall be identical to the lining material.
3. All seams on side slope shall run vertically to the center line of the pond. Seams parallel with center line of the pond on the side slope shall not be allowed.
4. No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped, and an overlap extrusion weld shall be applied. All welds on completion of the work shall be tightly bonded. Any membrane area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of membrane.

5. Unless authorized in writing by the Engineer, welding shall be performed between 20°F and 104°F as measured 6-inches above the liner surface. No welding shall be performed in the presence of free moisture.
6. Between 20°F and 40°F, seaming shall be allowed if the liner is preheated by a hot air device and if there is not excessive cooling resulting from wind.
7. After 40°F, no preheating will be required unless deemed necessary by the Inspector.

D. Seam Tests, Sampling and Quality Control:

1. A test weld three-feet long from each welding machine shall be made twice during each shift. Samples from weld shall be tested in shear and peel, and no welder may start work until sample weld has been approved. The test weld shall be marked with date, ambient temperature, and welding machine number.
2. Specimens of weld 1/2-inch to 1-inch wide shall be cut from the test weld and tested in shear and peel. Shear and peel test shall be based on ASTM D638 test standards.
3. Random weld samples shall be removed from the installed welded sheeting at a frequency of one sample per 400-feet weld. All weld samples shall be marked with their location roll and seam number. The installer shall also record in written form, the date, time, ambient temperature, seaming unit, number, name of seamer, welding apparatus, temperatures and pressures. Destructive shear and peel tests shall be done on weld samples based on ASTM D638 test standards.
4. In addition to random weld sampling, visual examination of the seam shall be conducted by the installer to detect any suspect areas, breaks, or holes in the weld for ensuring watertightness.
5. As required by the Engineer to verify the factory seam quality, non-destructive air pressure test and/or vacuum test shall be conducted by the installer to test up to 50% of factory seams and field seams. Defective seams shall be marked and repaired in accordance with repair procedure approved by the Engineer.
6. All field installation quality control tests shall be properly recorded and shall be made available for Engineer's review, if required.,

3.3 ACCEPTANCE

A. The Contractor shall retain all ownership and responsibility for the liner until accepted by the Owner and Engineer.

B. The liner shall be accepted by the Owner and Engineer when all of the following conditions are met:

1. Installation is finished.
2. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.
3. Certification, including "record" drawings showing actual layout of sheets and locations of field seams, are provided by the Contractor to the Engineer. A written warranty in accordance with PART I - GENERAL, 1.6 WARRANTY, is provided to the Engineer.

END OF SECTION

SECTION 03100 - CONCRETE FORMWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 03300 - Cast-In-Place Concrete: Supply of concrete and accessories for placement by this Section.

B. Section 05500 - Metal Fabrications: Supply of metal fabrications for placement by this Section.

1.3 RELATED SECTIONS

A. Section 03200 - Concrete Reinforcement.

B. Section 03300 - Cast-in-Place Concrete.

1.4 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 347 - Recommended Practice For Concrete Formwork.

C. PS-1 - Construction and Industrial Plywood.

1.5 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, lines, elevations and dimensions as shown on the Contract Drawings.

B. Safely support all vertical and lateral loads that might be applied during placing or operations until such loads can be supported by the concrete structure.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301. Include increased or additional loads, reduced design stresses, or more restrictive procedures whenever these measures are required to produce safe formwork, or when required by the Manatee County Building Code.

B. Maintain one copy of document on site.

1.7 QUALIFICATIONS

A. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Florida.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable codes for design, fabrication, erection and removal of formwork.

B. Conform to Occupational Safety and Health Administration Standards.

1.9 COORDINATION

A. Coordinate this Section with other Sections of work which require attachment of components to formwork.

B. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Engineer before proceeding.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Plywood: Select sheathing, tight face, high density overlaid one side, sound undamaged sheets with clean, true edges.

2.2 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage (1.5 mm) matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch (25 mm) back break dimension, free of defects that could leave holes larger than one inch (25 mm) in concrete surface.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Corners: Chamfered, rigid plastic type; 3/4 x 3/4 inch (20 x 20 mm) size; maximum possible lengths.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Contract Drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted unless previously approved in writing by Engineer. If approval has been received, hand-trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

E. Obtain approval before framing openings in structural members which are not indicated on Drawings.

F. Provide chamfer strips on external corners of beams, walls, curbs, slabs, and piers.

G. Maintain camber in the forms to compensate for the deflection due to weight and pressure of the freshly placed concrete.

3.4 APPLICATION - FORM RELEASE AGENT

A. Clean inside surface of all forms.

B. Apply form release agent on formwork in accordance with manufacturer's recommendations.

C. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in or passing through concrete work.

B. Locate and set in place items which will be cast directly into concrete.

C. Coordinate work of other Sections in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

D. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops continuous without displacing reinforcement. Heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean and remove foreign matter within forms as erection proceeds.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

3.8 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

A. Under normal conditions, the minimum waiting period for stripping forms after placing concrete shall be as follows:

1. Formwork supporting weight of poured concrete only, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 48 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

2. Formwork supporting dead, live, and construction loads, such as beam soffits, joists, and other structural elements, may not be removed for a minimum of 14 days or 2/3 the 28-day compressive strength ($f'c$), whichever is longer.

3. Formwork supporting dead, live, and construction loads, such as slabs may not be removed for a minimum of 7 days or 2/3 the 28-day compressive strength ($f'c$), whichever is greater.

4. The compressive strength of cast-in-place concrete shall be determined by testing and field-cured specimens representative of concrete locations or members.

B. Subject to approval of the Owners Representative, the periods listed in Paragraph 3.9 A. may be adjusted to conform to recommendations outlined in ACI 347; Section 3.6 (including 3.6.2.2 and 3.6.2.3) to meet specific job conditions.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Maintain safety rules and the regulations of local and other regulatory agencies and be totally responsible for any injury or damage to life and property during removal of the forms. The use of the above schedule shall not relieve the Contractor of responsibility for safety of the structure. The Owner's Representative may require longer times prior to stripping.

END OF SECTION

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric and accessories for cast-in- place concrete.

1.2 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03300 - Cast-in-Place Concrete.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements For Reinforced Concrete.

C. ACI SP-66 - American Concrete Institute - Detailing Manual.

D. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

E. ANSI/ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

F. ASTM A617 - Axle Steel Deformed and Plain Bars for Concrete Reinforcement.

G. ASTM A767 - Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.

H. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

I. CRSI - Concrete Reinforcing Steel Institute Manual of Practice.

J. CRSI 63 - Recommended Practice For Placing Reinforcing Bars.

K. CRSI 65 - Recommended Practice For Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS

A. Submit under provisions of Section 01340. Do not fabricate reinforcing before receipt of approved shop drawings.

B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, ACI SP-66, ACI 318.

B. Maintain one copy of each document on site.

C. Submit certified copies of mill test report of reinforcement materials analysis upon request by Owner or Engineer.

1.6 COORDINATION

A. Coordinate with placement of formwork, formed openings and other Work.

1.7 WELDING

A. Welding on reinforcing steel during shop fabrication or field work shall not be permitted.

1.8 MARKING AND SHIPPING

A. Ship reinforcing steel to size cut to proper length, tagged with non-rusting metal tags, showing shop drawing numbers and tied in bundles that can be easily handled.

1.9 DELIVERY, STORAGE AND HANDLING

A. Bars, when delivered at the site, shall be straight and free from twists, kinks and irregularities except such as are necessary to conform to reinforcing details. Steel shall be free from dirt, scale or loose rust or other coatings. Any bars upon which decided rust scales have formed shall be rejected.

B. Store reinforcing bars and wire fabric above ground and under cover to protect same from weather, dirt or grease.

C. Care shall be exercised to prevent any damage during shipment, handling and storage.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 ksi (414 MPa) yield grade; deformed billet steel bars, plain finish.

B. Reinforcing Steel: ASTM A617, 60 ksi (414 MPa) yield grade; plain axle steel bars, plain finish.

C. Welded Steel Wire Fabric: ASTM A185 plain type in flat sheets; galvanized to ASTM A767 Class II finish.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel or Stainless steel type; size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.

B. Locate reinforcing splices not indicated on Drawings, at point of minimum stress. Review location of splices with Engineer. Lengths of laps, splices, and embedments shall conform to ACI 318. Splices lengths to be based on Class "C", top bar, tension splice spaced less than 6" on centers.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Accommodate placement of formed openings.

C. Maintain concrete cover around reinforcing as follows:

Item	Coverage
Supported Beams	2 inches (50 mm)
Supported Roof Slab	2 inches (50 mm)
Supported Floor Slabs	2 inches (50 mm)
Formed Concrete exposed to earth	3 inches (76 mm)
Concrete Formed against earth	3 inches (76 mm)

D. Placing of all reinforcing steel shall conform to ACI 301, Chapter 5, and ACI 318, Chapter 7, unless otherwise noted herein.

E. Bending or straightening of rebars partially embedded in set concrete shall not be permitted except in isolated cases where corrective action or a field change is required and is specifically approved by the Owner or Engineer.

F. Reinforcing bars may be moved one diameter or within the limit of acceptable tolerances in order to avoid interference with other reinforcing bars, conduits or embedded items.

3.2 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01420.

END OF SECTION

SECTION 03210 - STEEL BAR AND WELDED WIRE FABRIC REINFORCING

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Concrete: Section 03300.

B. Concrete Reinforcement: Section 03200.

1.2 QUALITY ASSURANCE

A. Acceptable Manufacturers: Regularly engaged in manufacture of steel bar and welded wire fabric reinforcing.

B. Installer Qualifications: Three years experience in installation of steel bar and welded wire fabric reinforcing.

C. Allowable Tolerances:

1. Fabrication:

   a. Sheared length: + 1 in.
   b. Depth of truss bars: + 0, - 1/2 in.
   c. Stirrups, ties and spirals: ± 1/4 in.
   d. All other bends: ± 1 in.

2. Placement:

   a. Concrete cover to form surfaces: ± 1/4 in.
   b. Minimum spacing between bars: 1 in.
   c. Top bars in slabs and beams:

      (1) Members 8 in. deep or less: ± 1/4 in.
      (2) Members more than 8 in.: ± 1/2 in.

   d. Crosswise of members: Spaced evenly within 2 in. of stated separation.
   e. Lengthwise of members: Plus or minus 2 in.

3. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1 bar diameter.

1.3 SUBMITTALS

A. Shop Drawing

1. Show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.
2. Indicate bar schedules, stirrup spacing and diagrams of bend bars.

B. Manufacturer's Literature: Manufacturer's specifications and installation instructions for splice devices.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

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

B. Handle and store materials to prevent contamination.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bars: Deformed billet steel: ASTM A 615, Grade 60.

B. Wire: Cold drawn steel: ASTM A 82.

C. Wire Fabric: Welded deformed steel: ASTM A 497.

D. Tie Wire: FS QQ-W-461, annealed steel, black, 16 ga. minimum.

2.2 FABRICATION

A. In accord with CRSI Manual of Standard Practice.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placement:

1. Bar Supports: CRSI 65.
2. Reinforcing bars: CRSI 63.

B. Steel Adjustment:

1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
2. Do not move bars beyond allowable tolerances without concurrence of Engineer.
3. Do not heat, bend, or cut bars without concurrence of Engineer.

C. Splices:

1. Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.

2. Splice devices: Install in accordance with manufacturer's written instructions.
3. Do not splice bars without concurrency of Engineer, except at locations shown on drawings.

D. Wire Fabric:

1. Install in longest practicable length.
2. Lap adjoining pieces one full mesh minimum, and lay splices with 16 gauge wire.
3. Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
4. Offset end laps in adjacent widths to prevent continuous laps.

E. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

F. Protection During Concreting: Reinspect reinforcing steel and make any repairs necessary for secure and proper positions just before pouring concrete. Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete foundations, and supported slabs.

B. Floors and slabs on grade.

C. Control, and expansion and contraction joint devices associated with concrete work, including joint sealants.

D. Equipment pads.

E. Waterstops, anchor bolts, and other embedded accessories.

F. Topping slabs.

G. Adhesive cartridge anchors.

1.2 RELATED SECTIONS

A. Section 03100 - Concrete Formwork.

B. Section 03200 - Concrete Reinforcement.

C. Section 03600 - Grouting.

D. Section 07900 - Joint Sealants.

E. Section 05500 - Metal Fabrications.

F. Section 09981 - Cementitious Coatings.

1.3 REFERENCES

A. ACI 301 - Structural Concrete for Buildings.

B. ACI 302 - Guide for Concrete Floor and Slab Construction.

C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

D. ACI 305R - Hot Weather Concreting.

E. ACI 306R - Cold Weather Concreting.

F. ACI 308 - Standard Practice for Curing Concrete.

G. ACI 318 - Building Code Requirements for Reinforced Concrete.

H. ANSI/ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).

I. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type.

J. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

K. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

L. ASTM C33 - Concrete Aggregates.

M. ASTM C94 - Ready-Mixed Concrete.

N. ASTM C150 - Portland Cement.

O. ASTM C260 - Air Entraining Admixtures for Concrete.

P. ASTM C330 - Lightweight Aggregates for Structural Concrete.

Q. ASTM C494 - Chemicals Admixtures for Concrete.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on joint devices, admixtures, and adhesive cartridges.

C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record locations of embedded utilities and components which are concealed from view.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

1.7 COORDINATION

A. Coordinate work under provisions of Quality Control Section.

B. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement : ASTM C150, Type I, II or V.

B. Aggregates : Fine and Coarse per ASTM C33.

C. Water : Clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical: ASTM C494, Type A - Water Reducing, Type D - Water Reducing and Retarding, Type E - Water Reducing and Accelerating, Type F - Water Reducing, High Range admixtures. In no case shall admixtures containing any chlorides be used.

2.3 ACCESSORIES

A. Bonding Agent: Two component modified epoxy resin, or mineral filled polysulphide polymer epoxy.

B. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

C. Monofilament fiber mesh (1 lb per yard).

D. Anchor Bolts: ASTM 276 Type 316 per Section 05500.

E. Embedded Angles: Aluminum - ASTM B221 6061-T6 T6510 Alloy

F. Embedded Plates: Aluminum- ASTM B209 6061-T6 T6510 Alloy

G. Aluminum Extruded Shapes- ASTM B221, 6061-T6 Alloy

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1752; Closed cell foam, resiliency recovery of 95 percent of original thickness.

B. Waterstops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inch wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

C. Sealant and Primer: As specified in Section 07900.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ACI 304.

B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1 or Method 2 to meet the following criteria:

1. Weight: Normal (145 pcf)
2. Compressive Strength (28 days) :
   a) Masonry Fill: 3000 psi (per gravel)
   b) All Other: 4000 psi (per gravel)
3. Slump: 2 to 4 inches

C. Concrete mix properties.

1. Tanks & Water Retaining Structures- per ACI 350-R with the following properties:

a)	water-cement ratio	:	.4 to .45
b)	slump	:	2" to 4"
c)	coarse aggregate	:	well graded from No. 4 sieve to 1"
d)	cement content	:	5 1/2 to 6 bags per yard

2. Other structures- per ACI 301

D. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

E. Do not use calcium chloride.

F. Use set retarding admixtures during hot weather only when approved by Engineer.

G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

H. Toppings: Toppings shall consist of 300-400 pounds of sand, 100 pounds of type V cement and 3 pounds of monofilament fiber mesh (1 lb per yard) and a maximum of 5 gallons of water. The topping shall be mixed for 5 minutes in a mechanical mixer and shall not have a slump greater than 2 inches.

I. Pea Gravel Concrete: 3000 psi in 28 days with course aggregate well graded from No. 6 to 3/8".

2.6 ADHESIVE CARTRIDGE ANCHORAGES

A. Adhesive Cartridges: A self contained aggregate, polyester resin and hardening agent contained in a glass vile designed for anchoring reinforcing bars and anchor bolts into concrete. Anchorage shall be capable of developing full yield strength of bar. All bolts shall be 304 stainless steel.

ANCHOR INCHES	DIAMETER INCHES	EMBEDMENT TENSION	ALLOW LOAD (POUNDS) SHEAR
1/4	3 3/4	550	590
1/2	3 1/2	2130	2200
5/8	4	2930	3330
3/4	4 3/4	3870	4800
1	6	7200	7470

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing concrete, drill holes in existing concrete and insert adhesive capsules and reinforcing bars in accordance with manufacturer's instructions.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers and waterstops are not disturbed during concrete placement.

D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

E. Extend joint filler from bottom of slab to within 1/2 inch (13 mm) of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.

F. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

G. Place concrete continuously between predetermined expansion, control, and construction joints. Do not interrupt successive placement; do not permit cold joints to occur.

H. Do not interrupt successive placement; do not permit cold joints to occur.

I. Screed floors and slabs on grade to slope indicated, maintaining surface flatness of maximum 1/4 inch in 10 ft (6 mm /3 m).

J. Cold Weather - Temperature of concrete delivered to the jobsite shall conform to the following ranges:

Ambient Air Temperature	Concrete Temperature
30- 45 degrees F	55 - 90 degrees F
0- 30 degrees F	60 - 90 degrees F
Below 0 degrees F	65 - 90 degrees F

1. All work shall be in accordance with ACI 306, Latest edition, "Recommended Practice for Cold Weather Concreting."
2. When outdoor temperature is less than 40 degrees F, temperature of concrete in place shall be maintained at not less than 50 degrees F.

K. Hot Weather - Temperature of the concrete delivered to the jobsite shall not exceed 90 degrees F. All work shall be in accordance with ACI 305, latest edition, "Recommended Practice for Hot Weather Concreting."

L. Protect from rain and rainwater. No concrete shall be placed in rain, sleet or snow or other adverse weather conditions. Rainwater shall not be allowed to increase the water content of the concrete.

M. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.4 CONCRETE FINISHING

A. Concrete finishes shall be of the highest quality. Imperfections in concrete finish will not be accepted.

B. Provide formed concrete surfaces to be left exposed with smooth rubbed finish or sack rubbed finish as scheduled in this section. The surfaces shall be pointed and rubbed immediately after form removal.

C. Concrete Finishes:

1. Non-slip surfaces shall be surfaced with all oxide aggregate. "Alumdum" or "Emerdum". Aggregate shall be unit graded from 100 percent retained on a No. 50 sieve to 100 percent passing No. 8 sieve. Aggregate shall be uniformly distributed during steel troweling at the rate of ¼ pound per square foot, in accordance with manufacturer's recommendations.
2. Steel Trowel Finish - Interior floors scheduled to receive ceramic tile or resilient flooring shall have the aggregate well worked down from the surface and be given a hand, smooth finish.
3. Swirl Finish - Interior floors shall have the aggregate well worked down from the surface and be given a hard, smooth steel trowel finish. After the hard smooth finish is obtained, the finisher shall make an additional pass over the surface to obtain a nonskid finish, commonly known as a "swirl finish", which is smoother than "sidewalk finish" but is not a glasslike smoothness. Dusting with sand or cement will not be permitted.
4. Tank Walls – Holes and other voids shall be filled with grout. Apply coatings per Section 09900.
5. Interior Building Walls & Columns - Holes and other voids shall be filled with grout. Apply cementitious coating per Section 09981.
6. Broom Finish – Exterior slabs shall be screeded to proper elevation, initial floating as soon as workable. Second floating at time of initial set, then broom finish. Apply coatings per Section 09900.

D. The use of any finishing or troweling machine or other apparatus which has a water attachment for wetting the concrete during finishing operations is prohibited.

E. Finish concrete floor surfaces in accordance with ACI 301.

3.5 CURING AND PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Cure floor surfaces in accordance with ACI 308.

D. Curing can be accomplished by:

1. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 4 days.
2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
3. Membrane: Membrane curing compound may be used for those are which will not be later covered with a topping, mortar , or additional

concrete. Membrane shall be spray applied at a coverage of not more than 300 square feet per gallon and shall be applied within 30 minutes of final finishing or immediately after form removal.

4. Film Curing: Film curing with polyethylene sheeting may be used in-lieu of water curing for areas which will receive topping, mortar or additional concrete. Film shall be applied as soon as possible after initial set and shall be completely cover the surfaces with no trapped air pockets.

3.6 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 301 and under provisions of Section 01410.

B. Provide free access to Work and cooperate with appointed testing firm.

C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.

D. Tests of cement and aggregates shall be performed to ensure conformance with specified requirements.

E. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed each day.

F. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

3.7 PATCHING

A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections in accordance with ACI 301.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Engineer.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.9 CONSTRUCTION JOINTS

A. Construction joints shall be made and located as shown on the Contract Drawings. Additional construction joints or revised locations of joints shall be submitted to the Owner for approval. All such construction joints shall be shown clearly on the Contract Drawings. The construction joints shall be true to lines and shall be located not to impair the strength of the structure. All construction joints in contact with water, or in water retaining structures shall have waterstops.

B. Construction joints in general shall be located near the middle of spans of slabs, beams, and girders, unless a beam intersects a girder at this point, in which case the joints in the girders shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams or girders and at the top of footings or floor slabs. Beams shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

C. All reinforcement shall be continued across construction joints. Keys and dowels shall be provided as shown on the Contract Drawings. Vertical joints in walls shall be kept to a minimum. No joints are permitted in footing or foundation work. The Contractor shall make such provisions for bonding walls and footings as shown on the Contract Drawings or as approved by the Owner.

D. The surface of the hardened concrete at all joints shall be thoroughly cleaned and all laitance removed. The surface shall be prepared to ensure bonding of concrete placed on it.

3.10 EXPANSION JOINTS

A. Expansion joints shall be provided if shown on the Contract Drawings. The joint filler material shall be firmly placed against the face of the completed concrete work before the concrete of the adjoining portion is placed.

B. Reinforcement or other embedded metal items bonded to the concrete shall not be permitted to extend continuously through any expansion joint unless shown otherwise on the Contract Drawings or approved by the Owner.

C. Premolded expansion joint filler shall be of nonbituminous type unless noted otherwise on the Contract Drawings. Premolded expansion joint filler shall be self-expanding cork manufactured by W.R. Grace & Company or approved equal and shall conform to Specification for Preformed Expansion Joint Fillers to Concrete Paving and Structural Construction (Nonextruding and Resilient Nonbituminous Types), ASTM D1752.

3.11 INSERTS

A. All sleeves, anchor bolts, pipe anchors, inserts and embedded items shall be placed in positions prior to concreting. All such items must be clearly located on the shop drawings and shall be approved by the Owner. The Contractor shall coordinate and verify all mechanical, electrical and architectural drawings for the

location of sleeves, pipes, ducts and all other items. Anchor bolt threads shall be protected with a coat of grease before placing concrete, after which they shall be thoroughly cleaned, regreased and wrapped in burlap. All ferrous metal inserts shall be galvanized.

B. Contractor shall hold all embedded items in perfect position and alignment during placement of concrete using supplementary supports, ties or other approved means. Such supports or hardware which will remain permanently in the concrete shall be evaluated for their effect in shield integrity and shall be documented by photographs.

C. No items made of aluminum are allowed to be embedded in concrete unless otherwise shown on Contract Drawings. Aluminum surface in contact with concrete shall be given a heavy coat of an alkali- resistant bituminous paint before installation. Aluminum surface to be embedded in concrete shall be given one coat of zinc chromate primer conforming to U.S. Military Specification MPL-P735.

3.12 CONCRETE EQUIPMENT PADS AND TOPPINGS

A. Prior to placing concrete equipment pads or floor toppings, scrub existing concrete surface clean, remove oil and grease by chipping or grinding and roughen substrate concrete surface. The cleaned surface shall be rinsed with clean water and kept saturated for the 24 hour period immediately preceding the placement of the concrete/topping.

B. Place required edge strips and reinforcing and other items to be cast in.

C. Immediately before the concrete/topping is applied the concrete surface shall be coated with a bonding agent neat portland cement slurry having the consistency of paint.

D. Toppings shall be compacted with a mechanical compactor-float.

3.13 SCHEDULE - CONCRETE TYPES AND FINISHES

A. Foundations: 4,000 psi 28 day concrete, smooth rubbed finish with honeycomb filled surface.

B. Underside of Supported Floors and Structure Exposed to View: 4,000 psi 28 day concrete, sack rubbed finish.

C. Floor Slab: 4,000 psi 28 day concrete swirl finish.

D. Process tanks slabs: 4,000 psi 28 day concrete float finish to topping.

3.14 SCHEDULE - JOINT FILLERS

A. As shown on Drawings.

END OF SECTION

SECTION 03360 - ELONGATED PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing elongated prestressed concrete tanks as shown on the Drawings and as specified. Each complete tank shall be watertight and free of cracks.

1.2 QUALITY ASSURANCE

A. The entire tank, including all portions of the floor, wall and walkway shall be built by the prestressed tank contractor, using its own trained personnel and equipment.

B. Qualifications and Experience. The tank construction contractor shall have the following qualifications and experience:

1. Shall be a firm specializing in the design and construction of elongated prestressed composite tanks; shall have had at least ten years experience in this specialty; and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tanks in accordance with the quality required by these specifications; and be presently responsible for, a minimum of ten elongated prestressed concrete aeration tanks of comparable size now giving satisfactory service. A list of these tanks shall be attached to the Bid for this project.

2. The tank construction contractor shall have on its staff a full-time structural engineer, registered in the State in which the tank is to be built, who shall have no less than ten years experience in the design and field construction of elongated prestressed composite tanks (covered by U.S. Patent 5,237,793), and who shall be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such a registered structural professional engineer.

C. Available Tank Construction Contractors. Subject to compliance with requirements, tank construction contractors offering products which may be incorporated in the work are limited to the following:

1. The Crom Corporation, Gainesville, Florida

1.3 SUBMITTALS

A. Design Analysis and Drawings. After award of the contract, the tank contractor shall submit complete design analyses, working drawings and details of the structure for record purposes. Such drawings shall include details, influent and effluent pipes, plan and elevation details of the tank proposed for erection. In addition, upon request, the Contractor shall provide the complete calculations upon which his drawings are based. These calculations shall include an analysis of soil bearing pressures for review by the Engineer.

1.4 WARRANTY

A. The tank Contractor shall guarantee workmanship and materials on the complete structural portion of the tank for a five-year period from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the Contractor shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. To satisfy the five-year warranty, the tank contractor shall furnish a written company warranty for a five-year period.

PART 2 - MATERIALS AND EQUIPMENT

2.1 DESIGN CRITERIA

A. The thickness of the elongated prestressed shotcrete walls shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.

B. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

C. The design of the circular prestressed walls shall be in conformance with American Concrete Institute (ACI) Title 344R-W "Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures," and currently accepted engineering principles and practices for the design of such facilities.

	Concrete	
Compressive Strength	f'_c	4000 psi at 28 days
	Shotcrete	
Compressive Strength	f'_g	4000 psi or greater at 28 days
Allowable Compressive Stress	f_g	1250 + 75t with 0.45 f'_g maximum*
Allowable Compressive Stress Due to Initial Prestressing Force	f_{gi}	0.5 f'_{gi} or less, with a maximum of 2250 psi (where f'_{gi} is defined as compressive strength at time initial prestressing force is applied)

*t = thickness of core wall

Prestressing Wire

Wire Size	Diameter	0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250"
Working Stress, Wall	f_s	115,000 psi
Working Stress, Dome Ring	f_s	120,000 psi
Allowable Tensile Stress Before Losses	f_{si}	145,600 psi or no greater than 0.70 f'_s
Ultimate Tensile Strength	f'_s	231,000 psi or greater for 8 gauge 222,000 psi or greater for 6 gauge

Prestressing Strand

Seven-Wire Strand Size	0.6" Diameter
Ultimate Tensile Strength	270,000 psi

Prestressing Rods

Rod Size	1" Diameter
Ultimate Tensile Strength	150,000 psi

Reinforcing Steel

Allowable Tensile Stress	f_s	18,000 psi
Yield Strength	f_y	60,000 psi

2.2 SUBMITTALS

A. Submit to the Engineer complete design calculations and a complete set of detailed working drawings for the tank, including:

1. Concrete mix designs.
2. Guarantee document as specified in Paragraph 1.4 A.

2.3 FLOOR

A. Concrete membrane floors (minimum 4-½ inches thick) shall be thickened to a minimum of 8 inches of concrete over all pipe encasements and around sumps. The minimum percentage (0.625%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent minimum 4-½ inch thick floor.

B. Minimum tank floor thickness are shown on the drawings and specified herein. The tank Contractor shall be responsible to design and provide a sufficiently thick reinforced floor slab, including the foundation slab beneath the walls for the vertical loading.

C. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

D. Floors shall be continuously water cured until tank construction is completed.

2.4 SHOTCRETE WALLS

A. The prestressed walls and reinforced walls shall be constructed of shotcrete, encasing a steel diaphragm continuous the full wall height without horizontal splices.

B. The thickness of the prestressed wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the circular core wall be less than 3-1/2 inches thick and the straight core wall be less than 4-1/2 inches thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows.

C. To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the prestressed wall:

1. The top 2 feet of wall shall have not less than 1 percent reinforcing.
2. The bottom 3 feet of wall shall have not less than 1 percent reinforcing.
3. Inside Face:

    a) 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices.
    b) Additional vertical and horizontal reinforcing steel bars as required by design computations, or as shown on the plans.

4. Outside Face:

    a) Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center.
    b) Additional vertical and horizontal reinforcing steel bars as required by design computations, or as shown on the plans.

D. Interior and exterior surfaces of the prestressed wall shall be water cured until prestressing starts.

2.5 STEEL SHELL DIAPHRAGM

A. A 26 gauge steel tank shell, complying with ASTM A-366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the shotcrete wall, providing a positive waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than one inch thick at all places. The steel shell is to be so formed and erected that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.

B. In the prestressed walls, all vertical joints in the diaphragm shall be sealed watertight by mechanical crimping and epoxy injection.

C. Epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C 881, Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees F.

D. The steel shell design and its epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used in the ten tanks required in the Tank Construction Company's experience record. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.

E. In the reinforced shotcrete walls, vertical joints in the diaphragm shall be mechanically crimped and sealed watertight by epoxy injection as described in Paragraph C above.

2.6 SHOTCRETE

A. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with guidelines by ACI Committee 506. Certification will be accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.

1. *ELF- Engineering Laboratory Forum, Florida Institute of Consulting Engineers
2. FC&PA- Florida Concrete and Products Association

B. Shotcrete mixes, measured by weight, shall be:

1.	First coat on steel shell diaphragm and prestressing:	1 part cementitious material to 3 parts sand
2.	All other shotcrete:	1 part cementitious material to 4 parts sand

C. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm which is encrusted with overspray. No less than 1/8" thick shotcrete shall separate reinforcing steel and prestressing steel.

2.7 STRAIGHT PRESTRESSED WALLS

A. The core wall shall be constructed of shotcrete encasing a continuous steel shell diaphragm. The reinforcing steel and the shotcrete thicknesses shall be in accordance with the plans.

B. The straight walls shall be constructed on a footing covered with low friction sheet material to allow longitudinal movement of the wall under prestressing action.

C. Water curing of the straight walls shall be carried out to retard shrinkage until the walls are ready for prestressing.

D. The straight wall sections shall be prestressed linearly using 1" diameter prestressing steel rods conforming to ASTM 722. These rods shall have an ultimate tensile strength of 150,000 psi. After tensioning, rods shall be permanently grouted.

E. The design of these straight walls shall include an estimate of anticipated linear contraction under the prestressing forces applied. Construction of the connecting semi-circular walls and floor slab of the tank shall be delayed until such time as this anticipated contraction has taken place.

2.8 CIRCULAR PRESTRESSED WALLS

A. Horizontal circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A-648 Class II, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.

B. Placement of the prestressing steel shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equivalent to that shown on the drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of wire.

C. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire as it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or redrawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the drawings. No circumferential movement of the wire along the tank will be permitted during or after tensioning.

Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wire is to be not less than one wire diameter.

D. Measurement of Wire Stress. The tank contractor shall supply equipment at the construction site to measure extension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic-direct reading stressometer (with accuracy to within 1%); calibrated dynamometers; test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

2.9 EXTERIOR COVERCOAT

A. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete cover shall have a thickness of no less than one-inch over the wire. When multiple layers of the wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.

2.10 PIPE OPENINGS

A. Insofar as possible, all pipes shall pass into the tank through the floor slab. Underfloor piping shall be encased in concrete.

B. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe shall be no less than 18-inches above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36-inches.

C. A design analysis will be required for unbanded wall spaces having a vertical dimension greater than 36-inches.

D. All pipe sleeves passing through the wall shall be sealed to the steel sheet diaphragm by epoxy injection; after the sleeve and diaphragm have been encased in shotcrete.

PART 3 - EXECUTION

3.1 CONSTRUCTION CLEARANCE

A. In order to allow for proper application of shotcrete and prestressing wire, a level and unobstructed roadway no less than 15-feet wide shall be provided around the circumference of the tank at sub-floor elevation.

B. Excavation. Excavation, refill, and compaction shall be made around the structures as shown on the drawings and as specified in Section 02200 - Earthwork.

3.2 FILLING AND TESTING

A. Wherever possible, filling and testing of the tank shall be carried out prior to placing or backfill around the structure. Watertightness shall be tested in accordance with Chapter 5 of ACI-344. Reclaimed water shall be used for filling and testing.

3.3 PAINTING

A. Painting of the exposed exterior surfaces of the tank shall be as specified in Section 09900.

B. Painting of the interior wall sections shall be as specified in Section 09900.

3.4 CLEAN-UP

A. Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petrochemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

END OF SECTION

SECTION 03361 - CIRCULAR PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing circular prestressed concrete tanks as shown on the Drawings and as specified. Each complete tank shall be watertight and free of cracks.

1.2 QUALITY ASSURANCE

A. The entire tank, including all portions of the floor, wall and walkway shall be built by the prestressed tank contractor, using its own trained personnel and equipment.

B. **Qualifications and Experience.** The tank construction contractor shall have the following qualifications and experience:

1. Shall be a firm specializing in the design and construction of circular prestressed composite tanks; shall have had at least ten years experience in this specialty; and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tanks in accordance with the quality required by these specifications; and be presently responsible for, a minimum of ten circular prestressed concrete tanks of comparable size now giving satisfactory service. A list of these tanks shall be attached to the Bid for this project.
2. The tank construction contractor shall have on its staff a full-time structural engineer, registered in the State in which the tank is to be built, who shall have no less than ten years experience in the design and field construction of circular prestressed composite tanks, and who shall be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such a registered structural professional engineer.

C. Available Tank Construction Contractors. Subject to compliance with requirements, tank construction contractors offering products which may be incorporated in the work are limited to the following:

1. The Crom Corporation, Gainesville, Florida (Basis of Design)
2. The Natgun Corp., Wakefield Mass.
3. Precon Corp., Newberry, FL.

1.3 SUBMITTALS

A. Design Analysis and Drawings. After award of the contract, the tank contractor shall submit complete design analyses, working drawings and details of the structure for record purposes. Such drawings shall include details, influent and effluent pipes, plan and elevation details of the tank proposed for erection. In addition, upon request, the Contractor shall provide the complete calculations upon which his drawings are based.

1.4 WARRANTY

A. The tank Contractor shall guarantee workmanship and materials on the complete structural portion of the tank for a five-year period from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the Contractor shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. To satisfy the five-year warranty, the tank contractor shall furnish a written company warranty for a five-year period.

PART 2 - MATERIALS AND EQUIPMENT

2.1 DESIGN CRITERIA

A. The thickness of the prestressed shotcrete walls shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.

B. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

C. The design of the circular prestressed walls shall be in conformance with American Concrete Institute (ACI) Title 344R-W "Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures," and currently accepted engineering principles and practices for the design of such facilities.

	Concrete	
Compressive Strength	f'_c	4000 psi at 28 days
	Shotcrete	
Compressive Strength	f'_g	4000 psi or greater at 28 days
Allowable Compressive Stress	f_g	$1250 + 75t$ with $0.45\ f'_g$ maximum*
Allowable Compressive Stress Due to Initial Prestressing Force	f_{gi}	$0.5\ f'_{gi}$ or less, with a maximum of 2250 psi (where f'_{gi} is defined as compressive strength at time initial prestressing force is applied)

*t = thickness of core wall

Prestressing Wire

Wire Size	Diameter	0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250"
Working Stress, Wall	f_s	115,000 psi
Working Stress, Dome Ring	f_s	120,000 psi
Allowable Tensile Stress Before Losses	f_{si}	145,600 psi or no greater than 0.70 f'_s
Ultimate Tensile Strength	f'_s	231,000 psi or greater for 8 gauge 222,000 psi or greater for 6 gauge

Reinforcing Steel

Allowable Tensile Stress	f_s	18,000 psi
Yield Strength	f_y	60,000 psi

2.2 SUBMITTALS

A. Submit to the Engineer complete design calculations and a complete set of detailed working drawings for the tank, including:

1. Concrete mix designs.
2. Guarantee document as specified in Paragraph 1.4 A.

2.3 FLOOR

A. Concrete membrane floors (minimum 4 ½-inches thick) shall be thickened to a minimum of 8 inches of concrete over all pipe encasements and around sumps. The minimum percentage (0.625%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2 feet into the adjacent minimum 4 ½ -inch thick membrane floor.

B. Minimum tank floor thicknesses are shown on the drawings and specified herein. The tank Contractor shall be responsible to design and provide a sufficiently thick reinforced floor slab, including the foundation slab beneath the walls for the vertical loading.

C. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

D. Floors shall be continuously water cured until tank construction is completed.

2.4 SHOTCRETE WALLS

A. The prestressed walls shall be constructed of shotcrete, encasing a steel diaphragm continuous the full wall height without horizontal splices.

B. The thickness of the prestressed wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the circular core wall be less than 3-1/2 inches thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows.

C. To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the prestressed wall:

1. The top 2 feet of wall shall have not less than 1 percent reinforcing.
2. The bottom 3 feet of wall shall have not less than 1 percent reinforcing.
3. Inside Face:

    a) 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices.
    b) Additional vertical and horizontal reinforcing steel bars as required by design computations, or as shown on the plans.

4. Outside Face:

    a) Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center.
    b) Additional vertical and horizontal reinforcing steel bars as required by design computations, or as shown on the plans.

D. Interior and exterior surfaces of the prestressed wall shall be water cured until prestressing starts.

2.5 STEEL SHELL DIAPHRAGM

A. A 26 gauge steel tank shell, complying with ASTM A-366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the shotcrete wall, providing a positive waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than one inch thick at all places. The steel shell is to be so formed and erected that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.

B. In the prestressed walls, all vertical joints in the diaphragm shall be sealed watertight by mechanical crimping and epoxy injection.

C. Epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C 881, Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees F.

D. The steel shell design and its epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used in the ten tanks required in the Tank Construction Company's experience record. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.

2.6 SHOTCRETE

A. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with guidelines by ACI Committee 506. Certification will be accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.

1. *ELF - Engineering Laboratory Forum, Florida Institute of Consulting Engineers
2. FC&PA - Florida Concrete and Products Association

B. Shotcrete mixes, measured by weight, shall be:

1.	First coat on steel shell diaphragm and prestressing:	1 part cementitious material to 3 parts sand
2.	All other shotcrete:	1 part cementitious material to 4 parts sand

C. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm which is encrusted with overspray. No less than 1/8" thick shotcrete shall separate reinforcing steel and prestressing steel.

2.7 CIRCULAR PRESTRESSED WALLS

A. The core wall shall be constructed of shotcrete encasing a continuous steel shell diaphragm. The reinforcing steel and the shotcrete thicknesses shall be in accordance with the plans.

B. Horizontal circumferential prestressing of the tank shall be achieved by the application of cold drawn, high carbon steel wire complying with ASTM A-648, Class II placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.

C. Placement of the prestressing steel shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equivalent to that shown on the drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of the wire.

D. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire as it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or redrawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the drawings. No circumferential movement of the wire along the tank will be permitted during or after tensioning. Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wire is to be not less than one wire diameter.

E. Measurement of Wire Stress. The tank contractor shall supply equipment at the construction site to measure extension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic-direct reading stressometer (with accuracy to within 1%); calibrated dynamometers; test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

2.8 EXTERIOR COVERCOAT

A. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete cover shall have a thickness of no less than one-inch over the wire. When multiple layers of the wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.

2.9 PIPE OPENINGS

A. Insofar as possible, all pipes shall pass into the tank through the floor slab. Underfloor piping shall be encased in concrete.

B. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe shall be no less than 18-inches above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36-inches.

C. A design analysis will be required for unbanded wall spaces having a vertical dimension greater than 36-inches.

D. All pipe sleeves passing through the wall shall be sealed to the steel sheet diaphragm by epoxy injection; after the sleeve and diaphragm have been encased in shotcrete.

2.10 TANK ACCESSORIES

A. The Tank Construction Contractor shall furnish, install, and guarantee the following tank accessories for five years:

1. Flow Equalization Tank:

   a) Exterior Ladder T-6061 aluminum as shown on the plans.
   b) Interior Ladder 316 Stainless Steel as shown on the plans.
   c) Thickened vertical walls where pipe supports are to be fastened.

2. Sludge Holding / Aeration Tanks: Thickened vertical walls where pipe supports are to be fastened.

3. Final Clarifiers:

   a) Concrete effluent launders.

PART 3 - EXECUTION

3.1 CONSTRUCTION CLEARANCE

A. In order to allow for proper application of shotcrete and prestressing wire, a level and unobstructed roadway no less than 15-feet wide shall be provided around the circumference of the tank at sub-floor elevation.

B. Excavation. Excavation, refill, and compaction shall be made around the structures as shown on the drawings and as specified in Section 02200 - Earthwork.

3.2 FILLING AND TESTING

A. Wherever possible, filling and testing of the tank shall be carried out prior to placing of backfill around the structure. Watertightness shall be tested in accordance with Chapter 5 of ACI-344. Reclaimed water shall be used for filling and testing.

3.3 PAINTING

A. Painting of the exposed exterior surfaces and interior surfaces of the tank shall be as specified in Section 09900.

3.4 CLEAN-UP

A. Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petrochemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

END OF SECTION

SECTION 03410 - PRESTRESSED HOLLOWCORE CONCRETE PLANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prestressed Hollowcore Concrete Planks. Furnish all labor and materials for the manufacture, delivery and erection of prestressed hollowcore plank as specified herein and shown on drawings.

B. Structural Performance: Engineer, fabricate, and install structural precast concrete units to withstand design loading indicated within limits and under conditions required.

C. Engineer Responsibility: Engage a fabricator who assumes undivided responsibility of engineering structural precast concrete units by employing a qualified professional engineer to prepare design calculations, fire-resistance calculations, shop drawings, and other structural data.

1.2 SUBMITTALS

A. Shop drawings shall be submitted for approval, showing identifying marks of each unit, holes (other than plumbing and electrical), anchorage details, design loads, location of all prestressed and layout plan. The manufacturer shall not proceed with manufacture prior to receiving general contractor's and architect's approval of shop drawings. Field verification of dimensions is the responsibility of the general contractor.

1.3 REFERENCES

A. American Concrete Institute (AC1318) Latest Issue.

B. American Society for Testing and Materials (ASTM) Latest Issue.

C. Precast Prestressed Concrete Institute (PCI).

1. MNL - 116-85 PCI Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.
2. MNL - 126-85 Manual for the Design of Hollow - Core Slabs.

1.4 QUALITY ASSURANCE

A. Manufacturer shall be a firm specializing in providing prestressed concrete products and services of types specified herein on the plans; and shall have a minimum of 5 years successful experience in the fabrication of prestressed concrete units of quality and scope required on this project.

B. Furnish precast prestressed units in accordance with Precast Prestressed Concrete Institutes Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.

C. The precast concrete manufacturing plant shall be a member of PCI and participate in its Plant Certification program and be a certified PCI Plant prior to submittal bid.

D. Professional Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation and successful in-service performance of precast concrete units similar to this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code—Steel" and AWS D1.4 "Structural Welding Code—Reinforcing Steel."

1.5 PRODUCT DESIGN

A. Loading for Design

1. Initial handling and erection stresses.
2. All dead and live loads - as specified on the contract drawings.
3. All other loads specified for hollowcore slab units where applicable.

B. General contractor shall furnish sizes and location of all required penetrations for work of other trades.

C. Design calculations of products not completed on the contract drawings shall be performed by a registered engineer experienced in precast prestressed concrete design and submitted for approval upon request.

D. Design shall be in accordance with ACI 318 or applicable codes.

E. Design deviations will be permitted only after the Architect/Engineers approval of the manufacturer's proposed design supported by complete design calculations and drawings. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.

F. Fire resistance of units shall be designed in accordance with Southern Building Code Section 3102.

1.6 TESTING

A. Manufacturer shall make and test concrete compression specimens representative of the work in accordance with PCI MNL-116-85.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland cement type I or II shall conform to ASTM C-150.

B. Aggregates: shall conform to ASTM C-33, C-30 or have shown by special test or actual service to produce concrete of adequate strength and durability.

C. Concrete shall be zero slump. Water shall be potable or free from materials in amounts harmful to concrete embedded steel.

2.2 PRESTRESSING STEEL

A. High tensile three wire, 5/16" diameter stressed relieved strand (250 KSI) tested accordingly to ASTM-416-A-910-92. The wire shall be free of substance which would prevent bond to concrete.

2.3 CONCRETE MIXES

A. 28 day concrete compressive strength minimum of 5000 psi.

B. Strand release concrete strength minimum of 3500 psi.

C. Use of calcium chloride, chloride ions or other salts is not permitted.

2.4 BEARING PADS

A. Plastic: Multimonomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion.

B. Tempered Hardboard: to be used only where not exposed to continual wetting.

PART 3 - EXECUTION

3.1 FABRICATIONS

A. Prestressed concrete slabs shall be machine extruded in one single operation on long production lines on smooth rigid forms in 3'-4' nominal widths.

B. Openings

1. Opening requiring hanger type supplementary steel members shall be by prestressed concrete manufacturer.

2. All other holes or openings shall be cut in field by trade requiring the openings.

3. In no case shall any hole be cut without approval of prestressed concrete manufacturer.

C. Finish: Standard Finish: Normal plant-run finish produced in forms that impact a smooth finish to concrete. Small surface imperfections, normal color variations and from marks, and minor chips and spalls will be tolerated.

D. Patching: Patching will be acceptable providing the structural adequacy of the hollowcore unit is not impaired.

E. Lift and support units only at designated lifting or supporting points as shown on final shop drawings.

F. Deliver anchorage items that are to be embedded in other construction before starting such work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

3.2 TOLERANCES

A. Provide units with tolerance within the limits recommended by the Precast/Prestressed Concrete Institutes "Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products."

3.3 ERECTION

A. Prestressed concrete units shall be erected into final position under the supervision of the manufacturer or erector experienced in installation of the types of units specified herein.

B. Site Access: The General Contractor shall be responsible for providing suitable access to the building, proper drainage, and firm level bearing for the hauling and erection equipment to operate under their own power.

C. Preparation: The General Contractor shall be responsible for:

1. Providing true level bearing surfaces on all field placed bearing walls and other field placed supporting members.

2. All pipes, stacks, conduits and other such items shall be stubbed off at level lower than the bearing plane of the prestressed concrete products until after the latter are set.

D. Alignment: Erection tolerances shall be in conformance with PCI MNL-126-85 except where in specific circumstances the shop drawings show specified deviations.

3.4 GROUTING

A. Prestressed concrete units shall be aligned and leveled prior to grouting keyway joints in accordance with requirements and tolerances of PCI MNL-116. This operation is to be performed prior to units being loaded or ends restrained.

B. Keyways between units shall be cleaned and filled solidly with grout. Grout that may have seeped through to surfaces in areas below shall be removed before hardening.

C. Fine grout shall be mixed in proportion of one part Portland Cement and three parts sand with a 6" slump.

3.5 TOPPING

A. Topping when required, shall be placed by General Contractor with concrete of 3000 psi compressive value, to a minimum thickness of 2" and reinforced with a 6 x 6 10/10 welded wire mesh. General Contractor shall remove deleterious or bond inhibiting substances, and wet surface prior to topping.

END OF SECTION

SECTION 03455 - PRECAST CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all materials, labor and equipment and construct manholes consisting of precast sections as shown on the drawings and as specified herein.

B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be sloped to drain toward the flowing channel. Every effort shall be made by the Contractor to construct watertight structures. Structures that are not watertight or meet the requirements of ASTM C-443 are not acceptable.

C. The forms, dimensions, concrete and construction methods shall be available for inspection by the Engineer in advance of construction. The Engineer shall reserve the right to inspect the facilities of the supplier.

D. Manholes shall have 8" minimum wall thickness and shall conform to ASTM C 478 for structures designed to support vehicle loadings based on AASHTO H20.

E. Flexible gasket connectors for connecting pipes shall meet the requirements of ASTM C-923-89 or latest revision, and are required in all manholes.

F. Lifting devices shall not penetrate the walls of the manholes.

1.2 RELATED WORK NOT INCLUDED

A. Section 02221: Trenching, Bedding and Backfill for Pipe.

1.3 SUBMITTALS

A. Submit to the Engineer, as provided in the General Conditions, shop drawings showing details of construction, reinforcing, joints, openings and all other specified details.

1.4 INSPECTION

A. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection and approval by the Engineer or other representative of the Owner. Such inspection may be made at the place of manufacture, and/or at the site. Wherever possible, the precast sections shall be inspected prior to unloading from the delivery truck and marked by the inspector showing acceptance or rejection. However, discovery at any time of failure to meet requirements of these specifications is cause for rejection.

B. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which are damaged after delivery will be rejected and if already installed, shall be acceptably repaired, if permitted, or removed and replaced entirely at the Contractor's expense, as determined by the Engineer.

C. All sections shall meet the manufacturing tolerance requirements of ASTM C478 or the following casting tolerances, whichever are more severe:

1. Wall Thickness ± 3/8"
2. Inside Diameter ± 3/8"
3. Outside Diameter ± 1/2"
4. Height or Length ± 3/8"

D. Pipe openings shall meet the recommended tolerances of the individual manufactured pipe to manhole connectors; however, the horizontal location shall be within ± 2 degrees of arc of that detailed on shop drawings.

E. At the time of inspection, the sections will be carefully examined for compliance with ASTM C478 latest revision, these specifications and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

F. Imperfections may be repaired subject to the approval of the Engineer after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE SECTIONS

A. General: Except as modified in the specifications, manholes shall meet the requirement of ASTM C478, or most recent revision, Specification for Precast Reinforced Concrete Manhole Sections. Cement shall meet the requirements of ASTM C150-89, or most recent revision, Specification for Portland Cement, Type II. Concrete shall have a compressive strength of 4,000 psi. Minimum wall thickness for manholes shall be 8 inches or 1/12 the inside manhole diameter, whichever is greater. Sections shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Submit shop drawings, consisting of manufacturer's standard details of various sections for approval prior to manufacture. Drawings of individual manholes showing invert elevations, pipe sizes and similar details are required. Manufacturer shall submit concrete mix designs together with certified test results for the Engineer's review prior to commencing manufacture.

B. Joints: Form joint contact surfaces with machined castings. Surfaces shall be parallel and the tongue equipped with a proper recess for the installation of a rubber gasket. Gaskets shall meet the requirements of Specifications for Joint for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (ASTM C-443). In addition to this rubber gasket joint, the installation contractor may, at his own choice, add an exterior seal such as "Waterstop Rx", "Adeka Ultra Seal", "Cadilloc Sealing Bands" or approved equal.

C. Masonry for Grade Adjustment: Precast grade rings or brick shall be used for final grade adjustment. Bricks shall be wetted prior to laying. Bricks shall be set true to line with each course plumb. No mortar shall be used which has begun to set. The grade rings or bricks used on manholes with fiberglass linings shall also be protected in the same way.

D. Masonry

1. Brick: ASTM C32-73 or more recent revision, Specification for Sewer and Manhole Brick (made from clay or shale). Sound, hard and uniformly burned, regular and uniform in shape and size of compact texture. Grade MA.
2. Cement: Portland, ASTM C150-189 or most recent revisions, Specification for Portland Cement, Type II.

E. Sand: Washed silica sand, ASTM C144, latest revision. Specification for Aggregate for Masonry Mortar.

F. Invert Construction

1. Inverts: Form with Type II cement and sand mortar and brick to provide a smooth flowing channel of similar shape and size of the sewer to which it connects.
2. Straight Run Manholes: Shape inverts while manholes are under construction. Cut off pipe at inside faces of manhole and construct invert to exact shape and size of pipe indicated.
3. Junction Manholes: Shape inverts while manholes are under construction. Cut off pipe at inside faces or manhole and construct invert to shape and size of pipe indicated. All inverts shall follow grades of pipes entering manholes. Provide a true curve of the largest radius possible for changes in direction of sewer and entering branch or branches.

G. Manhole Frames and Lids: ASTM A48-74, or most recent revision, Specification for Gray Iron Castings. All casting shall comply with Federal Specification QQ-T-652. Cast in a true symmetrical pattern of tough, dense and even grained iron, free from warping, scales, lumps, blisters, sandholes or any defects of any kind. Provide indented pattern lids with lettering as shown on the drawings. Machine or grind frames and lids at touching surfaces to provide firm seats and prevent rocking. Remove and replace any set not matching perfectly. All frames and covers shall be designed to withstand an HS20-44 wheel loading as defined by AASHTO specifications.

H. Manhole Steps: Manholes shall be furnished with non-corrosive plastic encapsulated No. 4 deformed steel rod steps. Steps shall be spaced at 16" inches on center one over the other. Steps whenever possible shall be positioned over the inlet pipe.

I. The exterior of all precast manholes shall be coated with at least 15 mils dry thickness of PROCO EP-214-351 Epoxi-Mastic as manufactured by Protective Coatings, Inc.

2.2 LATERALS

A. Service Connections: Install types of connections shown on the drawings or as directed by the Engineer. Each connection location shall be accurately recorded by station and offset method and referenced from the center of the downstream manhole. Furnish two copies of this record to the Engineer.

B. Service Assembly: Provide wye branch, six inch curve pipe and clean-out pad as shown on the drawings.

2.3 MANHOLE CONSTRUCTION

A. Precast Concrete Manhole Installation: Set precast concrete sections vertical and in true alignment. Install rubber gasket in the previously set section.

B. The finished manhole shall not be out of plumb by more than 3/8" per 10 feet of height.

C. Any job or offset of wall surface each side of a joint shall not exceed 1/2".

D. Variation in the joint width around the circumference of the manhole shall not exceed 3/8".

E. Grade Adjustment: Construct brick masonry or set precast concrete grade rings on top of manhole slabs and precast concrete manhole cones to provide grade adjustment in setting manhole frames.

F. Setting Manhole Frames: Set manhole frames and lids to conform accurately to the finished ground or pavement as shown or as directed by the Engineer. Set frames on manholes concentric with the masonry and in a full bed or mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Place a ring of mortar around the outside of the bottom flange at least one inch thick and pitched to shed water away from the frame. Extend mortar to the outer edge of the masonry and finished smooth and flush with the top of the flange.

2.4 TESTING

A. After each manhole is constructed to its finished height and before backfilling, each manhole shall be tested for water tightness in one of the following manners:

1. Plug holes and fill the manhole with clean water. After eight hours, the water level shall be checked for loss of water. This loss shall not exceed 0.05 gals/hr/ft.dia/ft. head and for a 4'-0" diameter manhole, the allowable level change is shown in the following table:

Allowable Drop in Water Level
of 4' - 0" Dia. Manholes

Head of Water Feet	Level Drop Inches
4	0.8
5	1.0
6	1.2
7	1.4
8	1.6
10	2.0
12	2.45
16	3.3
20	4.0
24	4.9

2. Plug pipe lines and perform vacuum test. Observing all recommended safety measures induce a backpressure of 5.0 psi equivalent to 10" Hg (mercury). The manhole assembly is considered satisfactory if the vacuum loss is less than 1" Hg for the length of time listed in the following table:

Depth (Feet)	Time of Test in Seconds Manhole Diameter (Feet) 4	5	6
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
T	5	6.5	8

Note: Add "T" seconds for each additional 2'-0" of depth.

3. Failure to pass one of these tests requires the contractor to correct the problems and retest. The Contractor will replace leaking gaskets and/or concrete sections and retest the completed manhole. No manhole will be accepted without successfully passing one of these tests.

2.5 FIBERGLASS LINERS

A. Shall be full length and nominal inside diameters corresponding to the precast concrete manhole. Thickness and reinforcement shall be adequate to resist pressures from 30'-0" depth of water between concrete and linear, handling stresses, vertical and horizontal movement due to temperature changes, drying shrinkage of the concrete and/or uneven settlement of the manhole.

B. The prefabricated FRP manhole liner shall be a non-load bearing component installed and adequately anchored inside a new precast concrete manhole riser during the concrete casting process at the concrete precaster's manufacturing family. The FRP liner must be fully supported during the casting process.

C. Physical properties of the FRP liners shall meet or exceed:

Tensile Strength	9,000 psi	ASTM D638
Flexural Strength	16,000 psi	ASTM D790
Flexural Modulus	700,000 psi	ASTM D790
Thermal Expansion	10 x 10-^{6}in/in/ F	ASTM D696
Water Absorption	0.15% in 24 hours	ASTM D570

D. The FRP liners shall be fabricated from fiberglass reinforced polyester or vinyl ester resins resistant to the chemical environment normally found in the gravity wastewater transmission systems to which they will be exposed.

E. The FRP liner shall have a warranty against defects in material and workmanship for a period of one year.

F. After assembly and installation, in the field, all internal seams are be sealed with material similar to the FRP used on the sections.

G. The fiberglass liner shall be tested for watertightness as specified in Paragraph 2.4.

END OF SECTION

SECTION 03520 – INSULATING CONCRETE ROOF TOPPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes cast-in-place lightweight insulating concrete for roof decks.

B. Related Section: Division 7 Section "SBS-Modified Bituminous Sheet Roofing System" contains requirements that relate to this Section.

1.3 DEFINITIONS

A. Lightweight Insulating Concrete: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft. placed with or without embedded rigid insulation, and classified as follows:

1. Cellular-Type Lightweight Concrete: Low-density concrete made with portland cement, water, and air-producing foaming agents.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified. Include mixing and application instructions for each type of lightweight insulating concrete.

1. Include lightweight insulating concrete design designations of a qualified testing and inspecting agency evidencing compliance with requirements.

C. Shop Drawings including plans, sections, and details showing roof slopes, insulation thicknesses, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

D. Design mixes for each lightweight insulating concrete mix, including as-cast unit weight, oven-dry unit weight, and compressive strength per ASTM C495.

E. Material test reports from a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing of current materials:

1. Cement.
2. Aggregates.
3. Foaming agents.

4. Admixtures.
5. Molded insulation.

F. Material certificates in lieu of agency test reports, when permitted by Engineer, signed by lightweight insulating concrete manufacturer certifying that each material item complies with requirements.

G. Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction that evidence lightweight insulating concrete's compliance with building code in effect for Project.

H. Calculations per building demonstrating average R-valves required per ASTM C177.

I. Warrantee.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed lightweight insulating concrete work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer of primary materials.

B. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1077 and ASTM E 329, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. FM Listing: Provide lightweight insulating concrete evaluated by Factory Mutual as part of a roof assembly and listed in FM Research Corp.'s "Approval Guide" for Class 1 fire rating and Class 1-90 windstorm ratings.

D. Provide lightweight aggregates containing no detectable asbestos as determined by the method specified in EPA's 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

1.6 WARRANTY/GUARANTEE

A. Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the insulation system manufacturer's ten (10) year labor and materials warranty. The insulation system warranty shall include the composite rood deck system consisting of pregenerated foam and polystyrene insulation panels. All repair of replacement costs covered under the guarantee shall be borne by the insulation system manufacturer. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered during the term of the insulation system warranty include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the design thermal resistance, provided that the roofing membrane is free of leaks.

2. The roof insulation will remain in a reroofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane).

3. The Insulating Concrete Warranty will not limit, by geographic location, the owner's rights for claims, actions, and/or proceedings.

4. The roof insulation material will not cause structural damage to the buiiding as a result of expansion from thermal or chemical action.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.8 PROJECT CONDITIONS

A. Do not place lightweight insulating concrete when ambient temperature is at or below 32 deg F.

1. When air temperature has fallen or is expected to fall below 40 deg F, heat water to a maximum 120 deg F before mixing to attain lightweight concrete at point of placement with temperature of 50 deg F minimum and 80 deg F maximum.

B. Do not place lightweight insulating concrete unless ambient temperature is 40 deg F and rising.

C. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cellular Lightweight Concrete:

a. Celcore Inc.
b. Elastizell Corporation of America.
c. Grace: W.R. Grace & Co.; Construction Products Div.

d. Lite-Crete Inc.
e. Mearle Corp. (The); Foam and Chemical Div.

2.2 MATERIALS

A. Portland Cement: ASTM C 150, Type I, Type II, or Type III.

B. Fly Ash: ASTM C 618, Class C or F.

C. Foaming Agent: ASTM C 869.

D. Water: Clean, potable.

E. Air-Entraining Admixture: ASTM C 260.

F. Control Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi.

G. Molded Polystyrene Insulation Board: ASTM C 578, Type 1, 0.90-lb/cu. ft. minimum density.

1. Provide units with keying slots of approximately 3 percent of board gross surface area.

2.3 DESIGN MIXES

A. Prepare design mixes for each type and strength of lightweight insulating concrete by either laboratory trial batch or field test data methods. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the same testing agency for field quality-control testing.
2. Limit use of fly ash to not exceed 25 percent of portland cement by weight.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.4 CELLULAR LIGHTWEIGHT CONCRETE

A. Design mix to produce lightweight insulating concrete with the following minimum physical properties using the minimum amount of water necessary to produce a workable mix.

1. As-Cast Unit Weight: 38 to 48 lb/cu. ft. at point of placement, when tested according to ASTM C 138.
2. Oven-Dry Unit Weight: 30 to 36 lb/cu. ft., when tested according to ASTM C 495.
3. Compressive Strength: Minimum 200 psi, when tested according to ASTM C 495.

B. Place system with molded insulation to have a roof top average of R-10 insulation valve.

PART 3 - EXECUTION

3.1 PREPARATION

A. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of insulating lightweight concrete. Fill joints with glass-fiber control joint filler.

1. Provide 1-inch- wide joints for roof areas with dimensions up to 100 feet in length; 1.5-inch- wide joints for roof area dimensions exceeding 100 feet.

3.2 MIXING AND PLACING

A. Mix and place lightweight insulating concrete according to manufacturer's instructions with a minimum of 2" over any insulating board, using equipment and procedures to avoid segregation of mix and loss of air content.

B. Install insulation according to lightweight insulating concrete manufacturer's recommendations. Place insulation in wet slurry poured a minimum of 1/8 inch above the structural substrate. Ensure full contact of insulation with slurry, stagger joints, and tightly butt insulation boards.

1. Install insulation in a stair-step configuration.

C. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.

D. Finish top surface smooth, free of ridges and depressions, and maintain surface in acceptable condition to receive subsequent roofing application.

E. Begin curing operations immediately after placement, and air cure for not less than 3 days according to manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency, acceptable to Architect, to take samples and conduct tests to evaluate lightweight insulating concrete. Do not use same testing service that provided initial mix designs.

B. Testing Agency: Owner will engage a qualified independent testing agency to take samples and conduct tests to evaluate lightweight insulating concrete.

1. Take samples according to ASTM C 172, except as modified by ASTM C 495.
2. Determine as-cast unit weight during each hour of placement, according to ASTM C 138.
3. Determine compressive strength and oven-dry unit weight according to ASTM C 495. Make a set of at least 6 molds for each day's placement, but not less than 1 set of molds for each 5000 sq. ft. of roof area.

C. Report test results to Engineer and lightweight insulating concrete producer within 24 hours of completion of each test.

D. Additional Tests: Make additional tests when test results indicate as-cast unit weight, compressive strength, oven-dry unit weight, or other requirements have not been met.

1. Retest in-place lightweight insulating concrete according to ASTM C 513 for compressive strength and oven-dry unit weight.

3.4 DEFECTIVE WORK

A. Refinish, or remove and replace, lightweight insulating concrete surfaces that are excessively scaled or too rough to receive roofing, according to current published requirements of roofing manufacturer.

B. Remove and replace lightweight insulating concrete that fails to meet compressive strength and oven-dry unit weight requirements.

END OF SECTION

SECTION 03600 - GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes grouting of equipment bases; tank bottom and such locations as shown on the Drawings and as specified.

B. The types of grouting include the following:

1. Portland Cement Grout
2. Non-shrink, Non-expanding Grout

1.2 DELIVERY AND STORAGE

A. Prevent damage to or contamination of grouting materials during delivery, handling and storage.

B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PREMIXED GROUTS

A. ***Portland Cement Grout.***

B. (For grouting CMU cells and similar items)

1. Portland Cement: ASTM C150, Type I
2. Sand: ASTM C33, Fine Aggregate
3. Water: Portable
4. Pea Gravel: ASTM C33. Coarse aggregate, graded so that at least 90% passes 3/8-inch sieve and 90% is retained by a number 4 sieve.

C. (Grout Mortar for use as fillets and leveling)

1. Portland Cement: ASTM C150, Type I
2. Sand: ASTM C33, Fine Aggregate (Marson's sand)
3. Water: Potable
4. Mix 1-part Portland cement to 3-parts sand.

D. ***Pre-Mixed non-shrink, Non-expanding Grout (Nonmetallic).*** Non-shrink grout as shown on the Drawings shall be a mixture of selected silica sands, Portland cement, water reducing agents, plasticizing and shrinkage compensating agents. Grout shall be nonmetallic non-corrosive, non-staining and comply with CRD-C-588, Type D..

E. The grout shall be non-shrink in accordance with ASTM C827, ASTM C191, and ASTM C109. The water-grout ratio shall be approximately 8 to 10 quarts of water per cubic foot of grout adjustable for varying job conditions.

F. Grout shall not contain calcium chloride or other salt; aluminum or other metals; chemical additives, gypsum or expansive cements. Grout shall not expand after set.

G. Grout shall be used and applied in accordance with the manufacturer's written instructions.

H. Subject to compliance with requirements provide from the following:

1. L&M Construction Chemicals, Inc. - Crystex
2. Grout Corp. - Five Star Non-shrink Grout or equivalent

2.2 NONSHRINK GROUT

A. Non-shrink grout shall conform to the following requirements:

1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.
2. Contain nonmetallic aggregates specially graded to minimize bleeding.
3. Have an initial setting time of approximately one hour at 70°F.
4. Produce no settlement or drying shrinkage at 3-days or later.
5. Have higher strength at all ages than plain cement grout of the same flowability.
6. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.
7. Minimum compressive strength, in accordance with ASTM C-109, shall be 2500 psi after 1 day and 7000 psi after 28 days.

2.3 MIXES

A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of Portland cement, fine aggregate and water.

B. For greater than 2-inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.

C. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

D. Portland cement mortar for raked-out edges of non-shrink grout: one part Portland cement, two parts sand and 0.50 parts water by weight.

2.4 MIXING

A. Mix grout in accordance with manufacturer's printed specifications.

B. Mix grouting materials and water in a mechanical mixer for no less than 3-minutes.

C. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

D. After the grout has been mixed, do not add more water for any reason.

PART - EXECUTION

3.1 PROCEDURES

A. Installation methods and procedures shall be approved by Engineer and shall be in accordance with manufacturer's printed specifications before work is begun.

3.2 SURFACE PREPARATION

A. Surface preparation shall be in accordance with manufacturer's printed specifications.

B. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.

C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with waterproof membrane until ready to grout. Immediately before grouting remove waterproof membranes and clean any contaminated surfaces.

D. Remove foreign materials from metal surfaces in contact with grout. Align, level and maintain final positioning of all components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water and leave none standing.

3.3 PLACING

A. Placing shall be in accordance with manufacturer's printed specifications.

B. Place non-shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping or under gravity pressure.

C. Do not use either pneumatic-pressure or dry packing methods without written permission of the Engineer.

D. Apply grout from one side only to avoid entrapping air.

E. Final installation shall be thoroughly compacted and free from air pockets.

F. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.

G. Do not remove leveling shims for at least 480 hours after grout has been placed. After shims have been removed, fill voids with plain cement-sand grout.

H. After non-shrink grout has reached initial set, rake out exposed edges approximately 1-inch into the grouted area and paint with Portland cement mortar.

3.4 CURING

A. Cure grout for 3-days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION

SECTION 04100 – MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mortar and grout for masonry.

1.2 RELATED SECTIONS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions Division 1 Specification Sections apply to this Section.

B. Section 04330 - Cavity Wall Masonry System: Installation of mortar and grout.

C. Section 08111 - Aluminum Doors and Frames.

D. Section 09900 - Painting and Coatings.

1.3 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures.

B. ACI 530.1 - Specifications For Masonry Structures.

C. ASTM C91 - Masonry Cement.

D. ASTM C94 - Ready-Mixed Concrete.

E. ASTM C144 - Aggregate for Masonry Mortar.

F. ASTM C150 - Portland Cement.

G. ASTM C207 - Hydrated Lime for Masonry Purposes.

H. ASTM C270 - Mortar for Unit Masonry.

I. ASTM C476 - Grout for Masonry.

J. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

K. ASTM C1019 - Method of Sampling and Testing Grout.

L. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

M. IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Samples: Submit two (2) sets of mortar samples for color selection.

C. Product Data: Submit manufacturer's specifications and other data for each type of masonry, mortar and accessory used.

D. Submit results of preconstruction mortar testing in accordance with ASTM C780.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction, ACI 0530-1.

B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

PART 2 - PRODUCTS

2.1 MORTAR

A. Mortar: ASTM C 270, 1 part cement (ASTM C 150 and C 91, Type II) 1/4 part by volume lime (ASTM C 207, not less than 2-1/4 nor more than 3 times the sum of volumes of cement and lime used, (sand) aggregate (ASTM 144); type S (Tuck pointing utilize Type N).

B. Maximum air content: 12%

C. Calcium Chloride additive will not be permitted.

2.2 MORTAR COLOR

A. Mortar Color For Exterior Masonry Veneer: Grey.

B. Mortar Color For Concrete Masonry Units: Grey

2.3 MORTAR MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, re-temper only within two hours of mixing.

E. Use mortar within two hours after mixing at temperatures of 90 degrees F or two-and-one-half hours at temperatures under 50 degrees F.

2.4 GROUT MIXES

A. Bond Beams, Engineering Masonry and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; premixed type in accordance with ASTM C94 with #8 aggregate size.

2.5 GROUT MIXING

A. Mix grout in accordance with ASTM C94.

2.6 WATER

A. Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Request inspection of spaces to be grouted.

3.2 PREPARATION

A. Apply bonding agent to existing surfaces.

B. Plug clean-out holes with masonry units. Brace masonry for wet grout pressure.

3.3 INSTALLATION

A. Install mortar and grout in accordance with manufacturer's instructions.

B. Work grout into masonry cores and cavities to eliminate voids.

C. Do not install grout in lifts greater than 16 inches (two CMU courses) without consolidating grout by rodding.

D. Do not displace reinforcement while placing grout.

E. Remove excess mortar from grout spaces.

F. Tuck point with mortar of the same color.

3.4 FIELD QUALITY CONTROL

A. Test and evaluate mortar in accordance with ASTM C780. Tests shall be performed twice daily on two consecutive batches. One test mid-morning and the second test mid-afternoon.

B. Test and evaluate grout in accordance with ASTM C1019.

END OF SECTION

SECTION 04200 - CONCRETE MASONRY UNIT WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing concrete masonry unit work as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Obtain units from one manufacturer, cured by one process and of uniform texture and color, for each type required, for each continuous area and visually related areas.

1. Wherever concrete units are shown or scheduled to be painted provide fine-textured units.

B. Job Mock-Up. Prior to installation of masonry work, erect sample wall panel mock-up using materials, bond and joint tooling shown or specified for final work. Provide special features as directed for caulking and contiguous work. Build mock-up at the site, where directed, of full thickness and approximately 4-feet x 3-feet, unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed work. Obtain acceptance of the Engineer for visual qualities of the mock-up before start of masonry work. Do not alter, move or destroy mock-up until work is completed.

C. Fire-rated Concrete Unit Masonry. Wherever a fire-resistance classification or rating is shown or schedule for concrete masonry unit construction (four-hour, three-hour and similar designation), obtain unit complying with the requirements established by the American Insurance Association and other governing authorities.

D. Codes and Standards.

E. American Society for Testing and Materials (ASTM):

1.	A82	Cold Drawn Steel Wire for Concrete Reinforcement
2.	A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3.	C33	Concrete Aggregates
4.	C90	Hollow Load-Bearing Concrete Masonry Units
5.	C129	Non-Load Bearing Concrete Masonry Units
6.	C270	Mortar for Unit Masonry
7.	C331	Light-Weight Aggregates for Concrete Masonry Units
8.	C423	Sound Absorption and Sound Absorption Coefficient by the Reverberation Room Method
9.	C744	Prefaced Concrete and Calcium Silicate Masonry Units
10.	E84	Surface Burning Characteristics of Building Materials

F. Standard Building Code, South Florida Building Code, or Local Code, whichever applies.

G. Concrete Masonry Handbook published by the Portland Cement Association.

1.3 SUBMITTALS

A. Submit certified copies of laboratory test reports and other data as may be required to show compliance with the specified requirements.

B. Submit two samples of special shapes or integrally colored concrete masonry units. Select units to show the range of color and texture which can be expected in the finished work. Engineer will review for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.4 JOB CONDITIONS

A. Protect partially completed masonry against weather, when work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2-feet down both sides of wall and anchor securely in place.

B. Protect masonry against freezing when the temperature of the surrounding air is 40/F. and falling. Heat materials and provide temporary protection of completed portions of masonry work. Comply with the requirements of the governing code.

PART 2 - MATERIALS AND EQUIPMENT

2.1 CONCRETE MASONRY UNITS (CMU)

A. Where CMU are shown, comply with the following classifications, weights, grades, curing, and other requirements as indicated:

B. Size. Hollow Load-bearing CMU: ASTM C90, Grade N. Manufacturer's standard units with nominal face dimensions of 16-inches long x 8-inches high (15-5/8-inches x 7-5/8-inches actual), unless otherwise indicated.

C. Exposed Faces. Provide manufacturer's standard color and texture, unless otherwise indicated.

D. Special Shapes. Provide for lintels, corners, control joints, headers, bonding and other special conditions.

E. Weight. Provide normal weight units (CMU) using concrete aggregates complying with ASTM C33 producing dry new weight of not less than 125 lbs. per cu. ft.

F. Curing. Cure units by atmospheric drying for not less than 30-days before installation to comply with ASTM C90, Type II.

2.2 MORTAR MATERIALS

A. Masonry Cement: ASTM C91, Type S, N, or M (when exposed to earth).

B. Portland Cement: ASTM C150 Type I

1. Type III shall be used for cold weather protection. Provide natural color or white cement as required to produce the mortar color to be used.

C. Sand: Aggregate for masonry mortar, ASTM C144.

1. Use sand graded with 100% passing the No. 16 sieve, except for joints less than 1/4-inch.

D. Water: Clean, suitable for drinking and free of harmful amounts of acid, alkali, salts, or organic matter.

E. Do not use calcium chloride in mortar.

2.3 CONCRETE

A. Lintels and filled masonry units shall be filled with pea gravel concrete per Spec 3300.

2.4 MASONRY ACCESSORIES

A. Continuous Wire Reinforcing and Ties for Masonry. Provide welded wire units prefabricated in straight lengths of not less than 10-feet, with matching corner and tee units. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross-rods, and a unit width of 1-1/2-inches less than thickness of wall or partition.

B. Provide units fabricated as follows:

1. Ladder type fabricated with single pair of 9 ga. side rods and 9 ga. perpendicular cross-rods spaced not more than 16-inches o.c.
2. For exterior walls, hot-dip galvanize after fabrication with 0.8 oz. zinc coating, ASTM 153, Class B2.

C. Individual Wire Ties for Masonry. Fabricate from 3/16-inch cold-drawn steel wire, ASTM A82, unless otherwise indicated, of the length required for proper embedment in wythes of masonry shown, and crimped if used in cavity wall construction.

1. For use with hollow masonry units laid with cells vertical, provide rectangular shaped ties.

D. Anchoring Devices for Masonry. Provide straps, bars, bolts and rods fabricated form not less than 16 ga. sheet metal or 3/8-inch diameter rod stock, hot-dipped galvanized to ASTM A123, B-2 finish, unless otherwise indicated.

1. Where masonry is shown or specified to be anchored to structural framework with flexible anchors, provide 2-piece anchors which will permit horizontal and vertical movement of masonry but will provide lateral restraint.

E. Concrete Inserts for Masonry. Unit type shall be furnished in iron or malleable iron of the type and size shown, hot-dip galvanized after fabrication with 1.5 oz. zinc coating, ASTM A153 Class B2.

F. Wide Flanged Premolded Control Joint Strips. Solid rubber strips with a Shore A durometer hardness of 60 to 80, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration as indicated.

G. Plastic Weepholes. Unless otherwise indicated, provide 1/4-inch round x 4-inches long medium density polyethylene plastic tubes to form weepholes. Remove plastic weephole forms after masonry work is complete.

H. Dovetail Slots. Furnish dovetail slots with filler strips, where shown.

I. Installation of Concrete Inserts. See concrete section of these specifications. Advise concrete Installer of specific requirements regarding his placement of inserts which are to be used by the masonry Installer for Anchoring of masonry work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Masonry Installer must examine the areas and conditions under which masonry is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to masonry Installer.

3.2 INSTALLATION

A. Build chases and recesses as shown and as required for the work of other trades. Provide not less than 8-inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.

B. Cut masonry units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.

C. Lay CMU units in full-face shell mortar beds. Fill vertical head joints (end joint between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar; also bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilaster, and where adjacent to cells or cavities to be reinforced or to be filled with concrete.

D. Fill cells of block on both sides of any opening with concrete.

E. Joints. Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not shown, lay walls with 3/8-inch joints. Cut joints flush for masonry walls, which are to be concealed or to be covered by other materials. Tool exposed joints slightly concave. Rake out mortar in preparation for application of caulking or sealants where shown.

1. Do not soak concrete masonry units (CMU).

F. Pattern Bond. Lay exposed masonry in running bond to match existing building - verify, with vertical joint in each course centered on units in courses above and below. Lay concealed masonry with all units in a wythe bonded by lapping not less than 2-inches. Bond and interlock each course of each wythe at corners, unless otherwise shown.

1. Match coursing, bonding, color and texture of new masonry work with existing work, where indicated.

G. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-size units at corners, jambs and wherever possible at other locations.

H. Lay-up walls plumb and true with courses level, accurately spaced and coordinated with other work.

I. Frozen Materials and Work. Do not use frozen materials mixed or coated with ice or frost. For masonry which is specified to be wetted, comply with BIA recommendations. Do not build on frozen work. Remove and replace work damaged by frost or freezing. Do not lower the freezing point of mortar by use of admixtures or anti-freeze agents.

J. Stopping and Resuming Work. Rack back 1/2-masonry unit length in each course, do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if specified to be wetted), and remove loose masonry units and mortar prior to laying fresh masonry.

K. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

L. Horizontal Joint Reinforcing. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8-inch on exterior side of walls and 1/2-inch at other locations. Lap reinforcement a minimum of 6-inches at ends of units. Do not bridge control and expansion joints with reinforcing except at wall openings. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

M. Space continuous horizontal reinforcing as follows:

1. For single-wythe walls, space reinforcing at 16-inches o.c. vertically, unless otherwise shown.
2. For parapets, space reinforcing at 8-inches o.c. vertically, unless otherwise shown.

N. Reinforce masonry openings greater than 1-ft. wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8-inches apart, both immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2-ft. beyond jambs of the opening, bridging control joints where provided.

O. Anchoring Masonry Work. Provide anchoring devices of the type shown and as specified. If not shown or specified, provide standard type for masonry involved.

P. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

1. Provide an open space not less than 1/2-inch width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.
3. Space anchors as shown, but not more than 24-inches o.c. vertically and 36-inches o.c. horizontally.

Q. Provide masonry lintels where shown and wherever openings of more than 1-ft. are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

1. Unless otherwise shown, provide one reinforcing bar for each 4-inches of wall thickness and of a size and number not less than the number of feet of opening width with #4 bar a minimum.

2. For hollow masonry unit walls, use specially formed "U"- shaped lintel units with reinforcing bars placed as shown and filled with concrete grout.

R. Provide minimum bearing at each jamb, of 8-inches minimum.

S. Built-In Work. As the work progresses, built-in items specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar.
2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar.

T. Where intersecting load-bearing walls are carried up separately, block vertical joint with 8-inches maximum offsets and provide a rigid steel anchors spaced not more than 4-ft. o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2-ft. o.c. vertically. Form anchors of galvanized steel not less than 1-1/2-inches x 1/4-inch x 2-ft. long-with ends turned up not less than 2-inches or with cross-pins. If used with hollow masonry units, embed ends in mortar-filled cores.

U. Nonbearing interior partition walls shall be built-full height of story to underside of structure above, unless otherwise shown.

V. Mortar Bedding and Jointing. Mortar Mixes: ASTM C270, Proportion Specifications, and of the following types:

1. Type S for exterior work.
2. Type N for interior work.
3. Type M for exposure to earth.

W. Mix mortar ingredients for a minimum of five minutes in a mechanical batch mixer. Use water clear and free of deleterious materials which would impair the work. Do not use mortar which has begun to set, or if more than 2-1/2 hours has elapsed since initial mixing. Retemper mortar during 2-1/2 hour period as required to restore workability.

X. Filled Masonry Units. Where indicated field masonry units to be filled with concrete per section 2.3.

3.3 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, of if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared

C. for application of caulking or sealant compounds.

D. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

END OF SECTION

SECTION 04330 – CAVITY WALL MASONRY SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry face veneer.

B. Concrete masonry backup wythe.

C. Single wythe concrete masonry walls.

D. Reinforcement, anchorage, and accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 05500 - Metal Fabrications: Placement of loose steel lintels.

1.3 RELATED SECTIONS

A. Section 04100 - Mortar and Masonry Grout: Mortar and grout.

B. Section 05500 - Metal Fabrications: Loose steel lintels, fabricated steel items, and anchor bolts

C. Section 07212 - Board Insulation: Insulation for interior walls.

D. Section 07600 - Flashing and Sheet Metal: Cap flashings over masonry work and placement of reglets for flashings.

E. Section 07900 - Joint Sealants: Rod and sealant at control and expansion joints.

F. Section 08111 - Aluminum Doors and Frames: Coordination of Placement of Hollow Metal Frames.

1.4 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures.

B. ACI 530.1 - Specifications For Masonry Structures.

C. ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.

D. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate.

F. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

G. ASTM A580 - Stainless and Heat-Resisting Steel Wire.

H. ASTM A641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

I. ASTM B370 - Copper Sheet and Strip for Building Construction.

J. ASTM C55 - Concrete Building Brick.

K. ASTM C90 - Load Bearing Concrete Masonry Units.

L. ASTM C129 - Non-Load Bearing Concrete Masonry Units.

M. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

N. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot Weather Masonry Construction.

1.5 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Samples: Submit four samples of exposed CMU units to illustrate color, texture and extremes of color range. Submit manufacturers literature on all reinforcing items.

C. Product literature: Submit test reports on hollow masonry units illustrating conformance to referenced ASTM Standards.

D. Construct a 4' x 6' section of cavity wall for the Owner to approve installation of block brick and mortar. Rebuild entire wall until acceptance. Wall to remain until the job is complete. Contractor to remove the wall only when directed to do so by the Owner's representative.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

B. Obtain Masonry units from a single manufacturer for each type required.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable requirements for fire rated masonry construction where indicated on the drawings

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Accept pre-faced units on site. Inspect for damage.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

B. Hot Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

1.11 COORDINATION

A. Coordinate the masonry work with installation of louver anchors, and installation of door frames

1.12 DELIVERY, STORAGE AND HANDLING OF MASONRY

A. Deliver all units on tight pallets. Broken pallets will be rejected.

B. Confirm color of material conforms to sample wall.

C. Do not install broken units.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Backup & Interior Hollow Load Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight. Grade N

B. Backup & Interior Solid Load-Bearing Block Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight. Grade N

C. Exterior Veneer and Finish Block Units (CMU): ASTM C90, Type I - Moisture Controlled; normal weight. Grade N

D. Concrete Brick Units: ASTM C55, of same Grade, Type 1 Grade N.

E. Size and Shape: Nominal modular size of 8 x 8 x 16 inches. Provide special units for 90 degree outside corners, bond beams, lintels, jambs, and other special shapes called for on the drawings.

2.2 REINFORCEMENT AND ANCHORAGE

A. Manufacturers

1. Dur-O-Wall Inc.
2. Heckman Building Products Inc.
3. Hohmann & Barnard Inc.

B. Multiple Wythe Joint Reinforcement: Ladder type; without moisture drip; steel wire, hot dip galvanized to ASTM A641 Class B-2 after fabrication, cold drawn steel wire conforming to ASTM A82, 9 gauge side rods with 9 gauge cross ties.

C. Single Wythe Joint Reinforcement: Truss type; without moisture drip; steel wire, hot dip galvanized to ASTM A641 Class B-2 after fabrication, cold drawn steel wire conforming to ASTM A82, 9 gage side rods with 9 gage cross ties.

D. Reinforcing Steel: ASTM A615, 60 ksi yield grade, deformed billet bars, uncoated finish.

E. Veneer to concrete tie assembly equal to Dur-O-Wall 5213330.

F. For all assemblies which extend into exterior wythe, fabricate from steel with hot-dip galvanized coating, ASTM A 123 Class B1, B2, or B3.

G. Veneer to steel tie assembly shall be equal to Dur-O-Wall D/A 207 hot dip galvanized, with Dur-O-Wall D/A 807 fasteners and 5x5 triangular tie.

2.3 FLASHINGS

A. Through-Wall Flashings for Masonry: 1/3 mil metal foil encapsulated between layers of polyester film, bonded to a 20 x 10 fiberglass reinforcement with a total average thickness of 7 mils. Provide polyester tape as recommended by flashing manufacturer.

2.4 ACCESSORIES

A. Joint Sealer: As specified in 07900.

B. Weeps: Open head joints with PVC sleeve inserts. 32" o.c. above all lintels and solid surfaces or as noted on the drawings.

C. Air Space Drainage System: 1¼" Cavclear Masonry Mat by Cavclear/ Archovations Inc. or approved equal.

D. When called for on the drawings Interior cavity waterproofing for outside face of inner wythe shall be equal to Sonneborn Hydrocide 128 spray Mastic.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running or as noted on the drawings.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Interior Mortar Joints: Concave.
4. Exterior Motor Joints: Raked beneath "stucco" finish Concave elsewhere.

3.4 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

D. Remove excess mortar as Work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where resilient or ceramic base is scheduled.

I. Isolate masonry partitions from vertical structural framing members with a control joint.

3.5 WEEPS

A. Install weeps in veneer at 32 inches o.c. horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

3.6 CAVITY WALL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weeps.

B. Build inner wythe ahead of outer wythe to receive cavity insulation air/vapor barrier adhesive.

C. Install interior cavity waterproofing with minimum 1/16" WFT in compliance with manufacturer's recommendations.

D. After full drying on waterproofing install cavity clear system and outer Wythe.

3.7 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches o.c.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce joint corners and intersections with strap anchors 16 inches o.c..

3.8 MASONRY FLASHINGS

A. Extend flashings horizontally at foundation walls, above ledge or shelf angles and lintels, and at bottom of walls.

B. Turn flashing up minimum 8 inches and bed into mortar joint of masonry.

C. Lap end joints minimum 6 inches and seal watertight.

D. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.9 LINTELS

A. Install loose steel lintels over openings as scheduled.

B. Install reinforced unit masonry lintels over openings where scheduled.

C. Do not splice reinforcing bars.

D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

E. Place and consolidate grout fill without displacing reinforcing.

F. Maintain minimum 8 inch bearing on each side of opening.

3.10 GROUTED COMPONENTS

A. Reinforce bond beam with two (2) No. 5 bars minimum or as noted on the drawings with bars placed 1 inch from bottom web.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. Provide one No. 5 bar and fill masonry cores with grout for a minimum 8 inches above and below each side of opening unless shown otherwise on the drawings.

F. Provide additional reinforcing as shown on the drawings.

3.11 CONTROL JOINTS

A. Do not continue horizontal joint reinforcement through control joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joint in accordance with Section 07900 for sealant performance.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.

B. Install built-in items plumb and level.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

D. Do not build in organic materials subject to deterioration.

3.13 TOLERANCES (non cumulative)

A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch .

B. Maximum Variation From Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation From Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation From Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

F. Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 CLEANING

A. While laying the brick, good workmanship and job housekeeping practices shall be used so as to minimize the need for cleaning the brick. Protect the base of the wall from mud splashes and mortar droppings, protect the wall by setting scaffolds so that mortar is not deflected on to the wall, and at the end of each day, set the scaffolding boards so that they do not deflect rainfall onto newly laid masonry.

1. The bricklaying technique shall be such that mortar does not run down the face of the all, or smear the mortar onto the brick face.

2. After the joints are tooled, cut off mortar tailings with the trowel, and brush excess mortar burrs and dust from the face of brick. Do not bag or sack the wall, but use a bricklayer's brush made with medium soft hair.

B. Remove all large mortar particles with a hardwood scraper.

C. If after using the above outlined techniques, additional cleaning of the walls is found necessary, allow the walls to cure one month prior to initiating further cleaning processes.

D. Saturate the wall with clean water. The wall shall be thoroughly saturated prior to and at the time of cleaning solution is applied.

E. Clean the wall only with an approved cleaning solution applied with a brush, starting at the top of the wall. The use of any cleaning agents shall first be approved in writing by the manufacturer of the brick being cleaned, and the Designer. The concentration, method of application of the cleaning solution, and method of scraping shall be as outlined on the container by the manufacturer.

F. High pressure water and sandblasting shall not be used for cleaning except with the recommendation of the brick manufacturer, and the written approval of the Designer.

G. Immediately after cleaning a small area, the wall shall be rinsed thoroughly with quantities of water.

H. Protect adjacent surfaces and materials during brick cleaning operations.

I. After the walls are cleaned, take necessary precautions to ensure the other contractors and subcontractors do not damage or soil the walls. Mud protection around the base of walls shall be left in place until the final grading work is done.

J. Use non-metallic tools in cleaning operation.

3.16 PROTECTION OF FINISHED WORK

A. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION 04330

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing structural steel work as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Codes and Standards. Comply with the provisions of the following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges"
2. AISC "Specification for Structural Steel Buildings", including the "Commentary" and Supplements thereto issued.
3. AISC "Specification for Structural Joints using ASTM A 325 or 490 Bolts" approved by the Research Council on Structural Connections of the Engineering Foundation.
4. AWS D1.1 "Structural Welding Code".

B. Qualifications for Welding Work. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

C. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.

D. If recertification of welders is required, retesting will be the Contractor's responsibility.

E. Design of Members and Connections. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.

F. Promptly notify the Engineer whenever design of members and connections for any portion of the structure are not clearly indicated.

1.3 SUBMITTALS

A. Manufacturer's Data. Submit two copies of producer's or manufacturer's specifications and installation instructions for the following products, including laboratory tests, reports and other data as may be required to show compliance with these specifications (including specified standards). Indicate by transmittal that a copy of each applicable instruction has been distributed to Fabricators, Installers, and Erectors:

1. Structural steel (each type), including certified copies of all mill reports covering the chemical and physical properties.
2. High-strength bolts.

3. Structural steel primer paint.
4. Shrinkage-resistant grout.

B. Shop Drawings. Submit shop drawings in accordance with Section 01340.

C. Engineer's review of shop drawings will be general consideration only. Compliance with requirements for materials, fabrication, and erection of structural steel is the Contractor's responsibility.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and impact damage.

D. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replacement of damaged materials or structures shall be at the Contractor's expense.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. ***Steel.***

1. Rolled Steel Plates, Shapes, and Bars: ASTM A 36.
2. Cold-Formed Steel Tubing: ASTM A 500, Grade B.
3. Hot-Formed Steel Tubing: ASTM A 501.
4. Steel Pipe: ASTM A 53, Type E or S, grade B. Pipe weights to be as shown on the Drawings.
5. Steel Castings: ASTM A 711.
6. Unfinished Bolts, Nuts and Washers: ASTM A 307, Grade A.
7. High-strength Bolts, Nuts and Washers: ASTM A 325 or A 490, Type I.

B. ***Electrodes for Welding.*** Comply with AWS Code.

C. ***Paint.*** Refer to Section 09900 - Painting and Coatings, System B-1.

D. ***Grout.*** Cement Grout: Portland cement and clean sand, mixed at a ratio of 1.0 part cement to 3.0 parts sand, by volume with only the minimum amount of water required for placement and hydration.

E. ***Metallic Nonshrink Grout.*** Corps of Engineers CRD-C588, Type M, pre-mixed factory-packaged ferrous aggregate grouting compound.

F. Subject to compliance with requirements, provide metallic nonshrink grout from the following:

1. Embeco; Master Builders
2. Ferrolith G; Sonneborn
3. Irontox; Toch Brothers
4. Kemox C; Sika Chemical
5. Ferrougrout; L & M Construction Chemicals, Inc.

G. ***Nonmetallic, Nonshrink Grout.*** Pre-mixed, nonmetallic, noncorrosive nonstaining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C588.

H. Subject to compliance with requirements, provide nonmetallic nonshrink grout from the following:

1. Masterflow; Master Builders
2. Five Star Grout; U.S. Grout Corp.
3. Upcon; Upco Chem. Div., USM Corp.
4. Crystex; L & M Construction Chemicals, Inc.

2.2 FABRICATION

A. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the final shop drawings. Properly mark and match-mark all materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling.

B. ***Connections.*** Combinations of bolts and welds in the same connections are not permitted, unless otherwise detailed.

C. Weld or bolt shop connections, unless otherwise shown.

D. Bolt field connections, except where welded connections or other connections are indicated.

E. Provide high-strength bolts and nuts where shown.

F. ***Welded Construction.*** Comply with AWS Code for procedures, appearance and quality of welds, and for methods used in correcting welding work.

G. Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug weld steel bar stops to frames, except where shown removable. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10-inches o.c., unless otherwise shown.

H. ***Holes for Other Work.*** Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing

members as indicated. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.

I. Cut, drill, or punch holes perpendicular to metal surfaces.

J. Do not flame cut holes or enlarge holes by burning.

K. Drill holes in bearing plates.

L. ***Surface Preparation.*** After inspection and before shipping, clean steelwork to be painted complying with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning", or SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning". Remove oil, grease and similar contaminates, complying with SSPC SP-1 "Solvent Cleaning".

M. ***Shop Painting.*** Shop paint all structural steel work, except members or portions of members to be embedded in concrete or mortar.

N. Paint embedded steel on exposed portions and initial 2-inches of embedded areas only.

O. Do not paint contact surfaces which are to be welded or high-strength bolted.

P. Apply two coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

Q. ***Application.*** Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness of 2.0 mils. Use painting methods which will result in full coverage of joints, corners, edges and all exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erector must examine the areas and conditions under which structural steel work is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

A. Comply with the AISC Specifications and Code of Standard Practice, and these specifications. Maintain work in a safe and stable condition during erection.

B. ***Temporary Shoring and Bracing.*** Provide as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.

C. Provide temporary planking and working platforms as necessary to effectively complete the work.

D. ***Anchor Bolts.*** Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

E. Furnish templates and other devices as necessary to accurately locate present bolts and other anchors.

F. Refer to Division 4 sections for anchor installations in masonry.

G. ***Setting Base Plates.*** Clean concrete and masonry bearing surfaces and roughen to improve bond. Clean the bottom surface of base plates. Set loose and attached base plates for structural members on wedges, or other adjusting devices.

H. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base plate prior to packing with grout.

I. Pack grout solidly between bearing surfaces and bases of plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

J. ***Field Assembly.*** Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

K. Splice members only where indicated.

L. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members.

M. Ream holes that must be enlarged to admit bolts.

N. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the Engineer.

O. Finish gas-cut sections equal to a sheared appearance when permitted.

P. ***Touch-up Painting.*** Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

Q. ***Independent Structural Steel Inspection.*** Structural steel shall be checked for alignment and plumbness to assure conformance with the AISC Codes. Bolted connection's torque shall be checked to assure conformance to the AISC codes. Field welds shall be checked. The checking shall be done by an independent structural steel inspector selected and paid for by the Owner. Structural steel elements found to be in non-compliance by the independent structural steel inspector shall be brought up to compliance by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing steel joists as shown on Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Provide joists fabricated in compliance with the following:

1. SJI "Standard Specifications, Load Tables and Weight Tables"
2. K-Series Open Web Steel Joists

B. Qualification of Field Welding. Quality welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

C. Joists welded in place are subject to inspection and testing by an independent structural steel inspector. Expense of removing and replacing any portion of steel joists for testing purposes will be born by Owner if welds are found to be satisfactory. Removal and replacement of work found to be defective and to provide new acceptable work shall be at the Contractor's expense.

1.3 SUBMITTALS

A. Product Data. Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications".

B. Shop Drawings. Submit detailed drawings on sepia reproducibles showing layout of joist units, special connections, jointing and accessories. Include mark, number, type, location and spacing of joists and bridging.

C. Provide templates or location drawings for installation of anchor bolts.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle steel joists as recommended in SJI "Specification". Handle and store joists in a manner to avoid deforming members and to avoid stresses. Joists shall not be stored in contact with the ground.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. Steel. Comply with SJI "Specifications".

B. Steel Prime Paint. Comply with SJI "Specifications", except asphalt type paint not permitted.

C. Bedding Mortar. For joist ends bearing on concrete or masonry, provide bedding mortar as follows:

1. Portland cement and sand, mixed at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with enough water for placement and hydration.
2. Metallic shrinkage-resistant mortar complying with Corps of Engineers CRD-C588- Type M.
3. Subject to compliance with requirements, provide from the following:

    a) Embeco 153; Master Builders
    b) Ferrolith-G; Sonneborn Contech.
    c) Irontox; Toch Brothers.
    d) Kemox C; Sika Chemical
    e) Vibra-Foil; W.R. Grace

4. Non-metallic shrinkage-resistant mortar, premixed, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C588, Type A.
5. Subject to compliance with requirements for non-metallic, non-shrink mortar provide from the following:

    a) Euco N.S.; Euclid Chemical Co.
    b) Crystex; L&M Construction Chemicals
    c) Masterflow 713; Master Builders
    d) Five Star Grout; U.S. Grout Corp.
    e) Upcon; Upco Chem. Div., USM Corp.
    f) Propak; Protex Industries, Inc.

2.2 FABRICATION

A. Fabricate steel joists in accordance with SJI "Specification".

B. Holes in Chord Members. Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

C. Extended Ends. Provide extended ends on joists where shown, complying with manufacturer's standard requirements of applicable SJI "Specifications" and load tables.

D. Bridging. Provide horizontal or diagonal type bridging for "open web" joists, complying with SJI "Specifications".

E. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

F. End Anchorage. Provide end anchorages to secure joists to adjacent construction, complying with SJI "Specifications", unless otherwise indicated.

G. Header Units. Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

H. Shop Painting. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.

I. Apply one coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than one mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erector must examine areas and conditions under which steel joists are to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Erector.

3.2 ERECTION

A. Place and secure steel joists in accordance with SJI "Specifications", final shop drawings, and as herein specified.

B. ***Anchors.*** Furnish anchor bolts and other devices to be built into concrete and masonry construction. Furnish templates for accurate location of anchors in other work.

C. Refer to Division 3 sections for installation of anchors set in concrete.

D. ***Placing Joists.*** Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

E. Provide and install temporary bridging, connections, and anchors to ensure lateral stability during construction.

F. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.

G. ***Bridging.*** Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

H. ***Fastening Joists.*** Field weld joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.

I. Secure joists resting on masonry or concrete bearing surfaces by bedding in mortar and anchoring to masonry or concrete construction as specified in SJI "Specifications" for type of steel joist used.

J. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.

K. Provide unfinished threaded fasteners for bolted connections except where high-strength bolts or welded connections are shown.

L. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in accordance with AISC "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts".

M. ***Touch-Up Painting.*** After joist installation, paint field bolt heads and nuts, and welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

N. ***Independent Structural Steel Inspection.*** Steel joists shall be checked for alignment and plumbness, spacing, field welds and bridging to assure conformance to the AISC codes. The checking shall be done by an independent structural steel inspector selected and paid for by the Owner. Steel joists found to be in non-compliance by the independent structural steel inspector shall be brought up to compliance by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 05300 - METAL DECKING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing metal decking as shown on the Drawings, and as specified.

1.2 QUALITY ASSURANCE

A. Codes and Standards. Comply with provisions of the following codes and standards, except as otherwise shown or specified:

1. AISC "Specification for the Design of Cold-Formed Steel Structural Members".
2. AWS "Structural Welding Code".
3. SDI "Design Manual for Floor Decks and Roof Decks".

B. Qualification of Field Welding. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Contractor shall remove work found to be defective and replace with new acceptable work at his expense.

1.3 PERFORMANCE REQUIREMENTS

A. Uplift Loading. Install and anchor roof deck units to resist gross uplift loading of 45 lbs. per square foot of eave overhang and 30 lbs. per square foot for other roof areas.

B. Underwriters' Label. Provide metal floor deck units listed in Underwriter's Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1.4 SUBMITTALS

A. Submit Certificate of Compliance with specified requirements. Obtain drawings for installation showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. After verifying details and dimensions provide three sets of final drawings and installation instruction to Engineer for use in observing installation and for record purposes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. Steel for Painted Metal Deck Units: ASTM A 611, Grade C.

B. Steel for Galvanized Metal Deck Units: ASTM A 446, Grade A.

C. Miscellaneous Steel Shapes: ASTM A 36.

D. Galvanizing: ASTM A 525, G60.

E. Galvanizing Repair Paint. High zinc-dust content paint for repair of damaged galvanized surfaces complying with SSPC - Paint 20 or Military Specifications MIL-P-21035 (Ships) with dry film containing a minimum of 94% zinc dust by weight.

F. Paint. Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.

G. Flexible Closure Strips. Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

2.2 FABRICATION

A. Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2-inch laps at ends interlocking or nested side laps, unless otherwise indicated.

B. Roof Deck Units. Provide deck configurations complying with SDI "Roof Deck Specifications", of metal thickness, depth and width required for loading shown.

C. Metal Closure Strips. Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of not less than 0.045-inch minimum (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

D. Roof Sump Pans. Fabricate from single piece of 0.071-inch minimum (14 gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3-inches wide. Recess pans not less than 1-1/2-inch below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.

E. Cant Strips. Fabricate cant strips of 0.028-inch minimum (22 gage) galvanized sheet steel. Bend to form a 45/ cant not less than 5-inches wide, with top and bottom flanges not less than 2-inches wide, unless otherwise shown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION

A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

E. Do not place deck units on concrete supporting structure until concrete has cured and is dry.

F. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

G. Do not use floor deck units for storage or working platforms until permanently secured.

H. Tack weld or use machine screws at 4-foot o.c. for fastening end closures.

I. Fasten roof deck units to steel supporting members by not less than 1/2-inch diameter plug welds or elongated welds of equal strength, spaced not more than 12-inches o.c. at supports, and at closer spacing where required for lateral force resistance. Use welding washers.

J. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

K. Lock side laps of adjacent deck units between supports, at intervals not exceeding 36-inches o.c.

L. Cutting and Fitting. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

M. Reinforcement at Openings. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

N. Hanger Slots or Clips. Provide UL approved punched hanger slots between cells or flutes of lower element where deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
2. Locate slots or clips at not more than 14-inches o.c. in both directions, not over 9-inches from walls at ends, and not more than 12-inches from walls at sides, unless otherwise shown.

O. Provide manufacturer's standard hanger attachment devices.

P. Roof Sump Pans. Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12-inches o.c. with at least one weld at each corner. Cut opening in roof sump bottom to accommodate drain size indicated.

Q. Cant Strips. Weld to top surface of roof decking, and secure to wood nailers with galvanized nails, and to steel framing with welds or galvanized self-tapping screws. Space fasteners or welds at 12-inches o.c. Lap end joints not less than 3-inches and secure with galvanized sheet metal screws.

R. Closure Strips. Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.

S. Touch-Up Painting. Cleaning and touch-up painting of field welds, abraded areas and rust spots, as required after erection and before proceeding with field painting, is included in Division 9 under Painting.

T. Independent Structural Steel Inspection. When an inspection is called for in Section 05120 - Structural Steel, it shall apply to this Section also.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes miscellaneous metal fabrication work as shown on the Drawings and provides for items fabricated from aluminum, iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of the structural steel or other metal systems in other sections of these specifications.

B. The types of miscellaneous metal items may include, but are not limited to the following:

1. Rough hardware and fasteners
2. Concrete Inserts
3. Anchors
4. Aluminum Stairs
5. Loose bearing plates
6. Miscellaneous framing and supports
7. Stop Plates

1.2 QUALITY ASSURANCE

A. Codes and Standards. Comply with the provisions of the following codes, standards and specifications, except as otherwise shown and specified:

1. AISC "Specification for the Design of Cold-Formed Steel Structural Members".
2. Aluminum Association, Inc. "Specifications for Aluminum Structures."
3. AWS "Structural Welding Code".

B. Qualification for Welding Work. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Field Measurement. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

D. Shop Assembly. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations.

E. Clearly mark units for reassembly and coordinate installation.

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide final drawings and installation instructions (include setting drawings and templates for location and installation of items and anchorage devices) to Engineer for use in observing installation and for Record purposes.

B. Samples. Submit two sets of representative samples of materials and finished products as may be requested by the Engineer, who will review for color, texture, style, and finish only. All other requirements for the work at the Contractor's responsibility.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. Plates, Shapes and Bars.

1. Steel Plates (to be bent or cold-formed): ASTM A283, Grade C.
2. Cold-Finished Steel Bars: ASTM A108, grade as selected by the fabricator.
3. Cold-Rolled Carbon Steel Sheets: ASTM A366.
4. Galvanized Carbon Steel Sheets: ASTM A526, with ASTM A525, G90 zinc coating.
5. Steel Tubing (hot formed, welded or seamless): ASTM A501.
6. Steel Pipe: ASTM A53, Grade A, Type as selected, black finish unless galvanizing is required.
7. Gray Iron Casting: ASTM A48, Class 30.
8. Mallable Iron Castings: ASTM A47, grade as selected.
9. Aluminum Plates and Sheets: ASTM B209; 6061-T6, T651 alloy.
10. Aluminum Extruded Shapes: ASTM B221; 6061-T6, T6510 alloy.
11. Lead Caulking: ASTM B29 "Pig Lead".

B. Metal Surfaces. For the fabrication of metal items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coatings.

C. Metal Primer Paint. Primer paint selected must be compatible with the required finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9 of these Specifications.

D. Galvanizing Repair Paint. High zinc dust content paint for regalvanizing welds in galvanized steel, complying with Military Specifications MIL-P-21035 (Ships).

2.2 FABRICATED METAL ITEMS

A. Rough Hardware and Fasteners. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting work, and for anchoring or securing work to concrete or other structures.

B. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere furnish steel washers.

C. Fasteners.

1. Provide Series 300 stainless steel fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.

2. Expansion Anchor Bolts:

a) Stud: ASTM A278, Type 316 stainless steel.
b) Wedge: AISI 316 stainless steel.
c) Nut: ASTM F594, Type 316 stainless steel.
d) Washer: AISI 316 stainless steel.

3. Length identification marked on impact section of bolt.

D. Metal Strap Anchors. 16 gage x 1-3/4-inch wide steel; used for joists, rafters or trusses; length shown, or if not shown, as required for the condition used.

E. Metal Hurricane Anchors. Fabricated from 18 gage zinc coated steel; provide with 11 gage 1-3/4-inch long nails or 8d common nails. Locate and use at each end of roof joist, rafter or truss.

F. Loose Bearing and Leveling Plates. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts. Galvanize after fabrication.

G. Miscellaneous Framing and Supports. Provide miscellaneous framing and supports which are not a part of the structural steel framework and are required to complete the work.

H. Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates, doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

I. Cut, drill and tap units to receive hardware and similar items to be anchored to the work.

J. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is place. (See concrete section for installation of inserts).

1. Except as otherwise shown, space anchors, 2-feet-0-inches o.c. and provide units the equivalent of 1-1/4-inch x 1/4-inch x 8-inch steel strips.
2. Galvanize miscellaneous frames and supports unless noted otherwise.

K. Stop Plates. Fabricate stop plates of aluminum to the dimensions and configuration shown on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must examine the areas and conditions under which miscellaneous metal items are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

A. Workmanship. Use materials of the size and thickness shown, or if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of material shown or specified for various components of work.

B. Cutting, Fitting and Placement. Perform cutting, drilling and fitting required for installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to radius of approximately 1/32-inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

E. Weld corners and seams continuously and in accordance with the recommendations of AWS. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

F. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flat-head (countersunk) screws or bolts.

G. Provide for anchorage of the type shown, coordinated with the supporting structure. Fabricate and space anchoring devices to provide adequate support for the intended use of the work.

H. Cut, reinforce, drill and tap miscellaneous metal work indicated to receive finish hardware and similar items of work.

I. Field Welding. Comply with AWS code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

J. Galvanizing. Provide a zinc coating for those items shown on the Drawings or specified to be galvanized, using the hot-dip process after fabrication.

1. ASTM A153 for galvanizing of iron and steel hardware.
2. ASTM A123 for galvanizing for rolled, pressed and forged steel, shapes, plates, bars and strip 1/8-inch thick and heavier.
3. ASTM A386 for galvanizing of assembled steel products.

K. Dissimilar Materials. Where dissimilar metals contact each other or there is a condition such as aluminum against concrete, they shall be protected from each other with a pressure sensitive tape, bitumastic coating or other protective method.

L. Shop Painting. Shop paint metal fabrications (except those members or portions of members to be embedded in concrete or masonry), surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated.

M. Touch-Up Painting. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint, and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION

SECTION 05520 - HANDRAILS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes providing handrails as shown on the Drawings and includes miscellaneous handrails not included in other metal systems in other sections of these Specifications.

B. Height for stair rails and handrails shall conform to the applicable codes.

1.2 QUALITY OF ASSURANCE

A. Codes and Standards.

1. Standard Building Code
2. ANSI A117.1
3. OSHA Part 1920.23 and 1910.24
4. Life Safety Code 101
5. AWS "Structural Welding Code"

B. Qualification for Welding Work. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Field Measurements. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job process; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

D. Shop Assembly. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide three sets of final drawings and installation instructions to Engineer for use in observing installation and for Record Drawings.

PART 2 - MATERIALS AND EQUIPMENT

3.1 MATERIALS

A. Aluminum Extrusions. ASTM B221-76; alloy 6061-T6, T6510; except alloy 6061-T6 for pipe; unless otherwise indicated.

B. Aluminum Castings. ASTM B108-76; alloy 214 unless otherwise indicated.

C. Aluminum Sheet or Plate. ASTM B209-76; alloy 6061-T6, unless otherwise indicated.

D. Finish. Clear anodized finish AA C22A41R1X, medium matte, nondirectional, minimum 0.7 mil clear anodized, clear lacquer coating, unless otherwise indicated.

E. Nonshrink, Nonferrous Grout. CE CRD C588.

3.2 FABRICATION

A. The Contractor shall provide a "manufacturer's system" using welded connections.

1. Exposed work shall be formed true to line and level with accurate angles and surfaces and straight sharp edges.
2. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown.
3. Use bent-metal corners formed to the smallest radius possible without causing grain separation or otherwise impairing the work.

B. Nonwelded Connections. Intermediate post-to-rail connections may be made using internal pipe sleeve locks and Allen screw fasteners. Locking devices which do not produce flush, smooth, rigid, hairline joints will not be acceptable. Weld other connections.

C. Form exposed connections with flush, smooth, hairline joints, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flathead (countersunk) screws or bolts.

D. Provide anchorage of the type shown, coordinated with the supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support.

E. Toe Boards. Fabricate toe boards to the dimensions and details shown. If not shown, use 1/4-inch thick x 4-inch plate secured to each post of railing.

F. Brackets, Flanges and Anchors. Provide brackets, flanges, and anchors for railing posts and for handrail supports. Furnish inserts and sleeves as required for anchorage masonry work.

1. Furnish cast metal brackets, flanges, and exposed anchors of the same material and finish as rail supports, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which handrails are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

A. ***Fastening to In-Place Construction***. Provide anchorage devices and fasteners where necessary for securing handrail items to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.

B. Use railing manufacturer's standard methods of installation when acceptable to the Engineer.

C. ***Cutting, Fitting and Placement***. Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

D. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surface of units which have been coated or finished after fabrication, and are intended for field connections. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 6-feet on centers, unless otherwise shown. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts in concrete by means of pipe sleeves set and anchored into the concrete. Provide sleeves of galvanized, steel pipe, not less than 6-inches long and having an inside diameter not less than 1/2-inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve and of width and length not less than 1-inch greater than the outside diameter of the sleeve. After the posts have been inserted into the sleeves, fill the annular space between post and sleeve solid with nonshrink, nonferrous grout. Cover anchorage joint with a round metal flange finished to match post.

2. Anchor rail ends into concrete and masonry with round flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

E. Field Welding. Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting the work.

F. Dissimilar Materials. Where dissimilar metals contact each other or there is a condition such as aluminum against concrete, they shall be protected from each other with a pressure sensitive tape, bitumastic coating or other protective method.

G. Toe Boards. Provide toe boards where shown and as required by code.

H. Toe boards shall be provided wherever people can pass or work beneath the open sides or wherever falling material could create a hazard to moving machinery or equipment.

END OF SECTION

SECTION 05530 - METAL FLOOR PLATE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes the floor plate work as shown on the Drawings and provides floor plate which is not part of other metal systems in other sections of these specifications.

B. The types of plating include the following:

1. Aluminum floor plate

1.2 QUALITY ASSURANCE

A. Codes and Standards.

1. Standard Building Code
2. NAAMM "Metal Bar Grating Manual"
3. AWS "Structural Welding Code"

B. Qualification for Welding Work. Qualify welding processes and welding operators with AWS "Standard Qualification Procedure".

C. Design (Walking Surfaces). Uniformly distributed load of 200 lbs. per sq. ft., with maximum deflection of 1/160 of the span and a maximum allowable fiber stress of 12,000 psi for aluminum.

D. Field Measurements. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking field measurements before fabrication might delay the work.

E. Shop Assembly. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

F. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

G. Aluminum Grating:

Irving - IKG Industries
Liskey Aluminum, Inc.
or Equal

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide three sets for final drawings and installation instructions (include setting drawings and templates for location and installation of items and anchorage devices) to Engineer for use in observing installation and for Record Drawings.

B. Provide a written warranty which shall guarantee the grating to be free from defects in material and workmanship for a period of five years from date of shipment.

PART 2 - MATERIALS AND EQUIPMENT

2.1 METAL SURFACES

A. For the fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled names and roughness. Remove such blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.

2.2 FABRICATION, GENERAL

A. Use materials of the size and thickness shown, or if not shown, of the size recommended by product manufacturer. Work to the dimension shown or accepted on final shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.

2.3 FLOOR PLATE

A. Aluminum Floor Plate. Raised diamond pattern tread plate having a raised figured pattern (minimum 0.040-inch high) on one surface.

B. Include aluminum angle stiffeners and fixed and removable sections as shown on the Drawings, or where required.

1. Provide 2 floor lifting handles, one at each end of each removable section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must examine the areas and conditions under which floor plate is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

A. Fastening to In-Place Construction. Provide anchorage devices and fasteners where required for securing units to supporting members or prepared openings.

B. Cutting, Fitting and Placement. Perform all cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack.

C. Divide the panels into sections only to the extent required for installation wherever bar grating, platforms, runways and similar items are to be placed around previously installed pipe, ducts, and structural members.

D. Fit exposed connections accurately together to form tight hairline joints.

E. Weld nonremovable units to supporting members or framework. Secure removable units to supporting members or framework with stainless steel machine screws, or manufacturer's standard saddle or clip units.

F. Field Welding. Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

G. Dissimilar Materials. Where dissimilar metals contact each other or there is a condition such as aluminum against concrete, they shall be protected from each other with a pressure sensitive tape, bitumastic coating or other protective method.

END OF SECTION

SECTION 05532 - ALUMINUM GRATING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of Aluminum grating is shown on the drawings and shall include all necessary fasteners and accessory items to make a complete system.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide the aluminum grating to conform to the following codes and standards per current edition:

1. ASTM B 221: Specification for Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
2. ANSI/NAAMM MBG 531: Metal Bar Grating Manual
3. ASTM E-448: Test Method for Strength of Anchors in Concrete and Masonry Elements
4. ASCE 7-88: Minimum Design Loads for Buildings and Other Structures.
5. AWS D1.2: Structural Welding Code - Aluminum

1.3 SUBMITTAL

A. Submit manufacturer's specifications, load tables, dimensions, diagrams, anchor details and installation instructions.

B. On request, furnish reports of load versus deflection tests conducted on assembled grating panels. Such tests shall be certified by an independent, nationally recognized testing laboratory.

C. Shop Drawings: Submit shop drawings for the fabrication and erection of all assemblies of work which are not completely shown by the manufacturer's data sheets. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.

1. Include setting drawings and templates for location and installation of items anchorage devices.

1.4 JOB CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units as the project site Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.5 WARRANTY/GUARANTEE:

A. Manufacturer's Standard Warranty: The grating sections shall be free of defects in material and workmanship for one year from date of shipment. If, after inspection, the manufacturer agrees that materials are defective, the manufacturer shall repair or replace them at no additional cost.

PART 2 - MATERIALS AND EQUIPMENT

2.1 ALUMINUM GRATING

A. The Aluminum Grating design shall be manufactured with alloy 6063-T6.

B. Loading and Deflection Requirements: The grating shall be designed to support a 100 psf uniform live load with a theoretical design deflection of .25" or less.

C. Walking Surface Finish: The grating surface shall have a plain fluted pattern surface.

D. Color: The grating color shall be natural aluminum.

2.2 ACCESSORIES

A. Fastener: Provide Type 50 aluminum fasteners with hold down clips for sectional and frame attachment with stainless steel allen wrench screw type by the manufacturer.

B. Frame: Provide extruded aluminum alloy 6063-T6 frame by the grating manufacturer. The frame finish shall match that of the specified grating.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that the grating installation will not disrupt other trades and verify that the substrate is clean and free of foreign matter. Correct all defects prior to installation.

3.2 INSTALLATION

A. General: Install the grating in accordance with the project drawings, specifications, approved shop drawings, and manufacturer's installation standards.

B. Grating panels shall be fabricated to be square within manufacturer's tolerances and free from warping and any defect that may affect serviceability and reliability.

C. Install the grating with a min. 1-1/2" bearing surface at the frame or support ends. The grating shall be fastened to the frame or support substrate using fasteners and clips supplied by the grating manufacturer. Fastening shall be consistent with the manufacturer's instructions.

D. Tolerances between sections shall not exceed the dimensional spacing of the grating style type. Adjacent sections shall line up to form an uninterrupted straight line, where possible.

E. Grating sections shall be installed to be removable unless indicated otherwise.

F. Openings shall be field cut by the installer where indicated to permit field installation of wiring, equipment, piping, etc. All rectangular cutouts shall be made to the next bearing section past the obstruction. The cutout clearance to obstruction from the edge of the grating shall be no larger than 2". Cutouts shall be done in the field (unless otherwise requested).

END OF SECTION

SECTION 06100 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SCOPE

A. Work included in this section includes the furnishing of labor, materials, equipment, and services necessary for and incidental to the completion of all rough carpentry throughout the entire project, as shown on the drawings and as called for in these specifications.

1.2 QUALITY ASSURANCE

A. Fit carpentry to other work: Scribe and cope as required for accurate fit, correlate location of furring, nailing, blocking, grounds and similar supports to allow proper attachment of other work.

B. Factory-mark each piece of lumber and plywood to identify the type, grade, agency providing the inspection service, the producing mill and other qualities as specified herein.

C. Comply with requirements of the following standards unless otherwise indicated:

1. U.S. Department of Commerce

   a) "American Softwood Lumber Standard" (PS 20)
   b) "National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee (PS 20)
   c) "Softwood Plywood/Construction and Industrial" (PS 166)

2. American Wood Preservers Institute

   a) AWPI LP-2
   b) AWPI C-20B

3. Underwriters Laboratory

   a) UL Test 723

4. American Society for Testing & Materials

   a) ASTM E-84

5. National Forest Products Association

   a) National Design Specifications for Wood Construction (1977)
   b) Manual for House Framing (1977).

1.3 SUBMITTALS

A. Submit copies of certification of chemical treatment of wood for water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

B. Include a certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood and provide air circulation within stacks.

B. Protect installed carpentry work from damage by work of other trades until Owner's acceptance of the work. Advise Contractor of required protection procedures.

PART 2 - PRODUCTS

2.1 For a lumber standard, for each use, comply with the "American Softwood Lumber Standard" PS 20 by the U.S. Dept. of Commerce. Nominal sizes are shown or specified: Provide actual sizes complying with the minimum size requirements of PS 20 for the moisture content specified for each use.

Provide dressed lumber S4S, unless otherwise shown or specified.

Provide seasoned lumber with 19% maximum moisture content at time of dressing and complying with dry size requirements of PS 20, unless otherwise specified.

2.2 Where wood framing from 2" to 5" (but not including 5" in nominal thickness and 2" or more in nominal width) is shown or schedule; provide lumber complying with grading rules which conform to the requirements of the "National Grading Rule for Dimension Lumber" of the American Lumber Standards Committee established under PS 20.

A. For light framing (2" to 4" thick and 2" to 4" wide), provide construction grade.

B. For framing and blocking (6" and wider and from 2" to 4" thick), provide the following, unless noted otherwise on drawings:

Any species and grade which meets or exceeds the following values:

Fb (minimum extreme fiber stress in bending): 1200 psi.
E (minimum modulus of elasticity): 1,500,500 psi.

2.3 Where lumber less than 2" in nominal thickness and 2" or more in nominal width is shown or specified, provide boards complying with dry size requirements of PS 20.

2.4 Where boards will be exposed in the finished work provide the following:

Moisture Content: 19% maximum, mark boards "S-DRY".

For paint finish, where shown or scheduled, provide the following:

No. 1 Boards, Southern Pine (SP1B)

2.5 Where boards will be concealed by other work, provide the following:

Moisture Content 19% maximum, mark boards "S-DRY". Species and Grade: Provide Southern Pine (SP1B) No. 2 boards.

2.6 For a plywood standard, for each use, comply with the requirements for "Softwood Plywood/Construction and Industrial" PS 1 66 by the U.S. Dept. of Commerce.

A. Exposed Plywood: Where plywood will be exposed in the finished work, provide as specified for the type of exposure and finish shown or scheduled, as follows:

1. For smooth plywood exposed and to receive a paint finish, provide Grade A on exposed face; Grade D on concealed face with exterior glue.

2. For smooth plywood exposed and unfinished, provide pressure treated, Grade A on exposed face; Grade D on concealed face with exterior glue.

B. Concealed Plywood: Where plywood will be concealed by other work, provide Interior Type plywood C-D Plugged Grade, unless otherwise specified. Plywood for roof deck and siding to receive metal roofing and siding: Grade C-C exterior index number 48/24.

1. For backing panels for electrical or telephone equipment, provide fire-retardant treated Standard grade plywood with exterior glue.

C. Formwork Plywood: Where formed concrete will be exposed on the exterior, weather finished or not, provide as follows:

1. Provide Grade A on concrete contact face; Grade D on concealed face with structural strength sufficient to resist bowing and deformation during concrete pour and curing. Glue to be exterior grade. Formwork shoring and bracing design is the responsibility of the contractor.

2.7 For anchorage and fastening materials for each use, select proper type, size, material and finish complying with the applicable specification and details.

2.8 Where lumber or plywood is indicated as Treated ("PT"), or is specified herein to be treated, or is in contact with masonry surfaces above or below grade comply with the applicable requirements of the American Wood Preservers Institute (AWPI). Mark each treated item to comply with the AWPI Quality Mark requirements for the specified requirements.

A. Pressure treat above ground items with waterbourne preservatives complying with AWPI LP-2. Osmose K-33 at 0.45 pcf retention or Wolman CCA at 0.75 pcf retention. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:

1. Wood, nailers, blocking, stripping, and similar members in connection with roofing, vapor barriers and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

B. Kiln-dry treated items to a maximum moisture content of 15% or less.

2.9 Bolts shall conform to ASTM A307 Grade A; carbon steel, hex-head bolts and carbon steel nuts hot dip galvanized in accordance with ASTM A153 Class C.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor must examine all parts of the supporting structure and the conditions under which the carpentry work is to be installed and assure himself that all support work has been accomplished. Do not proceed until unsatisfactory conditions have been corrected in acceptable manner.

3.2 PREPARATION

A. Use only sound, thoroughly seasoned materials of the longest practical lengths and sizes to minimize jointing. Use materials free from warp which cannot be easily corrected by anchoring and attachment. Sort, cut, and discard warped material and material with other defects which would impair the quality of the work.

3.3 INSTALLATION

A. Securely attach carpentry work to substrates by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

C. Use common wire nails, except as otherwise shown or specified. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed.

D. For exterior installations, use hot-dip galvanized or stainless fasteners.

E. Wood Grounds, Nailers, Blocking and Sleepers:

F. Provide wherever shown and where required for screening or attachment of other work. Form to shapes as shown and cut as required for true to line and level of work to be attached. Set true to line and level, plumb, with intersections true to required angle. Coordinate locations and other work involved.

G. Attach to substrates securely with anchor bolts and other attachment devices as shown and as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry; anchor or formwork before concrete placement.

H. Provide grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of the thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

I. Set wood framing accurately to required lines and levels. Providing framing members of sizes and on spacings shown, comply with the recommendations of the "Manual for House Framing" of the National Forest Products Association. Cut, join and tightly fit framing around other work. Do not splice structural members between supports unless otherwise detailed.

J. Anchor and nail as shown, or if not shown, to comply with the "Recommended Nailing Schedule - Table 1" of the "Manual for House Framing" and other recommendations of the N.F.P.A.

END OF SECTION

SECTION 06610 - FIBERGLASS FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing fiberglass structural members, clarifier effluent weirs, clarifier scum baffles, sand filter cell dividers, and sand filter backwash discharge launders.

B. Some structural configurations are noted as FRP Pultrusions which is a form of molded fiberglass.

1.2 QUALITY ASSURANCE

A. The fiberglass equipment shall be molded by a fiberglass manufacturer with at least ten (10) years of experience in furnishing similar equipment to the water and water pollution treatment industry.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products which may be incorporated into the work are limited to the following:

1. Warminster Fiberglass
2. Or Equal.

1.3 SUBMITTALS

A. Submit manufacturer's literature for materials.

B. Submit shop drawings of shop fabricated items.

PART 2 - MATERIALS AND EQUIPMENT

2.1 STRUCTURAL CONFIGURATIONS

A. Where called for on the Drawings, corrosion-resistant and non-conductive structural shapes shall be made of fiberglass reinforced plastic.

2.2 EFFLUENT WEIRS FOR CLARIFIERS

A. The fiberglass weirs shall be furnished with oversized holes to permit field adjustment. Weir dimensions shall be as shown on the drawings. Lap plates shall be provided at points where weir plate sections connect to prevent leaks.

B. All components except for bolts and anchors shall be of fiberglass reinforced plastic. The matched metal die molding process shall be used, producing highest quality parts for smoothness, dimensional accuracy and consistency, with highest resistance to corrosive and physical attach from the process of

weathering. The color of the fiberglass components shall be white. Weir plates fabricated from plate stock with cut edges, will not be acceptable. When necessary to adjust length of weir plates for fit within a tank, all cut edges thus exposed shall be double sealed with polyester resin.

C. The fiberglass laminate shall have the following minimum physical properties:

		Test Method
Tensile strength	14,000 psi	ASTM D638
Flexural strength	25,000 psi	ASTM D790
Flexural modulus	1.0×10^6	ASTM D790
Impact, Notched, Izod foot pound per inch	15.0	ASTM D256
Barcol hardness	40 Min. Aver.	ASTM D2583
Water absorption, % 24 hours	0.1%	ASTM D570
Average coefficient of thermal expansion inch per inch per °F	10.5×10^{-6}	ASTM D696

D. Manufacturer shall maintain a continuous quality control program and, upon request, shall furnish to the ENGINEER certified results of the physical tests listed above.

E. All assembly hardware and wall anchors shall be provided by the fiberglass manufacturer and shall be stainless steel Type 316.

F. 1/16-inch neoprene gaskets shall be provided for the weirs to provide watertight connections.

2.3 FIBERGLASS BACKWASH DISCHARGE LAUNDERS FOR SAND FILTERS

A. A fiberglass backwash discharge launder shall be supplied, complete with 304 stainless steel supports from the tank wall. The trough shall be 12 inches deep and 12 inches wide. The trough shall incorporate a recessed joint design at the trough segment joints. The troughs shall include horizontal stiffeners (as required) to minimize horizontal deflection.

B. The trough shall be equipped with stiffener ribs as required on the inside of the troughs to enhance rigidity. No spacer rods or spreader bars shall be allowed to maintain a nominal width over the entire length of each trough segment. Each trough shall be laminated of fiberglass reinforced polyester resin to a minimum thickness of ¼". The inside surface of each trough shall have a smooth gel coat finish with no exposed glass fibers. Color shall be molded in and an ultraviolet inhibitor provided. All fasteners and accessories shall be Type 304 stainless steel provided with neoprene washers to isolate dissimilar metals.

C. The trough shall be supported on 304 stainless steel braces attached to the tank wall as shown on the Drawings. The braces shall be designed to withstand all uplift and downward forces encountered in this installation. Spacing of braces shall be a maximum of 9 feet on centers at the tank wall.

D. The troughs shall be designed, within stress and deflection limitations, for the following loadings:

1. Gravity Load - Downward vertical loads shall include the weight of the trough and all appurtenant attachments together with the weight of water to fill the trough. Any additional loads, such as piping, etc., shall also be considered.

2. Buoyant Load - The buoyant load shall act vertically upward, its magnitude equal to the weight of displaced water (trough weight neglected). The line of action passes through the centroid of the submerged cross-sectional area.

3. Lateral Load - Loads acting against the trough side walls; specifically those included by differential water levels on either side of the trough walls. The maximum possible differential, existing when the trough is empty and the tank is full, or, when the trough is full and the tank is empty, shall be used when calculating deflection, fiber stress, etc.

4. Thermal Stresses - The troughs shall be designed to accommodate temperature induced stresses resulting from differences in coefficients of thermal expansion (contraction) between the trough and tank/support materials.

5. Torsional Stability - The trough system shall be designed to resist torsional oscillations induced by the flow of water over through edges. Any or all of the following trough stabilization techniques shall be considered.

   a) Trough-to trough stabilization
   b) Torsional stiffness
   c) Support spacing and rigidity
   d) Internal baffles and/or flow straighteners

6. Deflection Under Load - Maximum vertical deflection under full buoyant or gravity load shall be less than or equal to L/1000, where L is defined as the unsupported trough length, in inches. Under no circumstances shall the maximum vertical deflection, measured at midpoint between trough supports, exceed 3/16".

   a) Maximum trough side wall horizontal deflection under full lateral load shall be less than or equal to D/100, where D is defined as the trough depth, in inches. Under no circumstances shall the maximum side wall deflection exceed 3/16".

   b) Trough bottom deflection (oilcanning) under full buoyant or gravity load shall be less than or equal to W/100, where W is defined as the trough width, in inches. Under no circumstances shall the maximum bottom deflection exceed 3/16".

7. Fiber Stress Limitations - Supplemental to the deflection criteria, the troughs shall also be designed such that the maximum wall stress under the most severe loading conditions is less than or equal to 2,400 psi. The stress criteria is equivalent to 5:1 safety factor (approximate) as applied to the tensile and flexural properties of contact molded troughs and launders.

8. Thermal Expansion/Contracting - The troughs shall be designed to accommodate a thermally induced expansion (contraction) of 1/8" per 20 ft. length of trough over temperature range of -10°F. to 100°F., without exceeding the deflection or strain limitations set forth in the preceding sections.

E. The manufacturer shall submit all design calculations to the ENGINEER for review only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's instructions.

B. Weir plates and baffles shall be installed level and watertight.

END OF SECTION

SECTION 06612 - FIBERGLASS GRATING AND TREADS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes fiberglass grating and treads and shall include all necessary fasteners and accessory items to make a complete system as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Duradek Systems, Aligned Fiber Composites, Inc.
2. IKG - Borden
3. Seasafe
4. Fibergrate - Industrial Plastics

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide final drawings and installation instructions (include setting drawings and templates for location and installation of items and anchorage devices) to Engineer for use in observing installation and for Record Drawings.

1.4 JOB CONDITIONS

A. Field Measurements. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Shop Assembly. Preassemble items in the shop to the greatest extent possible so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PULTRUDED FIBERGLASS GRATING

A. Fiberglass grating shall be the pultruded type, fabricated from isophthalic polyester fire retardant Class 1. Grating shall have I-beam shaped bearing bars with cross rods spaced at 6-inches; grating shall be 1-1/2" tall.

B. Provide non-skid surface to bearing bars.

C. Grating shall carry a uniform distributed load of 200 lbs./sq.ft. on a simple span of 36-inches and not deflect more than 1/4-inch.

D. Fire retardant grating shall meet the requirements of ASTM E-84, Class 1, flame spread of 25 or less as well as ASTM D-636.

E. Grating reinforcement shall be thoroughly wetted out with fire retardant resin.

2.2 JOINING AND HOLD-DOWN HARDWARE

A. Provide end panel attachment clips and hold-down attachments as required to secure the grating in place.

B. The type used shall be as recommended by the grating manufacturer. Fastenings and clips shall be of stainless steel unless the environment precludes their use in which case thermoplastic fasteners may be used.

2.3 FIBERGLASS STAIR TREADS

A. Where called for on the Drawings, provide fiberglass stair treads by the same manufacturer as the grating. Material shall be isophathalic polyester resin. COLOR SHALL MATCH GRATING. Treads shall have grit impregnated nosing. Mesh dimensions shall be (nominal) 1-1/2-inches x 1-1/2-inches or 6-inches by 1-1/2-inches.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's instructions for cutting, placing and securing fiberglass grating and treads.

END OF SECTION

SECTION 06616 - FRP FLAT PANEL COVERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing all labor, materials, equipment and hardware required to place in satisfactory service fiberglass reinforced plastic covers as shown on the Drawings and specified. Anchor bolts, fasteners and gaskets required for a complete installation are to be included as part of the covers. Loose pieces, such as closure strips or seals and other such items shall not be allowed.

1.2 QUALITY ASSURANCE

A. A system of quality control is required of the manufacturer of the panel to assure and to document that the panels were manufactured to the following standards and conditions where applicable:

1. ASTM D638 - Tensile Properties of Plastics
2. ASTM D790 - Flexural Properties of Plastics
3. ASTM D2583 - Indentation Hardness of Plastics (Barcol)
4. National Bureau of Standard, PS-15-69

B. Manufacturer's Qualifications. Manufacturer shall submit a document describing his quality control procedure and system.

C. Manufacturer shall have been in the manufacturer of fiberglass covers and roof systems for five years minimum.

D. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Delta Fiberglass Structures
2. Or Equal

1.3 SUBMITTALS

A. Quality control procedure and system document.

B. General arrangement drawings showing complete structure, fasteners, other such items and erection procedures for a complete assembly.

C. Shop drawings showing detail of all components.

D. Design calculations sealed by a registered professional engineer in the State of Manufacture.

E. Certification that manufacture had been actually engaged in the manufacture of fiberglass flat panel covers and roof systems for a minimum of ten years.

F. Color samples for approval.

G. Operation and maintenance manuals to include:

H. Installation Instructions, Operation and Maintenance Instructions, copies of all approved drawings, material specifications of resin used, procedures, and repair procedures for fiberglass.

PART 2 - MATERIALS AND EQUIPMENT

2.1 DESIGN

A. The covers shall be designed to provide a minimum safety factor of three to one against maximum calculated stresses and ultimate physical properties of the laminate.

B. The panels shall be designed to withstand a live load of 1-inch W.C. vacuum, 25 PSF liveload, and 100 MPH wind with a maximum deflection of L/120.

C. All panels shall be totally sealed and any access holes, or other penetrations that pass through the panels shall be totally sealed.

D. Panels shall be designed to support a 250 lb. load on an area 1-ft. x 2-ft. anywhere on the cover.

E. Any connections such as ducting or vents that fasten to the panels shall be provided with molded-in nut plates or molded-in studs in the panels so that bolting shall be from the exterior of the cover.

2.2 MATERIALS

A. FRP covers furnished shall be specifically designed, constructed and installed for the service intended. (Jobsite inspections are recommended to assure that object locations, elevations, actual conditions and similar items, are know before fabrication is started).

B. The materials shall provide a minimum of three to one factor of safety against the maximum calculated stresses.

C. Fiberglass reinforcement shall consist of a combination of chopped strand matt and woven roving suitably treated with a finish compatible with the resin system. Glass content shall not be less than 25 percent.

D. Panels shall be manufactured using sandwich type construction but the effect of the core material will not be allowed in calculating the bending, tensile, rigidity of buckling stresses of the fiberglass skins and panel. In other words, the fiberglass shell shall support all of the above loads as though the core material was not present.

E. Each panel will be manufactured with overlapping and Neoprene gasketed seams. These seams shall contain molded-in Type 304 S.S. nut plates for fastening the panels together with stainless steel bolts from the exterior of the cover.

F. Where the panels rest on the curb wall or support beams they shall contain a Neoprene gasket and shall be held in place by 304 S.S. anchor bolts with suitable S.S. washers.

G. The top of the panels shall be peaked, to allow for drainage, with a non-skid surface. The panels will be 3" high in the center and sloped towards the ends, at approximately ¼" per ft. Any structure needed for support of the panels shall be placed on the underside of the panels.

H. The exterior surface of the fiberglass panels shall contain Ultra Violet Stabilizers for protections against sunlight.

PART 3 - EXECUTION

3.1 INSPECTION

A. Customer will be allowed access to manufacturing area for the purpose of inspection.

B. All items should be inspected for shipping damage at the time of unloading and the proper papers filled out should there be any apparent damage.

3.2 INSTALLATION

A. The panel shall be stored and handled carefully at the job site.

B. The Contractor may be required to cut or make small adjustments to the panels for proper fit. Also some bolting will require drilling and tapping before the fit-up bolts can be installed.

C. The manufacturer of the cover system shall supply instructions for installation of the covers.

3.3 SPARE PARTS

A. Furnish two percent of all installation hardware. These shall be packaged in a sturdy container and labeled "Spare Hardware - FRP Flat Panel Covers".

3.4 MAINTENANCE MANUALS

A. See Section 01700 - Contract Closeout for O & M Manual requirements.

END OF SECTION

SECTION 06618 - HDPE MANHOLES FOR LEACHATE COLLECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all materials, labor and equipment and construct manholes consisting of HDPE sections as shown on the drawings and as specified herein.

B. The manholes shall have a concrete invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be sloped to drain toward the flowing channel. Every effort shall be made by the Contractor to construct watertight structures.

C. The forms, dimensions, and construction methods shall be available for inspection by the Engineer in advance of construction. The Engineer shall reserve the right to inspect the facilities of the supplier.

1.2 RELATED WORK NOT INCLUDED

A. Section 02200: Earthwork.

B. Section 02622: Plastic Pipe for Gravity Service.

C. Section 03300: Cast-in-Place Concrete

1.3 SUBMITTALS

A. Submit to the Engineer, as provided in the General Conditions, shop drawings showing details of construction, reinforcing, joints, openings and all other specified details.

1.4 INSPECTION

A. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection and approval by the Engineer or other representative of the Owner. Such inspection may be made at the place of manufacture, and/or at the site. Wherever possible, the HDPE manholes shall be inspected prior to unloading from the delivery truck and marked by the inspector showing acceptance or rejection. However, discovery at any time of failure to meet requirements of these specifications is cause for rejection.

B. Manholes rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which are damaged after delivery will be rejected and if already installed, shall be acceptably repaired, if permitted, or removed and replaced entirely at the Contractor's expense, as determined by the Engineer.

C. The horizontal location of pipe stubouts shall be within ± 2 degrees of arc of that detailed on shop drawings.

D. At the time of inspection, the sections will be carefully examined for compliance with these specifications and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, blisters, cracks, roughness, soundness, etc.

E. Imperfections may be repaired subject to the approval of the Engineer after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval.

PART 2 - PRODUCTS

2.1 GENERAL

A. The 4-foot diameter manhole sections shall consist of PE 3408 high density high extra molecular weight polyethylene pipe, the cell classification of which shall be PE 345434C as specified by ASTM D3350. Dimensions and workmanship shall be as specified by ASTM F714. The dimension ratio shall be SDR 32.5.

B. The HDPE base shall be of the same material, 6-feet in diameter and 2-inches thick.

C. Inlet and outlet pipes shall be of the same material as above and shall have flanged ends. Inlet and outlet pipes shall be connected to the HDPE barrel of the manhole with a watertight fused connection.

D. Top plate shall be of the same material, 4-feet in diameter, and 1½-inches thick.

E. Manway shall be of the same material, 2 feet in diameter, 2 feet high with a 24-inch HDPE flange. The manway shall be fused to the top plate.

F. The cover shall be of the same material with dimensions to fit over the 24-inch flange and 1-inch thick. The cover shall be held in place with 316 SS bolts and nuts.

G. Concrete for invert and anti-flotation ring shall have a 28-day compressive strength of 4,000 psi. The anti-flotation ring shall have sufficient concrete to offset buoyancy forces assuming groundwater at ground surface elevation.

2.2 INVERT CONSTRUCTION

A. Inverts: Form with concrete to provide a smooth flowing channel of similar shape and size of the sewer to which it connects.

B. Straight Run Manholes: Construct invert to exact shape and size of pipe indicated.

C. Junction Manholes: Construct invert to shape and size of pipes indicated. All inverts shall follow grades of pipes entering manholes. Provide a true curve of the largest radius possible for changes in direction of sewer and entering branch or branches.

3.1 MANHOLE CONSTRUCTION

A. Manhole Installation: Set manhole sections vertical and in true alignment.

B. The finished manhole shall not be out of plumb by more than 3/8" per 10 feet of height.

END OF SECTION

SECTION 07212 - BOARD INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Adhesive bed vapor and air barrier.

B. Board insulation at cavity wall construction.

1.2 RELATED WORK

A. Section 04330 - Cavity Wall Masonry System: Cavity wall construction.

1.3 REFERENCES

A. ANSI/ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

B. ASTM E96 - Water Vapor Transmission of Materials.

C. FS L-P-375 - Plastic Film, Flexible, Vinyl Chloride.

D. FS HH-I-524 - Insulation Board, Thermal (Polystyrene).

1.4 SYSTEM DESCRIPTION

A. Materials of this Section shall provide a continuous thermal, vapor and air barrier at building enclosure elements.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Rigid Insulation - (Cavity wall construction): Extruded polystyrene closed cell foam panel with continuous front and back skins. 1-1/2" thick with 16" width. Minimum compressive strength of 25 lb. per square inch when tested in accordance with ASTM D1621. Water absorption in accordance with ASTM C272. 0.3 percent by volume.

2.2 ADHESIVE MATERIALS

A. Adhesive: As recommended by insulation manufacturer for application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify substrate and adjacent materials and insulation boards are dry and ready to receive adhesive and insulation.

B. Verify substrate surface is flat, and free of irregularities and materials that will impede bond .

C. Verify liquid applied cavity moisture barriers are completely cured.

D. Verify insulation boards are unbroken, free of damage and with face membrane undamaged.

3.2 INSTALLATION

A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Extend insulation over entire area to be insulated. Install insulation in longest practical lengths. Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent board and to protrusions.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

D. Protect insulation from damage and hold securely in place until covering material is in place.

END OF SECTION

SECTION 07527 - SBS-MODIFIED BITUMINOUS SHEET ROOFING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Modified bituminous sheet with field-applied surfacing.
2. Vapor retarder.
3. Roofing asphalt.
4. Roof membrane surfacing material.
5. Protected roof membrane insulation.
6. Roof ballast.
7. Temporary roofing.
8. Wall flashing.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 3 Section " Lightweight Insulating Concrete Roof Deck" for roof insulation system.
2. Division 6 Section "Rough Carpentry" for treated wood nailers, curbs, and wood cants.
3. Division 7 Section "Sheet Metal Flashing and Trim" for metal counter flashings and parapet flashing.
4. Division 7 Section "Roof Specialties and Accessories" for prefabricated curb units.
5. Division 15 Section "Drainage and Vent Systems" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

B. Thermal Resistivity (r-value) is the reciprocal of thermal conductivity (k-value) which is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees F between two parallel surfaces required to cause 1 Btu to flow through 1 sq. ft. of a homogenous material exactly 1 inch thick per hour at the mean temperature indicated.

C. Thermal Resistance (R-value) is the reciprocal of thermal conductance (C-value) which is the rate of heat flow through a material of the thickness indicated. Thermal resistance (R-value) is expressed by the temperature difference in degrees F between the two exposed faces required to cause 1 Btu to flow through 1 sq. ft. per hour at the mean temperature indicated.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Install modified bituminous sheet roofing to withstand wind loads, structural movement, thermally induced movement, and exposure to weather, without failure.

B. UL Listing: Provide modified bituminous sheet roofing system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.

1. Provide roof-covering materials bearing UL Classification Marking on bundle, package, or container indicating that materials have been produced under UL's Classification and Follow-up Service.
2. Provide modified bitumen sheet roofing system that can be installed to comply with UL requirements for Fire Classified and Class 90 wind-uplift requirements.

C. FM Listing: Provide modified bitumen sheet roofing system and component materials that have been evaluated by Factory Mutual System for fire spread, wind uplift, and hail damage and that are listed in "Factory Mutual Approval Guide" for Class I construction.

1. Roofing system shall comply with FM Class I-90 for wind-uplift resistance.
2. Provide roof-covering materials bearing FM approval marking on bundle, package, or container, indicating that material has been subjected to FM's examination and follow-up inspection service.

D. Insulation Fire-Performance Characteristics: Provide insulation materials that are identical to materials whose fire-performance characteristics have been determined for the assemblies of which the insulation materials are a part, per test method listed below, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Surface Burning Characteristics: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.

1.5 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified. Include data substantiating that materials comply with requirements.

1. For asphalt bitumen, provide label on each container or certification with each load of bulk bitumen, indicating flash point (FP), finished blowing temperature (FBT), softening point (SP), and equiviscous temperature (EVT).

C. Manufacturer's certification indicating that bulk bituminous materials delivered to Project comply with required standards. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.

1. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported prior to final heating and application on roof.

D. Field Test Reports: Submit daily softening point test reports on samples of asphalt used on project, taken at beginning of each day's work and at 2-hour intervals during course of the work. Test by Ring and Ball Test, ASTM D 36, or similar recognized test method. Submit samples to independent laboratory for testing or perform tests in field, at Contractor's option.

E. Samples of the following:

1. 3 lb samples of aggregate surfacing material.
2. 12 x 12 inch square samples of each color modified, bituminous, mineral-surface cap sheets to be exposed as finished roof surface.
3. 12 x 12 inch square samples of metal foil-covered, modified, bituminous cap sheets to be exposed as finished roof surface.

F. Installer Certification: Submit written certification from manufacturer of modified bituminous sheet roofing system certifying that Installer is approved by manufacturer to install specified roofing system. Provide copy of certification to Architect before award of roofing work.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain primary products, including each type of roofing sheet, bitumen, membrane flashings, and vapor retarder, from a single manufacturer. Provide secondary products as recommended by manufacturer of primary products for use with roofing system specified.

B. Installer Qualifications: Engage an experienced Installer (Roofer) who is certified by modified bituminous sheet roofing system manufacturer as qualified to install manufacturer's roofing materials.

1. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman on job site during times that modified bituminous sheet roofing work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project.

C. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

D. Preliminary Roofing Conference: As soon as possible after award of modified bitumen sheet roofing work, meet with Installer (Roofer), installers of substrate construction (roof decks) and other work adjoining roof system including

penetrating work and roof accessories, Architect, Owner, and representatives of other entities directly concerned with performance of roofing system including (as applicable) Owner's insurers and test agencies.

1. Review requirements (Contract Documents), submittals, status of coordinating work, availability of materials, and installation facilities and establish preliminary installation schedule. Review requirements for inspections, testing, certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.
2. Discuss roofing system protection requirements for construction period extending beyond roofing installation. Discuss possible need for temporary roofing.
3. Record discussion, including agreement or disagreement on matters of significance; furnish copy of recorded discussions to each participant. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

E. Preapplication Roofing Conference: Approximately 2 weeks before scheduled commencement of modified bitumen sheet roofing installation and associated work, meet at Project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, test agencies, and governing authorities.

1. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:

    a) Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
    b) Review structural loading limitations of steel deck and inspect deck for loss of flatness and for required mechanical fastening.
    c) Review roofing system requirements (drawings, specifications, and other contract documents).
    d) Review required submittals, both completed and yet to be completed.
    e) Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    f) Review required inspection, testing, certifying, and material usage accounting procedures.
    g) Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.

2. Record (Contractor) discussions of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store and handle roofing sheets in a dry, well-ventilated, weather tight place to ensure no possibility of significant moisture pickup. Store rolls of felt and other sheet materials on end on pallets or other raised surface.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather or other moisture sources.

C. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Condition Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit unit of Work to be installed in accordance with manufacturers' recommendations and warranty requirements.

B. Temporary Roofing: When adverse job or weather conditions prevent permanent roofing system from being installed according to requirements and Contractor determines that roofing cannot be delayed because of need for job progress or protection of other work, install temporary roofing. Engage roofing Installer to provide temporary roofing and to remove it prior to proceeding with permanent roofing work, at no additional cost to the Owner.

1.9 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of Work specified in other Sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity.

1.10 WARRANTY

A. Special Project Warranty: Submit two executed copies of standard 2-year Roofing Warranty covering work of this section including roofing membrane, membrane flashing, roof insulation, any vapor retarders, and roofing accessories, signed and countersigned by Installer (Roofer) and Contractor.

B. Manufacturer's Warranty: Submit executed copy of roofing manufacturer's standard Limited Service Warranty agreement including flashing endorsement, signed by an authorized representative of modified bitumen sheet roofing system manufacturer, on form that was published with product literature as of date of Contract Documents, for the following period of time:

1. 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TEMPORARY ROOFING (IF REQUIRED)

A. Temporary Roofing Membrane: Two plies of asphalt-impregnated glass-fiber felt complying with ASTM D 2178, Type IV, set in and glaze-coated with hot moppings of ASTM D 312, Type III asphalt.

1. Provide base of rigid perlite board roof insulation over metal deck surfaces of minimum thickness as required to span between top flutes of deck without deflection, but not less than 3/4 inch. Attach to deck with FM-approved adhesive.

2.2 ROOF INSULATION

A. See Specification Section 03520 Lightweight Insulating Concrete.

2.3 MODIFIED BITUMINOUS SHEET ROOFING SYSTEM

A. Modified Bituminous Sheet, General: Furnish modified bituminous sheet materials complying with the following:

1. Breaking Strength: ASTM D 412, minimum 66 lb.
2. Ultimate Elongation (elongation at break): ASTM D 412, 4.0 percent.
3. Water Resistance: ASTM D 570, will not absorb more than 1.0 gram of water and dimensional change will not exceed 1.0 percent (ASTM D 1204).
4. Water Vapor Transmission: ASTM E 96, maximum 1.0 gram in 24 hours.
5. Dynamic Impact (puncturing): Pass water-tightness test after impact of 1.8 ft. lb.
6. Lap Joint Strength: ASTM D 412, 66 lbf, after immersion at 50 deg F for 5 days plus five freeze-thaw cycles.
7. Breaking Strength: ASTM D 412, Minimum 175 lb.
8. Ultimate Elongation (elongation at break): ASTM D 412, 8.0 percent.
9. Water Resistance: ASTM D 570, will not absorb more than 1.0 gram of water and dimensional change will not exceed 1.0 percent (ASTM D 1204).
10. Water Vapor Transmission: ASTM E 96, maximum 1.0 gram in 24 hours.
11. Dynamic Impact (puncturing): Pass water-tightness test after impact of 3.6 ft. lb.
12. Lap Joint Strength: ASTM D 412, 176 lbf, after immersion at 50 deg F for 5 days plus five freeze-thaw cycles.

B. Insulated-Deck, Modified Bitumen Membrane/Fully Adhered (IMBF):

1. Base Sheet: Asphalt-impregnated, glass-fiber felt, complying with ASTM D 2178, Type IV.
2. Interply Bitumen: Roofing asphalt, complying with ASTM D 312, Type III.

3. Modified Bitumen Sheet Membrane/Plain Surfaced: Styrene Butadiene Styrene (SBS)-modified asphalt sheet with smooth surface, dusted on both sides with fine mineral granules; manufacturer's standard sheet thickness.

   a) Sheet Reinforcing: Glass-fiber mesh or nonwoven glass-fiber mat.

4. Comply with "NRCA Roofing and Waterproofing Manual," Specification Plate No. 47-3--IMBF.
5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a) Bitec, Inc.
   b) The Celotex Corporation.
   c) Firestone Building Products Company.
   d) GAF Building Materials Corporation.
   e) GS Roofing Products Co., Inc.
   f) The Garland Company, Inc.
   g) Koppers Industries, Inc.
   h) MBTechnology.
   i) Manville Sales Corporation.
   j) Nord Bitumi U.S., Inc.
   k) Siplast, Inc.
   l) Soprema Roofing and Waterproofing, Inc.
   m) Tamko Asphalt Products, Inc.
   n) Tarmac Roofing Systems Inc.
   o) Tremco, Inc.
   p) Tri-ply.
   q) U.S. Intec, Inc.

2.4 MISCELLANEOUS MATERIALS

A. Surfacing Aggregate: Clean, water-worn, opaque gravel complying with ASTM D 1863.

B. Wood Members: Comply with requirements of Division 6 Section "Rough Carpentry" for wood members indicated as roofing system work.

C. Cants: Comply with requirements of Division 6 Section "Rough Carpentry" for cants indicated as roofing system work.

D. Tapered Edge Strips: Rigid perlite board, ASTM C 728.

E. Fasteners: Provide mechanical fasteners for modified bitumen sheet roofing system work, tested by manufacturer for required pull-out strength where applicable and compatible with deck type and roofing products used. Provide either 1 inch diameter nail heads or 1-3/8 inch diameter by 0.012 inch sheet metal caps for nails used to secure base sheets, felts, or insulation boards.

F. Wall and Parapet Flashing: Fry Reglet spring 10K system with SM fastening/receiver system or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

1. Verify that flatness and fastening of metal roof decks comply with installation tolerances specified in Division 5 Section "Steel Deck."
2. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane.
3. Test concrete substrate for excessive moisture by pouring 1 pint of hot bitumen at 400 deg F or EVT on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if test sample foams or can be easily and cleanly stripped after cooling--then substrate is too wet.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet roofing system.

B. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of modified bituminous sheet roofing system work.

C. Insurance/Code Compliance: Where required, install and test modified bitumen sheet roofing system to comply with governing regulations and specified insurance requirements.

D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut offs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed with roofing cement. Remove cut offs immediately before resuming work.

E. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 25 deg F, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable tests. Do not exceed recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 deg F below flash point. Discard

bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Keep kettle lid closed except when adding bitumen.

F. Aggregate Surfacing: Limit temperature of adhesive coat to minimum required for proper embedment of aggregate and maximum that will permit retention of required coating weight based on slope of surface.

G. Bitumen Mopping Weights: For interply mopping, apply bitumen at the rate of 25 lb of asphalt per roof square (plus or minus 25 percent on a total-job average basis).

H. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. Where mopping is applied directly to substrate, tape substrate joints or, where steep asphalt is used, hold asphalt back 2 inches from both sides of the joint.

I. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and any insulation. Provide temporary covering of two plies of No. 15 roofing felt set in full moppings of hot bitumen; remove at beginning of next day's work.

3.3 TEMPORARY ROOF INSTALLATION (IF REQUIRED)

A. Temporary Roofing on Steel Decks: Apply continuous ribbons of Type III hot asphalt to deck at 6 inches o.c.; thickness sufficient to spread to 2 inches in width when insulation is placed. Install one course of perlite board roof insulation in hot asphalt; thickness as required to span deck flutes but not less than 1/2 inch thick. Apply two plies of roofing felts, lapping each felt 19 inches over preceding one, using solid moppings of 20 lb per square (plus or minus 25 percent) of Type III asphalt. Glaze-coat completed surface with Type III asphalt at rate of 20 lb per square (plus or minus 25 percent).

1. Comply with NRCA "Low-Slope Roofing Manual" Specification 10-TR and Diagram TR-SI.

B. Remove temporary roof completely prior to installing permanent roofing system.

3.4 INSTALLING INSULATION

A. General: Comply with insulation manufacturer's instructions and recommendations for the handling, installation, and bonding or anchorage of insulation to substrate.

B. Secure insulation to deck using mechanical fasteners specifically designed and sized for attaching specified board-type insulation to deck type shown. Fasten insulation over entire area of roofing at spacing as required by FM for specified Windstorm Resistance Classification. Run long joints for insulation in continuous straight lines, perpendicular to roof slope with end joints staggered between rows.

C. Two-Layer Installation: Where overall insulation thickness is 2 inches or greater, install required thickness in two layers with joints of second layer staggered from joints of first layer a minimum of 12 inches each direction. Install second layer in full mopping of hot Type III asphalt.

D. Trim surface of insulation where necessary at roof drains so completed surface is flush with ring of drain.

3.5 ROOF MEMBRANE INSTALLATION

A. Shingling Plies: Install membrane with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in proper direction to shed water on each large area of roofing, where slope is significant (over 1/2 inch per foot).

B. Cant Strips/Tapered Edge Strips: Install preformed 45-degree cant strips at junctures of modified bituminous sheet roofing system membrane with vertical surface. Provide preformed, tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

C. Base Sheet: Install one lapped course of base sheet. Mop to non-nailable substrate with steep asphalt, except use special adhesive where indicated.

D. Interply Sheets: Install two (2) intermediate ply sheets, lapped amount indicated to form a continuous, uniform membrane with continuous bitumen moppings between sheets so that ply sheets do not touch.

E. Top Sheet: Install top sheet using hot bitumen at the same rate as interply sheets to form a continuous bonded membrane.

1. Extend modified bituminous sheet to 2 inches above top edge of cant strip and terminate.
2. Nail edges of membrane to wood blocking at perimeter edges of roof prior to installing metal gravel stops/fascias. Space nails at minimum 8 inches on center.

F. Set-On Accessories: Where small roof accessories are set on modified bituminous sheet roofing, set metal flanges in a bed of roofing cement and seal penetration of membrane with bead of roofing cement to prevent flow of bitumen from membrane.

3.6 MEMBRANE FLASHING AND STRIPPING

A. Install modified bituminous flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Install one ply of flashing sheet material by mopping substrate and back of flashing sheet with Type III asphalt and embedding flashing solidly against substrate. Extend flashing a minimum of 6 inches onto modified bituminous sheet roofing.

B. Install modified bituminous stripping where metal flanges are set on roofing. Install one ply of modified bituminous stripping in a continuous mopping of Type III asphalt and extend stripping a minimum of 6 inches out onto the roof membrane.

C. Roof Drains: Set 30 x 30 inch lead flashing sheet in bed of roofing cement on completed modified bituminous roofing sheet. Cover lead sheet with modified bituminous stripping, with stripping extending a minimum of 4 inches beyond edge of lead flashing onto roof membrane. Clamp roof membrane, lead flashing, and stripping into roof drain clamping ring.

D. Allow for expansion of running metal flashing and edge trim that adjoins roofing. Do not seal or bond membrane or modified bituminous flashing or stripping to metal flanges over 36 inches in length.

E. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other Sections.

F. Roof Accessories: Miscellaneous sheet metal accessory items, including piping vents, insulation vents and other devices to be coordinated with modified bituminous roofing system work, are specified in other Sections.

G. Aggregate Surfacing: Promptly after completing modified bituminous roof membrane, flashings, and roof accessories installation, flood-coat roof surface and, while each small area is hot and fluid, cast the following approximate weight of aggregate in a uniform course.

1. Flood Coat: 60 lb per square of Type I or Type II asphalt, except provide steep asphalt where slope exceeds 3/4 inch per foot.
2. Aggregate: Gravel, averaging 400 lb per square.
3. Do not install flood coating of bitumen and aggregate surfacing at edges of roofing until flashing and stripping work has been completed. Delay aggregate surfacing only as long as necessary to substantially complete edge work and any tests.

3.7 INSTALLING PROTECTED ROOF MEMBRANE INSULATION

A. General: Only install the quantity of insulation that can be ballasted or secured within each work day or before the start of unacceptable weather for roofing.

B. Lay insulation boards over deck, with joints tightly butted and end joints staggered. Cut and trim boards to fit snugly at edges, projections, and penetrations.

3.8 PROTECTING ROOFING

A. Protect roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report, with copies to Architect and Owner, describing nature and extent of deterioration or damage found.

B. Repair or replace (as required) deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.9 WALL PARAPET FLASHING

A. Install surface mounted bar with gasketed mechanical fasteners as provided by the manufacturer.

B. Install sealant at locations directed by the manufacturer.

C. Sealant to be as specified in 07900.

END OF SECTION

SECTION 07710 - PRE-MANUFACTURED COPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Furnishing and installing factory fabricated and finished coping/ scupper and downspout systems.

1.2 RELATED WORK

A. 04430 Cavity wall Masonry System

B. 03520 Lightweight insulating Concrete roof Deck System

C. 07527 - SBS Modified Bituminous Sheet Roofing System

1.3 REFERENCES

A. Factory Mutual Research Corporation (FMRC), P.O. Box 9102, Norwood, MA 02082, 617-762-4300.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's product and complete installation data for all materials in this specification.

B. Shop drawings: Show profiles, joining method, accessories location, anchorage and flashing details, adjacent construction interface, and dimensions.

C. Samples: Available on request; sized to represent material adequately.

D. Contract Closeout: Submit Special Warranty and Manufacturer's performance certifications.

E. Installation Guide: The product manufacturer shall provide a written installation guide.

1.5 QUALITY ASSURANCE

A. High performance coping shall be CERTIFIED by the coping manufacturer to meet performance design criteria according to the following test standards:

1. FMRC Loss Prevention Data Sheet I-49 "Perimeter Flashing." The coping product shall be listed in current Factory Mutual Research Corporation Approval Guide approved for Zone 2, 90 PSF uplift.

1.6 QUALITY ASSURANCE

A. All materials shall be delivered in the manufacturer's original sealed, labeled containers.

B. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.

C. Remove protective plastic surface film immediately after installation [if applicable].

1.7 SUBSTITUTIONS

A. Proposals for substitution products shall be accepted only from bidding contractors a minimum of 10 working days before bid due date. The proposed substitution shall meet the performance and quality standards of this specification.

1.8 JOB CONDITIONS

A. Verify that other trades with related work are complete before mounting coping covers.

B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.

C. Refer to the construction documents, shop drawings and manufacturer's installation instructions.

D. Coordinate installation with roof membrane manufacturer's instructions before starting.

E. Observe all appropriate OSHA safety guidelines for this work.

1.9 WARRANTY/GUARANTEE

A. Special Performance/15-Year Umbrella Warranty: Manufacturer shall guarantee that a standard size coping/scupper system, when installed per manufacturer's instructions, will not blow off, leak, or cause membrane failure, even in wind conditions up to 110 mph, or the manufacturer shall replace or repair their materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. W.P. Hickman Company
PO Box 15005
Asheville, NC 28813-0005
Ph: 1-704-274-4000
Fax: 1-704-274-4031

B. Metal - Era, Inc.
N4 W22450 Bluemound Road
Waukesha, WI 53186
Ph: 800-558-2162
Fax: 414-549-6009

C. Architectural Products Co..

2.2 PARAPET COPING SYSTEM

A. Gravel Stop System: Equal to Hickman Safeguard Gravel Stop System and shall be a three-part assembly designed for built-up or modified bitumen roofs; consisting of continuous galvanized steel waterdam, exterior fascia and continuous compression clamp with fasteners. Model shall be extruded aluminum: FX775; FX850; or FX1000 as indicated by the facia dimensions on the drawings.

B. Formed metal fascia shall be extruded aluminum per manufacturer standard; variable metal thickness per size.

C. Fascia: Std. 10'-0" (3048 mm) lengths with matching concealed joint splice plates.

D. Waterdam cant: Std. 10'-0" (3048 mm) length of commercial type G90 galvanized steel.

E. Compression clamp: Formed .032" aluminum of 10'-0" (3048 mm) lengths with prepunched fastener holes at 18" (457 mm) on center.

F. Fasteners: #12 x 1-1/4" (32 mm) corrosion coated screws; hex head and conical neoprene washers.

G. Exterior Fascia finishes: Kynar-500 from manufacturer's standard colors.

2.3 ACCESSORIES

A. Corners, fascia sumps, spillouts, etc. shall be fabricated by the gravel stop manufacturer. Factory fabricated, mitered corners shall have 12" nominal (305 mm) leg lengths.

B. Welded or METAL-LOCK® assembly shall be used to maintain watertight integrity of corners.

C. Provide matching ledgecaps, downspouts, or other special fabrications as detailed.

D. Downspouts to be .024 inch thick aluminum 2" deep X 3" wide minimum (larger if so noted on the drawings) finished to match the pre-manufactured copying. Secure to the wall 4'.0" o.c. with blind, color matched straps.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that gravel stop installation will not disrupt other trades. Verify that substrate is dry, clean and free of foreign matter. Report and correct defects prior to any installation.

3.2 INSTALLATION

A. Submit product design drawings for review and approval to Architect or Specifier before fabrication.

B. Installing contractor shall check as-built conditions and verify the manufacturer's gravel stop details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the manufacturer's installation guide when setting gravel stops.

C. Installer shall furnish mechanical fasteners consistent with manufacturer's instructions, minimum 1-1/2" depth, type 20 roofing nails suitable to the substrates to which being installed.

END OF SECTION

SECTION 07900 - JOINT SEALERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparing sealant substrate surfaces.

B. Sealant and backing.

1.2 REFERENCES

A. ANSI/ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

B. ANSI/ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

C. ASTM C804 - Use of Solvent-Release Type Sealants.

D. ASTM C920 - Specification for Elastomeric Joint Sealants.

E. FS TT-S-01657 - Sealing Compound: Butyl Type.

F. SWI (Sealing and Waterproofers Institute) - Sealant and Caulking Guide Specification.

1.3 SUBMITTALS

A. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and intended use.

B. Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.

B. Applicator: Company specializing in applying the work of this Section with minimum five years documented experience.

C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent curing sealants in enclosed building spaces.

B. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with all Sections referencing this Section.

1.7 WARRANTY

A. Provide five year warranty.

B. Warranty: Include coverage of installed sealants and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

C. In addition, the warranty shall state that all exposed sealants will be guaranteed against any crazing developing on the surface of the material for five years of outdoor exposure, any staining of the adjacent surfaces, by sealant or by primer (yellowing, etc.) caulking, or color change on surface of cured sealant.

1.8 DEFINITIONS

A. Regardless of the terminology used on the drawings the following definitions shall be used to identify and clarify the use of materials specified.

B. "Caulking" may apply only to oil based and other organic materials and work in connection with them. Use in the filling or closing of interior joints where expansion or contraction are of no consideration, and where filling and closing of these interior joints is primarily for appearance, or painting.

C. "Sealant" shall apply to all other conditions, interior and exterior, where either expansion, contraction, resiliency, and waterproof or weather tight construction is a consideration.

PART 2 - PRODUCTS

2.1 SEALANTS

A. Sealant for Exterior Work including roof flashing, perimeter of exterior doors and windows (except as specified otherwise) Single component polyurethane, ASTM C-920 type W, grade NS, class 25, use NT, M, A:

1. Sonneborn: "Sonolastic" NP1
2. Tremco: "Dymonic"
3. Pecora: "Dynatrol" I

B. Polyurethane Sealant for use in masonry control joints and expansion joints and where traffic rated sealant is called for: ASTM C920, Class A, single component, chemical curing, non-staining, non-bleeding, self-leveling type; limestone color; manufactured by:

1. Tremco: "Tremflex" S/L.
2. Sonneborn: "Sonolastic" SL1.
3. Pecora: "Urexpan" NR-201.

C. Butyl Sealant for threshold setting bed: Single component, solvent release, non-skinning, non-sagging, TT-S-01657 type I, manufactured by:

1. Tremco: "Butyl Seal".
2. Sonneborn: "Multi-Purpose Sealant"
3. Pecora: "BC158"

D. Color: Match adjacent surfaces where not painted, or as otherwise selected by the Owner from manufacturers standard colors.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.3 JOINT BACKING

A. Closed cell polyethylene rod, circular or rectangular dimension as indicated or required; or bond-breaking type coated open cell polyurethane rod similar to "Polytite B" by Sandell Manufacturing. Materials shall be free of oil or other staining elements. Oakum and other types of absorptive materials shall not be used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces, and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing surfaces & substrate.

3.2 PREPARATION

A. Clean and prime joints in accordance with manufacturer's instructions.

B. Remove loose materials and foreign matter which might impair adhesion of sealant.

C. Verify that joint backing and release tapes are compatible with sealant.

D. Perform preparation in accordance with ASTM C804 for solvent release, C790 for latex base sealants.

E. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Measure joint dimensions and size materials to achieve required width/depth ratios.

C. Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

D. Install bond breaker where joint backing is not used.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Tool joints as detailed.

3.4 CLEANING AND REPAIRING

A. Clean adjacent soiled surfaces.

B. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of the Supplemental General Conditions.

B. Protect sealants until cured.

END OF SECTION

SECTION 08111 - ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Non-rated, fire rated and thermally insulated aluminum doors and frames.

1.2 RELATED SECTIONS

A. Section 04100 - Mortar: Masonry mortar fill of metal frames

B. Section 08710 - Finish Hardware.

C. Section 08800 - Glazing: Glass for doors.

1.3 REFERENCES

A. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

B. NAAMM CHM - 1 - 74 - Recommended Architectural Specifications for Hollow Metal Doors and Frames

C. NAAMM Hollow Metal Technical and Design Manual - Section 6 - Installation of Doors and Frames.

D. Door Hardware Institute (DHI) - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers and finish.

C. Product Data: Indicate door configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Indicate special installation instructions.

E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Conform to requirements of Federal Specification QQ - A - 250/2c.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01010.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Break seal on-site to permit ventilation.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.9 COORDINATION

A. Coordinate work under provisions of Section 01010.

B. Coordinate the work with door opening construction, door frame and door hardware installation.

PART 2 - PRODUCTS

2.1 DOOR MANUFACTURERS

A. Cline Aluminum Doors, Inc. , Bradenton Fl.

B. Creative Design Doors, Inc.

C. Approved Equal.

2.2 MATERIALS

A. Frame Material: 6063 - T5 alloy.

B. Door Face: 3003 - H14 stretcher leveled aluminum alloy facing.

C. Door Core Construction: 4" wide by 1/8" wall thickness extruded aluminum tube on 4 sides.

D. Door Core Filler: Honeycomb material , 80 lb. per 300 sf. ream 20 % phenolic resin, 7/16 cell size.

E. Door Edges: Beveled edge design aluminum extrusion 6063 - T5 alloy.

F. Face Underlayment: 0.125" tempered hardboard.

2.3 FRAME AND DOOR COMPONENTS

A. Interior and Exterior Frames: Shall be of extruded aluminum 6063 - T5 alloy and a wall thickness of 0.125". Weather stripping shall be aluminum backed wool pile.

B. Doors: Doors shall be 1-3/4" thick. Face shall be one piece of 0.040" , vertically ribbed embossed No. 10 pattern laminated to 0.125" tempered hardboard.

C. Provide masonry anchors as indicated on the drawings.

2.4 FABRICATION

A. Hardware Preparation: Doors shall be prepared for hinges, locks, and bolts. Frames shall be mortised , drilled, and tapped. Use templates provided under Section 08710.

B. Glass: according to Section 08800.

2.5 HARDWARE INSTALLATION

A. Locksets to be installed in accordance with ANSI standards referenced in section 08710 Finish Hardware.

B. Shop install astragals and weather stripping.

2.6 FINISH

A. Frame coating at masonry or concrete surfaces: Fibered asphalt emulsion min thickness 1/16 ".

B. Frame and door shall be anodized in accordance with AAM12G22A31 Class II 204R1 - clear anodized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify wall openings sizes and tolerances are acceptable.

B. Verify substrate.

3.2 INSTALLATION

A. Install doors in accordance with NAAMM and DHI.

B. Coordinate installation of glass and glazing.

C. Install assemblies plumb, level and free of warp or twist.

D. Coordinate installation of doors and frames with hardware specified in Section 08710.

E. Touch-up factory finished doors.

3.3 ERECTION TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.4 ADJUSTING

A. Adjust work under provisions of Section 01700.

B. Adjust door for smooth and balanced door movement.

3.5 CLEANING

A. Clean work in accordance with Section 01700.

B. Provide temporary protection and clean assemblies just prior to acceptance.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished installation from damage during balance of work.

B. Do not permit traffic near finished work without protection to finishes.

END OF SECTION

SECTION 08520 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing aluminum window units as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Standards. Except as otherwise indicated, requirements for aluminum windows, and terminology and standards of performance and fabrication workmanship are those specified and recommended in ANSI/AAMA 101-88.

B. Manufacturer. Provide aluminum window units produced by a single firm, capable of showing prior successful production of units similar to those required.

C. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Kawneer Co., Inc., Basis of Design
2. Efco Corp.

D. Performance and Testing. Except as otherwise indicated, comply with air infiltration tests, water resistance tests and applicable load tests specified in ANSI/AAMA 101 for type and classification of window unit required in each case.

E. Design wind velocity at project site is 120 mph.

F. Testing. Use manufacturer's standard window units that comply with requirements and have been tested in accordance with specified tests, provide certification by manufacturer showing compliance with such tests.

1.3 SUBMITTALS

A. Submit Certificate of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. Include certified test laboratory reports as necessary to show compliance with requirements.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

A. Aluminum Extrusions. Aluminum shall be of commercial quality and of proper alloy for window construction, free from defects impairing strength and/or durability.

1. Where aluminum extrusions are used for a main frame and panel sections, they shall have a minimum ultimate tensile strength of 22,000 psi and a minimum yield strength of 16,000 psi.
2. As an example, commercial alloy 6063-T5 is one of several alloys that will meet the requirements of ANSI/AAMA 101.

B. Fasteners. Aluminum, nonmagnetic stainless steel or other metallic or nonmetallic materials warranted by the manufacturer to be noncorrosive and compatible with the aluminum window members, trim, hardware, anchors and other components of the window units.

C. Reinforcement. Where fasteners anchor into aluminum with screws less than 0.125-inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.

1. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors, Clips and Window Accessories. Depending on strength and corrosion-inhibiting requirements, fabricate units of aluminum, nonmagnetic stainless steel, or hot-dip zinc coated steel or iron complying with ASTM A386.

E. Compression Glazing Strips and Weatherstripping. Unless otherwise indicated, or at manufacturer's option, provide molded neoprene gaskets complying with AAMA SG-1 or with ASTM D2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D2287, or molded expansion neoprene gaskets complying with ASTM C509, Grade 4.

F. Sealant. Unless otherwise indicated for sealants required within fabricated window units, provide type recommended by window manufacturer for joint size and movement, to remain permanently elastic, nonshrinking and nonmigrating.

G. Insect Screens. Provide manufacturer's standard aluminum frames units for each operable sash (vent), with replaceable mesh, sized as required and vinyl retainer spline.

1. Provide plastic-coated glass fiber fused mesh; FS L-S-125.

2.2 WINDOW TYPES (OPERATION)

A. The following paragraphs define the operating arrangements for types of sash (ventilators) required in window units, and specify minimum provisions for each type. The drawings show which panels of each window unit are operable sash, and which are fixed.

B. Commercial Windows. Except as otherwise indicated, provide window units complying with requirements of AAMA Classification for "Commercial" buildings, and the following requirements:

C. Hardware and anchors of aluminum or nonmagnetic stainless steel. Provide galvanized steel anchors only if completely separated (no metal contact) from aluminum window unit.

D. Fabricate units with corners and intersections either mitered and welded or mortised and welded, with hairline joints, no open joints (or leakage), and with exposed surfaces dressed smooth. Butt joints may be used if they meet the requirements of ANSI/AAMA 101.

E. Provide metal thickness as required to withstand performance requirements.

F. Projected Windows. Units containing swing-out, top-hinged or pivoted vent sash as shown, requiring 2 balance-support arms and pivots with friction shoes. Unless otherwise indicated provide cam latch or other standard latching hardware with lever handle or pull. Provide two latches on units over 3-feet-6-inches wide. Provide sash operation which permits inside cleaning of outside glass face. Glazing shall be 1" insulated.

2.3 SPECIAL GRADES/CONSTRUCTION

A. Thermal-Barrier Construction. Fabricate aluminum window units with an integrally concealed thermal barrier, located between extrusions exposed to the exterior or contacting exterior finish materials and window members exposed on interior or contacting interior finish materials, in a manner which eliminate direct metal-to-metal contact between exterior and interior metal members of window units. Provide thermal barriers of low thermal-conductive materials, including polyurethane, polyvinyl chloride, or cellular rubber or plastic. Provide manufacturer's standard construction which has been in use on similar window units for a period of not less than 5-years, and has tested to show adequate strength and security of glass retention.

2.4 FABRICATION AND ACCESSORIES

A. General. Provide manufacturer's standard fabrication and accessories which comply with indicated standards, and are reglazable without dismantling of sash framing, except to extent more specific or more stringent requirements are indicated. Include complete system for assembly of components and anchorage of window units, and prepare sash for glazing except where preglazing at factory is indicated.

B. Sizes and Profiles. Required sizes for window units and profile requirements are shown on the drawings.

C. The details shown are based upon standard details by one or more manufacturers. It is intended that similar details by other manufacturers will be acceptable, provided they comply with the size requirements, and with minimum/maximum profile requirements as shown.

D. Provide water-shed members above side-hinged ventilators and at similar lines of natural water penetration.

E. Provide mullions and cover plates as shown, matching window units, and complete with anchors for support to structure and for installation of window units. Allow for erection tolerances and provide for movements of window units due to thermal expansion and building deflections, in manner indicated.

F. Provide insect screen unit for each operable exterior sash, except as otherwise indicated. Locate screen units on either inside or outside of sash, depending upon window type and as shown. Where possible, design window units and hardware to accommodate screens in a tight-fitting removable arrangement, with a minimum of exposed fasteners and latches, and without necessity of wickets for hardware access. Where wickets are necessary, provide either sliding or hinged type, framed and trimmed for durability during handling, and for tight fit.

G. Fabricate screen frames of either extruded or formed aluminum tubular-shaped members of 0.040-inch minimum wall thickness, with mitered or coped joints and concealed mechanical fasteners, with removable PVC spline-anchor concealing the edge of the screen fabric. Finish frames to match window units, unless otherwise indicated.

2.5 ALUMINUM WINDOW FINISHES

A. Baked-on Enamel Finish. Color shall be white to match existing facility windows.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for the installation of window units, hardware, operators, and other components of the work.

B. Set units plumb, level and true to line, without warp or rack of frames or sash. Anchor securely in place. Separate aluminum and other corrodible subsurfaces from sources of corrosion or electrolytic action at points of contact with other materials.

C. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping, for smooth operation and weathertight closure.

D. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage of protective coatings and finishes. Remove excess glazing and sealant compounds, dirt and other substances. Lubricate hardware and moving parts.

END OF SECTION

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Labor and materials for the installation of finish hardware as specified and scheduled. Should hardware for a particular door not be scheduled it will be furnished with hardware as scheduled for a similar door serving the same function.

1.2 RELATED SECTIONS

A. 08111 Aluminum Doors and Frames

1.3 REFERENCES

A. American National Standards Institute (ANSI)

1. A156.1 - 1981 Butts & Hinges
2. A156.2 - 1983 Bored & Preassembled Locks & Latches
3. A156.3 - 1984 Exit Devices
4. A156.4 - 1986 Door Controls - Closers
5. A156.5 - 1984 Auxiliary Locks & Associated Products
6. A156.6 - 1986 Architectural Door Trim
7. A156.7 - 1981 Template Hinge Dimensions
8. A156.8 - 1988 Door Controls - Overhead Holders
9. A156.13 - 1987 Mortise Locks and Latches
10. A156.15 - 1986 Closer Holder Release Devices
11. A156.16 - 1981 Auxiliary Hardware
12. A156.17 - 1987 Self Closing Hinges & Pivots
13. A156.18 - 1987 Materials & Finishes
14. A117.1 Accessibility Guidelines

B. Door and Hardware Institute

1. Recommended locations for Builders Hardware for standard steel doors and frames.
2. Recommended location for Builders Hardware for custom steel doors and frames.

C. National Fire Protection Association

1. NFPA 80 Fire Doors and Windows
2. NFPA 101 Life Safety Code
3. NFPA 105 Smoke and Draft Control Door Assemblies

D. South Florida State Building Code

E. ANSI A115 Specifications for Steel Door & Frame Preparation for Hardware.

1.4 DEFINITIONS

A. "Finish Hardware" and "Builders Hardware" include items known commercially which are required for swinging and sliding doors.

1.5 SUBMITTALS

A. Product Data: Submit detailed finish hardware schedule in accordance with Division 1 "Submittals". Include all information necessary to show compliance with specifications. Schedule will be complete showing type, manufacturer's name, product number, size, finish, fastenings, degree of control and hand for each item required. Include complete schedule of keying system.

B. Samples: Submit a sample of each type of finish hardware that is proposed for project. Approved samples may be used on project.

C. Templates: Furnish Templates required for fabrication of related products within seven days of receipt of approved submittals.

D. Certification: If requested by architect, submit factory certification that hardware proposed meets the requirements of this specification.

1.6 QUALITY ASSURANCE

A. Manufacturer: Obtain each type of hardware from a single manufacturer.

B. Supplier: A recognized architectural hardware supplier who has been furnishing hardware for a period not less than five years.

C. Fire Rated Openings: Provide hardware for fire-rated openings that comply to NFPA 80 and local building codes. Provide hardware which has been tested and carries a label attesting its' fire rating for types and sizes of doors required.

D. All hardware shall comply with applicable requirements for handicapped accessibility.

1.7 DELIVERY, STORAGE AND HANDLING

A. Package and deliver hardware items separately and mark each item to correspond with heading number on hardware schedule. Mark door numbers on locksets.

B. Include necessary instructions, templates and fasteners for proper installation.

C. Inventory hardware jointly with hardware supplier's representatives to assure that the count is correct.

D. Check hardware delivery invoices against approved schedule to assure that amounts received coincide with approved schedule. If discrepancies are found, report them to the hardware supplier within 72 hours of receipt of goods.

E. Provide secure lock-up for hardware delivered to the project site. Control handling and installation of hardware items. Assure that work will not be delayed by hardware losses.

1.8 WARRANTY

Provide manufacturer's standard warranty on all materials for a period of not less than one year from building acceptance. Provide a minimum five year warranty on door closers.

1.9 MAINTENANCE

Furnish a complete set of specialized tools and maintenance instructions to owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Catalog numbers of the manufacturers listed in column one are to establish minimum quality. Manufacturers listed in column two and three are the only approved substitutes. Other manufacturers seeking approval will do so in writing as per the supplementary general conditions and shall list exact catalog numbers, descriptions and supply samples if requested.

ITEM	COLUMN 1	COLUMN 2	COLUMN 3	
Locksets	Corbin	Russwin	Yale	Sargent
Deadbolts	Corbin	Russwin	Yale	Sargent
Exit Devices	Corbin	Russwin	Yale	Sargent
Closers	Corbin	Russwin	Yale	Sargent
Overhead Stops/ Holders	Corbin	Russwin	Yale	Glyn Johnson
Stops	BBW	Ives	Rockwood	
Flat Goods	BBW	Ives	Rockwood	
Thresholds	Pemko	Reese	Zero	
Weatherstrip	Pemko	Reese	Zero	
Hinges	Stanley	McKinney	Hager	

2.2 SCREWS AND FASTENERS

A. Provide concealed fasteners where possible. Exposed fasteners will be finished to match items fastened.

B. Provide Phillips flat-head screws accept as specified otherwise.

C. Provide necessary expansion shields, toggle bolts and lead shields to attach hardware to substrate as required.

D. Provide thru bolts for closers, overhead holders, and surface leaves of hinges.

2.3 HINGES

A. ANSI 156.1 - 1981, Type A8133 furnish on all doors except as listed in section 2.3 B & 2.3 C.

Stanley	F179
McKinney	T2714
Hager	1279

B. ANSI 156.1 - 1981, Type A8112 Furnish on all doors with closer, all fire rated doors, all hollow metal doors and all solid core wood doors over 36" in width.

Stanley	FBB179
McKinney	TB2714
Hager	BB1279

C. ANSI 156.1 - 1981 Type A5112 Furnish on all exterior doors.

Stanley	FBB191
McKinney	TB2314
Hager	BB1191

D. Provide 4-1/2" x 4-1/2" Hinges for doors up to 36" in width. For doors over 36" in width provide 5" x 4-1/2" hinges.

E. Provide quantity of hinges per leaf as follows:

1. Doors up to 90 inches in height - 3 hinges.
2. Doors over 90 inches and less than 120 inches - 4 hinges.

F. Provide non-removable pins for out-swing exterior doors and out-swing corridor doors.

2.4 BORED LOCKSETS - HEAVY DUTY - MARINE USE

A. ANSI 156.2 - 1983, Series 4000. Grade 1 with non-ferrous components, infunctions as scheduled.

Yale	5500 series, CA knob
Sargent	9-line with OB knob

B. Provide with minimum 2-3/4" backset.

C. Provide knurling of knobs where required by code.

2.5 EXIT DEVICES

A. Vertical Rod Type Devices:

Corbin/Russwin	ED5400 series with D7 Trim
Yale	7200 series Type 5 with 500 trim and AR lever
Sargent	8700 series with ETA escutcheon trim - function 13

B. Provide rated exit devices for all listed fire doors.

2.6 DOOR CLOSERS

A. ANSI A156.4 - 1986, Type C02000 Grade 1 with optional feature PT4H. Closer body must be manufactured from cast iron.

Corbin/Russwin	DC2000 series
Yale	400 series
Sargent	1250 series

B. Provide hold-open and delayed action as scheduled.

C. Provide parallel arm bracket with all closers to allow maximum versatility in mounting.

D. Provide with hex nuts and bolts.

E. Where used in conjunction with overhead holders, closers will be furnished with proper brackets for installation.

2.7 OVERHEAD STOPS/HOLDERS

A. ANSI A156.8 - 1988, Type C14500 Grade 1.

Corbin/Russwin	DH5200 series
Glynn Johnson	GJ90M series

B. Provide with hex nuts and bolts.

2.8 DOOR STOPS: ANSI A156.16 - 1981

A. Wall Stops: Type L02251

Builders Brass Works	WC12X
Ives	406-1/2
Rockwood	409

B. Floor Stops - Interior: Type L02141

Builders Brass Works	8061X
Ives	436
Rockwood	1210

C. Floor Stops - Exterior: Type L02131

Builders Brass Works	121X
Ives	444
Rockwood	471

2.9 FLUSH BOLTS: ANSI A156.16 - 1981, Type L04201

A.

Builders Brass Works	5021
Ives	458
Rockwood	3917

B. Provide extended top rod where door height exceeds 7'0".

C. Provide dust proof strike for bottom bolt; coordinate-ordinate with sill condition.

2.10 PROTECTIVE PLATES: ANSI 156.6 - 1986, J100 Series

A.

Builders Brass Works	37 series
Ives	8400 series
Rockwood	

B. Height, Armour Plate 40"
Kickplate 8"
Mop Plate 4"

C. Width, 2" Less door width. Where special conditions exist such as surface mounted vertical rod exit devices shorten plat to allow for installation of hardware.

D. Thickness, 0.50"

2.11 DOOR EDGE PROTECTION: A156.6 - 1986, Type J204 - J206

A. Builders Brass Works Type A
Type 300 or 301

B. Height, 42"

C. Thickness, .050"

D. Provide with cutouts for hardware and protective plates scheduled.

2.12 THRESHOLDS

A.

PEMKO	2005AV
Reese	483AV
Zero	564

B. Provide lead expansion shields and machine screws for masonry application.

2.13 WEATHERSTRIP

A.

PEMKO	303AV
Reese	807A
Zero	328

B. Provide natural aluminum finish.

2.14 SILENCERS

A. Provide silencers for all frames not scheduled to receive Weatherstrip. Furnish Glynn-Johnson Type 64 or 65.

B. Provide 3 silencers for single doors and 2 silencers for pairs of doors.

2.15 FINISHES

A. Hinges: Ferrous - US26D

B. Hinges: Non-Ferrous - US32D

C. Lockset & Related Trim: US32D or US26D

D. Exit Devices: US32D or US26D

E. Closers: Enamel to match

F. Flat Goods: US32D

G. Thersholds & Weather-strips - Natural Aluminum

2.16 KEYING

A. All locksets will be keyed into a grandmaster or masterkey system new or existing.

B. All locksets will have a construction masterkey feature which permits voiding of construction keys without cylinder removal.

C. No keying will be performed until receipt of approved keying schedule.

D. Furnish
6 Construction Masterkeys
4 Grandmaster Keys
4 Master Keys
3 Keys per Lock
6 Keys per Keyed alike group

E. Send permanent keys directly to Owner via registered mail.

F. Assist Owners personally in voiding of construction Masterkey.

2.17 KEY CONTROL

A. Key Cabinet: Provide key control system with capacity of 150% of the total number of keys supplied. The system will include printed key gathering envelopes, key tags with self locking key clip, key receipts and receipt holders and a three part visible card index.

B. Install as advised by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all doors, frames and related items for conditions that would prevent proper application of finish hardware.

B. Do Not Proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Securely install finish hardware in accordance with schedule and templates furnished with hardware.

B. Install mortised hardware flush with adjacent surfaces.

C. Install locksets, closers and trim after finish painting.

D. Locate hardware in accordance with the Door and Hardware Institutes' "Recommended Locations For Builders' Hardware", unless noted otherwise.

E. Test and adjust hardware for quiet, smooth operation. Adjust handicapped accessible closers to meet required opening force per governing code.

F. At final completion, properly tag and identify keys and turn over to Owner.

3.3 FINISH HARDWARE SCHEDULE

A. Furnish each opening with hardware items scheduled in hardware sets. Furnish size, type, finish and quantity as specified in Part II of this specification. Furnish specific function or component as scheduled below, or as required to function with specific door details.

B. Hardware Schedule:

HW1
1 ½ PR Butts
1 Threshold
2 Kick plates
1 Lockset – classroom function
1 Closer
1 Weatherstripping kit

HW2
3 PR Butts
1 Threshold (continuous)
4 Kick plates
1 Vertical rod exit device
1 Set head and foot bolts
1 Chain restraint
1 Closer
(Equipment exit device and head bolts for removable horizontal mullion swing side of door)

HW3
3 PR Butts
1 Threshold (continuous)
4 Kick plates
1 Lockset – storeroom function
1 Set head and foot bolts
1 Closer
1 Chain restraint

HW4
1 ½ PR Butts
2 Kick plates
1 Lockset - storeroom function
1 Closer

HW5
1 ½ PR Butts
2 Kick plates
1 Vertical rod exit device
1 Threshold
1 Closer
1 Weatherstripping

HW6
1 ½ PR Butts
1 Latchset passage
1 Closer

HW7
3 PR Butts
1 Threshold (continuous)
4 Kick plates
1 Lockset – classroom
1 Set head and foot bolts
1 Closer
1 Chain restraint

END OF SECTION

SECTION 08800 - GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Glass, plastic and glazing for sections referencing this section for Products and installation.

1.2 RELATED SECTIONS

A. Section 07900 - Joint Sealers: Sealant and back-up material.

B. Section 08111 - Aluminum Doors and Frames.

C. Section 08520 - Aluminum Windows.

1.3 REFERENCES

A. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

B. ASTM C669 - Glazing Compounds for Back Bedding and Face Glazing of Metal Sash.

C. ASTM C804 - Use of Solvent-Release Type Sealants.

D. ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C920 - Elastomeric Joint Sealants.

F. ASTM C1036 - Flat Glass.

G. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

H. ASTM C1172 - Laminated Architectural Safety Glass.

I. ASTM E84 - Surface Burning Characteristics of Building Materials.

J. ASTM E283 - Test Method For Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.

K. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

L. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.

M. ASTM E576 - Test Method For Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.

N. ASTM E773 - Test Method for Seal Durability of Sealed Insulating Glass Units.

O. ASTM E774 - Sealed Insulating Glass Units.

P. FGMA - Glazing Manual.

Q. FGMA - Sealant Manual.

R. Laminators Safety Glass Association - Standards Manual.

S. SIGMA - Sealed Insulated Glass Manufacturers Association.

1.4 PERFORMANCE REQUIREMENTS

A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:

1. In conjunction with materials described in Section 07900.
2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
3. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Size glass to withstand dead loads and positive and negative live loads acting normal to plane of glass as calculated in accordance with the Southern Building code as measured in accordance with ASTM E330.

C. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.5 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 6 x 6 inch (of insulating glass) in size, exampling glass units, coloration and design.

1.6 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

B. Manufacturer's Certificate: Certify that sealed insulated glass, meets or exceeds specified requirements.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 WARRANTY

A. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

B. Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

PART 2 - PRODUCTS

2.1 FLAT GLASS MATERIALS

A. Manufacturers:

1. PPG
2. LOF
3. Ford
4. Or approved equal.

B. Tempered Glass (Type FG-B): Fully tempered minimum 1/4 inch thick.

2.2 SEALED INSULATING GLASS MATERIALS

A. Manufacturers:

1. PPG
2. LOF

3. Globe Amerada
4. Or approved equal.

B. Insulated Glass Units: ASTM E774 and E773; double pane with aluminum spacer and dehydrated space. Spacer shall be roll-formed with slightly bent or tightly soldered joints to completely seal periphery and eliminate moisture and hydrocarbon vapor transmission into air space. Primary seal shall be compressed polyisobutylene and the secondary seal shall be specially formulated silicone.

1. Glass thickness: 3/16"
2. Overall thickness: 3/4" unless noted otherwise.
3. Tint (light reducing): Class 3 tinted, Quality q3-glazing select, color as selected from manufacturer's standard palette. (ASTM C1036).
4. Tempered.

C. Edge Seal Construction: Aluminum, mitered and spigoted corners.

D. Edge Seal Material: Black color.

2.3 GLAZING COMPOUNDS

A. Manufacturers:

1. Tremco.
2. Sonneborne.
3. Pecora.
4. Or approval equal.

B. Sealant: Elastomeric conforming to ASTM C920, Type S or M, grade NS, Class 12.5, use G, of type chemically compatible, and as recommended by window and isolated glass manufacturers.

2.4 GLAZING ACCESSORIES

A. Setting Blocks: ASTM C864 Option II Silicone, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: ASTM C864 Option II Neoprene Silicone, 50 to 60 Shore A durometer hardness, minimum 3 inch long x one half the height of the glazing stop x thickness to suit application , self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; width as recommended by glazing manufacturer for application.

D. Glazing Splines: ASTM C864 Option II, Resilient silicone extruded shape to suit glazing channel retaining slot; black color.

E. Glazing Clips: Manufacturer's standard type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealant in accordance with manufacturer's instructions.

3.3 INSTALLATION - EXTERIOR WINDOWS

A. Glaze windows in accordance with manufacturer's recommendations to achieve performance called for in Section 08520. Consult aluminum window system manufacturer and glazing compound and accessory manufacturer.

3.4 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.5 MANUFACTURER'S FIELD SERVICES

A. Glass and glazing product manufacturers to provide field surveillance of the installation of their Products.

B. Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.7 PROTECTION OF FINISHED WORK

A. Section 01700 - Contract Closeout: Protecting installed work.

B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09220 - POLYMER MODIFIED CEMENT PLASTER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Stucco finishes.
2. Acrylic-based finishes.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel studs and joists.
2. Division 6 Section "Rough Carpentry" for wood framing and furring.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each product specified.

C. Samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units at least 2 inches square showing the full range of colors, textures, and patterns available for each type of finish indicated.

1. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
2. Include similar Samples of material for joints and accessories involving color selection.

D. Samples for verification in units at least 12 inches square of each type of finish indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

E. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

1.4 QUALITY ASSURANCE

A. Mockups: Prior to installing plaster work, construct panels for each type of finish and application required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Engineer.
2. Erect mockups 48 by 48 inches by full thickness in presence of Engineer using materials, including lath, support system, and control joints, indicated for final Work.
3. Notify Engineer 7 days in advance of the dates and times when mockups will be constructed.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Engineer's approval of mockups before start of plaster Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed portland cement plaster Work.

    a. When directed, remove mockups from Project site.

B. Install products from only one manufacturer or products recommended from the factory for incorporation in the system configuration.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.6 PROJECT CONDITIONS

A. Environmental Requirements, General: Comply with requirements of manufacturer for environmental conditions before, during, and after plaster application.

B. Cold-Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

C. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

D. Exterior Plaster Work: Do not apply plaster when ambient temperature is below 40 deg F .

E. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acrylic-Based Finishes:

a. Bonsal: W.R. Bonsal Co.
b. Dryvit Systems, Inc.
c. Sto Industries.
d. Thoro System Products.

2.2 ACCESSORIES

A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.

2.3 PLASTER MATERIALS

A. Surface Conditioner: Acrylic modifed surface conditioner equal to STO-Plex W.

B. Job-Mixed Finish-Coat Cement: Polymer modified cement based fiber reinforced stucco equal to STO-Leveler.

C. Cement Color: Gray.

D. Acrylic-Based Finish Coat: Factory-mixed formulation of silicone modified acrylic elastomeric membrane equal to STO-Silicolastic. (9-10 perm rating)

2.4 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable.

B. Acid-Etching Solution: Muriatic acid (10 percent solution of commercial hydrochloric acid) mixed 1 part to not less than 6 nor more than 10 parts water.

2.5 PLASTER MIXES AND COMPOSITIONS

A. General: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.

B. Factory Leveling Coat: Add water only; comply with finish coat manufacturer's written instructions.

C. Acrylic-Based Finish Coat: Apply material as factory packaged; do not add other ingredients; comply with manufacturer's written instructions.

2.6 MIXING

A. Mechanically mix cementitious and aggregate materials for materials to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 PREPARATIONS FOR PLASTERING

A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.

B. Etch concrete and concrete unit masonry surfaces indicated for direct plaster application. Scrub with acid-etching solution on previously wetted surface and rinse thoroughly with clean water. Repeat application, if necessary, to obtain adequate suction and mechanical bond of plaster (where dash coat, bonding agent, or additive is not used).

C. Apply bonding agent on concrete and concrete unit masonry surfaces indicated for direct plaster application; comply with manufacturer's written instructions for application.

D. Surface Conditioning: Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application, except where a bonding agent has been applied. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

3.2 PLASTER APPLICATION

A. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.

B. Do not use excessive water in mixing and applying plaster materials.

C. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed at any location on surface.

D. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

E. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated.

F. Corners: Make internal corners and angles square. Finish external corners flush with abutting materials

G. Number of Coats: Apply plaster of composition indicated, to comply with the following requirements:

1. One Coat of Finish-Coat Cement over:

   a. Concrete unit masonry.
   b. 1/8" minimum to ¼" maximum thickness.

2. Two coats of Acrylic Based Finish Coat over:

   a. Finish-Coat Cement
   b. Total DFT 15-17 Mils.
   c. Color to match existing plaster finish.

3. Trowel-Textured Finish: Apply finish coat with hand-troweled-textured finish matching existing plaster finish and sample panel.

H. Cure plaster base and finish coats in compliance with manufacturers recommendations.

3.3 CUTTING AND PATCHING

A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.4 CLEANING AND PROTECTING

A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 09900 - PAINTING AND COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes furnishing all plant, labor, materials and equipment required to complete the painting and coatings as indicated on the Drawings and in these specifications.

B. Surface preparation, paint and coatings materials, and their application shall be as recommended by the coating manufacturer and approved by the Engineer. The Contractor shall take all health and safety precautions necessary to prevent accidents during the storage, handling, application, and drying of any of the coatings described.

C. Paints and coatings used to furnish the surfaces of structures or vessels which come into contact with potable water shall meet the applicable requirements of the County Health Department and the State Department of Environmental Protection or other regulatory agencies having jurisdiction.

D. Related Work Specified Elsewhere:

1. Section 09902 - Pipe Painting

1.2 QUALITY ASSURANCE

A. The Contractor is responsible for a satisfactory paint application which will adhere without peeling, flaking, blistering or discoloration. Before application of any painting materials, the Contractor shall submit a letter of Certification from the manufacturer of the materials selected for the application proposed.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are limited to the following:

1. Ameron - Corrosion Control Division
2. Carboline Company
3. Glidden - Durkee Division of SCM Corporation
4. Indurall Coatings, Inc.
5. Koppers Company, Inc.
6. Mobil Chemical Company
7. Porter Coatings - Division of Porter Paint Company
8. Royston Laboratories, Inc.
9. Rust-Oleum Corporation
10. Tnemec Company, Inc.

1.3 SUBMITTALS

A. Data Sheets and Color Charts:

1. The full name of each product and descriptive literature shall be submitted along with a list of water and wastewater plants in Florida where the product has been used.
2. Within a minimum of 30 days prior to application of paints and coatings, the Contractor shall submit six sets of color charts and data sheets for selection by the Owner. Before work is commenced, the Contractor shall prepare samples as required until the color and textures are satisfactory to the Owner.
3. Resubmit samples as requested until required sheen, color and texture is achieved.

    a) On 12-inch x 12-inch hardboard, provide two samples of each color and material, with texture to simulate finish conditions. On actual wood surfaces, provide two 4-inch x 8-inch samples for stained wood finish. On concrete Masonry, provide two 4-inch square samples of masonry for each type of finish and color, defining filler, prime and finish coats. On actual wall surfaces and other building components, duplicate painted finish of acceptable samples, as directed by the Engineer.

1.4 DELIVERY AND STORAGE

A. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name, trade name, and label analysis. Store where directed in accordance with manufacturer's instructions. All paint materials used on the job shall be kept in a single place which shall be kept neat and clean. All oily rags, waste or debris shall be removed every night and all precautions taken to avoid the danger of fire.

B. Extra Stock: At the conclusion of the project, the Contractor shall provide the Owner with a minimum of one quart from each 50 gallons or fraction thereof for each paint system used on the project. The paint or coating container shall indicate the applicable paint system as indicated in these specifications.

1.5 JOB CONDITIONS

A. Painting or coating and finishing of interior and exterior items and surfaces, unless otherwise indicated:

1. Paint all new construction and portions of existing facilities disturbed by new construction.
2. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated, colors will be selected by the Engineer from standard colors available for the coatings required.
3. Includes field painting of bare and covered pipes and ducts (including color coding), and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work.

4. Painting shall be done at such times as the Contractor and Engineer may agree upon in order that dust-free and neat work be obtained. Painting shall be done strictly in accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the Engineer.
5. "Shop" painting as referred to defines the paint coat which shall be applied in the shop or plant immediately after manufacturer, fabrication or assembly and prior to shipment to the site of installation. "Field" painting defines the paint coats to be applied at the project site where the structure or equipment is completed, erected, or installed in place as specified.

B. Materials and Application:

1. Obtain painting materials from one manufacturer. Painting materials not obtainable from the prime manufacturer shall be obtained from a second source recommended by the prime manufacturer.
2. There shall be a perceptible difference in shades of successive coats of paint so that the application of successive coats of paint can be properly and uniformly spread and inspected. Pipes, sheet metal ducts and other metal items which are to be installed in inaccessible locations shall be painted prior to installation.
3. Each coat shall be allowed to dry for the period of time recommended by the manufacturer before the next coat is applied.

C. Equipment, Machinery, and Shop Fabricated Items:

1. Pumps, motors, machinery, equipment and other manufactured items shall have surfaces prepared, primed and finish-coated in accordance with the standard practice of the manufacturer. Finish coat colors shall be as approved by the Engineer.
2. Shop-fabricated items and components for field assembly shall have surfaces prepared and shop-primed. Finish coat colors shall be as approved by the Engineer. Items for submerged service shall be field sandblasted and primed per Paint System B-3(1).

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS - ALL SYSTEMS

A. The film thickness designated and/or the number of coats to be applied shall not be decreased and shall be increased where required to meet other manufacturer's recommendations.

B. There shall not be a change from the generic type of coating specified.

C. Manufacturer's recommendations as to which finish coat should be used with a particular primer shall be observed. In all cases, the prime coat and finish coat shall be from the same manufacturer. All paint shall be mildew resistant.

D. Tnemec products are given as examples of painting and coating systems identified in the following paragraphs. The products of other manufacturer's (listed in Paragraph 1.2.B.) may be used as long as they are of the same quality.

2.2 GROUP A - CONCRETE AND MASONRY (NOT IN CONTACT WITH POTABLE WATER)

A. System A-1. For use on above grade interior walls and ceilings and architectural surfaces not subject to high moisture, corrosion, splashing or fumes.

1. Surface Preparation: Level protrusions and remove mortar splatter from all surfaces. Allow new concrete to cure 28 days.

2. First Coat:

   a) Concrete and dense block - Acrylic latex coating, matte finish, minimum 2 mils of Tnemec 6 Tneme - Cryl, or Equal.
   b) Lightweight or porous concrete block surfaces - acrylic latex block filler of sufficient thickness to fill pores and voids, 60-80 S.F./Gal., Tnemec 54-562 Masonry Filler, or Equal.

3. Second Coat:

   a) Concrete and dense block - Acrylic latex coating, semi-gloss type, minimum 2 mils dry thickness of Tnemec 7Tneme - Cryl, or Equal.
   b) Lightweight or porous concrete block surfaces - acrylic latex coating, matte finish, minimum 2 mils DFT, Tnemec 6 Tneme - Cryl, or Equal.

4. Third Coat:

   a) Concrete and dense block - None.
   b) Lightweight or porous concrete block surfaces - acrylic latex coating, semi-gloss type, minimum 2 mils DFT-Tnemec7Tneme - Cryl SG, or Equal.

B. System A-2. For use on above and below grade - interior walls, inside surfaces of tanks, ceilings, and non-traffic slabs, and subject to high moisture, corrosion, splashing or fumes. Use for immersion and non-immersion exposures..

1. Surface Preparation:

   a) Concrete - Brush off blast (if the exposure is severe). Allow new concrete to cure 28 days.
   b) Concrete Block Surfaces - Clean and dry, level protrusions and remove mortar splatter from all surfaces.

2. First Coat:

   a) Concrete - Two-component, polyamide cured epoxy, semi-gloss minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
   b) Concrete Block Surfaces - two component, polyamide cured epoxy masonry filler, 60-80 S.F./Gal - Tnemec Masonry Filler 54-600, or Equal.

3. Second Coat:

   a) Concrete - Two-component, epoxy filler and surfacer used to fill the voids created by brush-off blasting as required - Tnemec 63-1500 Filler & Surfacer, or Equal.
   b) Concrete Block Surfaces - High performance two component polyamide epoxy coating, minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.

4. Third Coat: Concrete and Concrete Block Surfaces - high performance two component polyamide epoxy coating, minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.

C. System A-3. For use on exterior walls above grade to a point six inches below finish grade.

1. Surface Preparation. Fill voids with grout; remove loose protrusions and mortar splatter. Allow new concrete to cure 28 days.

2. First Coat:

   a) Concrete: Acrylic latex coating, matte finish, minimum 2 mils dry thickness of Tnemec 6 Tneme - Cryl, or Equal.
   b) Concrete Block: Acrylic latex block filler of sufficient thickness to fill pores and voids, 60-80 S.F./Gal., Tnemec 54-562 Masonry Filler, or Equal.

3. Second Coat:

   a) Concrete: Acrylic latex coating, semi-gloss type, minimum 2 mils DFT of Tnemec 7 Tneme - Cryl SG, or Equal.
   b) Concrete Block: Acrylic latex coating, matte finish, minimum 2 mils DFT - Tnemec 6 Tneme - Cryl, or Equal.

4. Third Coat:

   a) Concrete: None.
   b) Concrete Block: Acrylic latex coating, semi-gloss type, minimum 2 mils DFT-Tnemec 7 Tneme - Cryl SG, or Equal.

D. System A-4: For use on exterior walls below a point six inches below finish grade.

1. Surface Preparation: Brush-off blast.
2. First Coat: Asphalt base high build coal tar epoxy foundation coating, minimum 6 mils DFT Tnemec 46H-413 hi-Build Tneme - Tar, or Equal.
3. Second Coat: Asphalt base high build coal tar epoxy foundation coating applied at right angles to First Coat, minimum 6 mils DFT Tnemec 46H-413 hi-Build Tneme - Tar, or Equal.

E. System A-5. For use on interior concrete block walls.

1. Surface Preparation: Clean and dry, level protrusions and remove mortar splatter from all surfaces.
2. First Coat: High performance block filler used with acrylic epoxy systems, 60-80 S.F./Gal - Tnemec 130 Enviro fill, or Equal.
3. Second Coat: High performance acrylic epoxy, minimum 4 mils DFT - Tnemec Series 113 H.B. Tneme-Tufcoat, or Equal.

2.3 GROUP B - STRUCTURAL STEEL; CONCRETE AND STEEL TANKS; EQUIPMENT AND PIPING (NOT IN CONTACT WITH POTABLE WATER)

A. System B-1. For use on exposed structural and miscellaneous steel, both interior and exterior - not exposed to corrosion, splash, fumes, or immersion conditions.

1. Surface Preparation: Commercial blast clean per SSPC SP-6.
2. First Coat: One coat of alkyd primer compatible with alkyd finishes, min. 2 mils DFT. If shop coat is damaged, re-prime base areas in field, Tnemec Versare Primer 4, or Equal.
3. Second Coat: One coat of semi-gloss alkyd finish, minimum 1.5 mils DFT - Tnemec 23 Enduratone, or Equal.
4. Third Coat: Same as second coat.

B. System B-2 (1). For use on piping, equipment and tanks - non-submerged, not exposed to splash, spray or corrosive atmosphere.

1. Surface Preparation: Commercial blast bare metal per SSPC SP-6.
2. First Coat: One coat of alkyd primer compatible with alkyd finishes, minimum 2 mils DFT. If shop coat is damaged, re-prime base areas in field, Tnemec Versare Primer, or Equal.
3. Second Coat: One coat of high-gloss alkyd finish, minimum 1.5 mils DFT - Tnemec 2H Hi-Build Tneme-gloss, or Equal.
4. Third Coat: Same as second coat.

C. System B-2 (2). For use on bituminous coated cast iron or steel pipe.

1. Surface Preparation: Hand or power tool clean, scarify or wire brush per SSPC SP-2 and SP-3.
2. First Coat: One coat of polyamide epoxy minimum 3 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat.
4. Third Coat: One coat of polyurethane finish, minimum 2 mils DFT - Tnemec 73 Endura - Shield, or Equal.

D. System B-3.(1) For use on interior walls of steel tanks, piping and equipment, submerged or non-submerged, exposed to spray, splash or corrosive atmosphere, excluding chains and sprockets and similar items. This system shall be used for all materials submerged or in contact with wastewater.

1. Surface Preparation. FIELD sandblast to a near white metal blast cleaning according to SSPC-SP10.
2. First Coat: One coat of polyamide epoxy, minimum 3 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: One coat of high solids coal-tar epoxy coating, minimum 8 mils DFT - Tnemec 46H-413, Hi-Build Tneme-Tar, or Equal.
4. Third Coat: Same as second coat.

E. System B-3.(2) For use on interior walls of concrete tanks, submerged or non-submerged, exposed to spray, splash or corrosive atmosphere, and/or in contact with wastewater.

1. Surface Preparation. Brush-off blast.
2. First Coat: One coat of polyamide epoxy, minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second and Third Coats: Two coats of high solids coal-tar epoxy coating, minimum 8 mils DFT each coat - Tnemec 46H-413, Hi-Build Tneme-Tar, or Equal.

F. System B-3.(3) For all other submerged metals.

1. Surface Preparation. Field sandblast to a near white metal blast cleaning according to SSPC-SP10.
2. First Coat: One coat of high performance polyamide epoxy, minimum 3 mils DFT - Tneme 66 Hi-Build Epoxoline or Equal. If shop coat is damaged, re-prime bare areas in field.
3. Second Coat: One coat of high performance polyamide epoxy coating, minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
4. Third Coat: Same as second coat.

G. System B-4. For use on structural steel, tanks, equipment and piping subject to severe abrasion, corrosive atmosphere, splash or spray, not in contact with wastewater or where a color finish is desired.

1. Surface Preparation: Submerged surfaces, near white metal blast according to SSPC-SP 10. Non-submerged surfaces, commercial blast according to SSPC-SP 6.
2. First Coat: One coat of high performance polyamide epoxy, minimum 3 mils DFT. If shop coat is damaged, re-prime bare areas in field. Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: One coat of high performance polyamide epoxy coating, minimum 4 mils DFT - Tnemec 66 Hi-Build Epoxoline, or Equal.
4. Third Coat: Interior - Same as second coat. Exterior Exposure - One coat of semi-glass polyurethane, minimum 2 mils DFT - Tnemec 73 Endura - Shield, or Equal.

H. System B-5: For use on hollow metal (steel) doors and frames, steel embedments, and steel lintels:

1. Surface Preparation: Pre-primed with alkyd primer.

2. First Coat (touch-up only): Universal alkyd primer, minimum 2 mils DFT, Tnemec 73H Chem-Prime HS, or Equal.
3. Second Coat: One coat of high-gloss alkyd finish, minimum 1.5 mils DFT - Tnemec 2H Hi-Build Tneme-gloss, or Equal.
4. Third Coat: Same as second coat.

2.4 GROUP C - GALVANIZED AND NON-FERROUS METALS

A. System C-1: For use in interior corrosive areas, submerged or non-submerged surfaces, non-potable water applications, galvanized steel and aluminum, including ductwork.

1. Surface Preparation: Solvent cleaning followed by brush-off blast to provide a 1 to 2 mil profile suitable for mechanical adhesion per SSPC-SP1.
2. First Coat: One coat of high performance two component polyamide epoxy, minimum 3 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat, except minimum 4 mils DFT.

B. System C-2: For use in interior dry galvanized steel and aluminum, including ductwork.

1. Surface Preparation: Solvent clean per SSPC-SP1.
2. First Coat: One coat of high performance two compartment polyamide epoxy, minimum 2 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat.

C. System C-3 For use in exterior non-corrosive areas, galvanized steel and aluminum materials, including ductwork.

1. Surface Preparation: Solvent cleaning followed by brush-off blast to provide a 1 to 2 mil profile suitable for mechanical adhesion per SSPC-SP1.
2. First Coat: One coat of polyamide epoxy, minimum 3 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: One coat of polyurethane finish, minimum 2 mils DFT - Tnemec 73 Endura - Shield, or Equal.

2.5 GROUP E - WOOD

A. System E-2. For use on interior surfaces not exposed to moisture or corrosive conditions, exterior wood, and exterior wood trim surfaces.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).
2. First Coat: One coat of white pigmented, non penetrating alkyd-based primer, minimum 2 mils DFT - Tnemec 36 Undercoater, or Equal.
3. Second Coat: One coat of matte finished acrylic coating, minimum 2 mils DFT - Tnemec 6 Tneme - Cryl, or Equal.
4. Third Coat: One coat of semi-gloss acrylic, minimum 2 mils DFT, Tnemec7Tneme - Cryl SG, or Equal.

B. System E-3: For use on interior surfaces exposed to moisture or corrosive conditions.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).
2. First Coat: One coat of high performance polyamide epoxy, minimum 2 mils DFT, Tnemec 66 Epoxoline, or Equal.
3. Second Coat: Same as first coat.

C. System E-5 For use on interior wood paneling and trim.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).
2. First Coat: One coat of white pigmented non-penetrating alkyd based primer, minimum 2 mils DFT, Tnemec 36 Undercoater, or Equal.
3. Second Coat: One coat of semi-gloss acrylic finish, minimum 1.5 mils DFT, Tnemec 23 Endurtone, or Equal.
4. Third Coat: Same as second coat.

2.6 GROUP K - METAL EXPOSED TO CORROSIVE ATMOSPHERE (EXTERIOR OF NEW STEEL TANKS); EXPOSED INTERIOR OF OPEN TOP STEEL TANKS; STRUCTURAL STEEL, EQUIPMENT AND PIPING

A. System K-1. For use on the exterior of new steel tanks and support structures; interior of open top steel tank surfaces - above a point six inches below the water line; and other exposed structural steel, equipment and piping subject to a corrosive atmosphere.

1. Surface Preparation: Commercial blast according to SSPC-SP-6 and clean.
2. First Coat: One coat of high performance two component polyamide epoxy, minimum 3 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat, except minimum 2 mils DFT.
4. Third Coat: One coat of high gloss polyurethane finish, minimum 2 mils DFT - Tnemec 74 (gloss) Endura - Shield.

2.7 GROUP L - WALLS OF CONCRETE TANKS

A. System L-1. For use on exterior of concrete tank walls below a point 6 inches below finish grade.

1. Surface Preparation: Fill voids with grout, remove loose protrusions and mortar splatter, brush-off blast.
2. One coat of high build coal tar epoxy, minimum 16 mils DFT, Tnemec 46 H-413 Hi-Build Tneme-Tar, or Equal.

B. System L-2. For use on the interior of open top concrete tanks to a point 6-inches below liquid level and similarly exposed concrete or masonry surfaces in a corrosive atmosphere.

1. Surface Preparation: Level protrusions, fill tie rod holes with grout, brush blast to 6-inches below water line (if required), hose wash and let dry.
2. First Coat: One coat of high performance two component polyamide epoxy, minimum 4 mils DFT, Tnemec 66 Hi-Build Epoxoline, or Equal.
3. Second Coat: Same as first coat.

2.8 GROUP M - SPECIAL COATINGS

A. System M-1. For use as barrier between dissimilar materials and metals.

1. Prime: None
2. Finish: Asphaltic varnish applied at a rate of at least 2.0 mils dry film thickness

B. System M-2. For use as a primer - sealer for coloring asphaltic and tar surfaces.

1. Prime: None.
2. Finish: Vinyl phenolic sealing coat for the prevention of discoloring of the finish coat. Apply at a rate of at least 2.0 mils dry film thickness.

C. System M-3. For sealing concrete floors where concrete is shown as natural in the Finish Schedules and on all exposed concrete floors where no finish has been shown.

1. Surface Preparation: Mechanically abrade floor to achieve a medium grip sandpaper profile.
2. First Coat: One coat of clear epoxy floor sealer, minimum 10 mils DFT, Tnemec 201 Epoxoprime, or Equal.

2.9 FINISH COAT OVER EXISTING FINISH

A. The required painting shall consist of one coat of the system "Finish Coat" to provide continuity of texture and color over previously painted surfaces.

2.10 THINNING

A. Where thinning is necessary, only the products for the particular purpose and by the manufacturer furnishing the paint shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions and with the full knowledge and approval of the Engineer.

PART 3 - EXECUTION

A. SHOP PAINTING

1. All ferrous an non-ferrous surfaces shall be solvent cleaned before priming. Primer shall be applied in the shop to protect surfaces from rust during shipment and storage.
2. Apply two coats of paint to surfaces which are inaccessible after assembly or erection.

B. FIELD PREPARATION

1. All surfaces to be painted shall be prepared in a workmanlike manner with the objective of obtaining a smooth, clean and dry surface. No painting shall be done before the prepared surfaces are approved by the Engineer.

2. Surface preparation for miscellaneous surfaces to be painted, not specifically covered in these specifications, shall be as recommended by the manufacturer of the paint selected for use and as approved by the Engineer.

3. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

4. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted, or provide surface-applied protection. Reinstall removed items after painting is completed. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes to masonry walls unless moisture content of surfaces are below 12 percent.

C. APPLICATION

1. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.

2. Apply painting and finishing materials in accordance with the manufacturer's directions. Use applicators and techniques best suited for the material and surfaces to which applied.

3. Workmanship for applying paint shall be of professional quality. The painter shall apply each coat at the rate recommended by the manufacturer smoothly without runs, sags, or holidays. If the material has thickened or must be diluted for use with a spray gun, the coating shall be built up to the same thickness as achieved with undiluted materials. In other words, one gallon of paint as originally furnished by the manufacturer shall not cover a great square foot area when applied by spray gun than when applied by brush. Deficiencies in film thickness shall be corrected by the application of additional coat or coats of paint. On masonry, application rates will vary according to the surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint. Before succeeding coats are applied to a surface, the preceding coat shall have been approved by the Engineer.

4. Drying time shall be construed to mean "under normal conditions". 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 placed in service, until paints are thoroughly dry.

TABLE 09900-1

PAINTING SCHEDULE

A. Headworks:

1. Exterior concrete walls below a point 6-inches below finish grade - System A-4.
2. Exterior concrete walls above grade to a point 6-inches below finish grade - System A-3.
3. Concrete top- System M-3.
4. Concrete channels (sides and bottom) - System B-3 (2).
5. Interior concrete walls and ceilings - System A-2.
6. Interior concrete block walls - System A-5.
7. Steel and ductile iron pipe and equipment exposed to spray splash or corrosive atmosphere - System B-3 (1).
8. Hollow metal doors and frames and miscellaneous steel - System B-5.
9. Galvanized and non-ferrous metals in interior corrosive areas - System C-1.

B. Odor Control Facilities:

1. Exterior concrete walls above grade to a point 6-inches below grade - System A-3.
2. Secondary containment concrete tanks and top of concrete equipment pad - System A-2.
3. Steel and ductile iron pipe and miscellaneous equipment - System B-3(1).

C. Flow Splitter Box

1. Exterior concrete walls below a point 6-inches blow finish grade - System A-4.
2. Exterior concrete walls above grade to a point 6-inches below grade and concrete top - System A-3.
3. Interior concrete walls, floors and ceilings - System B-3(2).
4. Interior and aboveground exterior ductile iron and steel pipe and miscellaneous items - System B-3(1).
5. Miscellaneous steel and iron equipment - System B-5.
6. Monorail - System B-4.

D. Flow Equalization Tank:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tanks walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete tank walls (entire height) and floor - System B-3(2).
4. Aboveground ductile iron and steel pipe and equipment on outside of tank - System B-4.
5. Ductile iron and steel pipe and equipment inside tank - System, B-3(1).

E. MCC/Blower Building No. 2:

1. Exterior concrete masonry walls above grade - System A-3.
2. Interior masonry walls - System A-5.
3. Concrete floor - System M-3.

4. Miscellaneous exterior steel items - System B-1.
5. Interior and exterior wood surfaces - System E-2.
6. Miscellaneous interior steel items - System B-2(1).

F. Anoxic/Aerobic Tank No. 3:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete tank walls from floor to top of tanks, including bottom of concrete top slab - System L-2.
4. Top of concrete top slab - System M-3.
5. Submerged steel and ductile iron piping and equipment, or subject to spray and splash - System B-3(1).
6. Aboveground steel and ductile iron pipe and equipment not in contact with wastewater spray or splash - System B-4.

G. Clarifier Flow Splitter Box:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom of wall with pipe penetrations - System L-1.
2. Interior of concrete tank wall with pipe penetrations (entire wall, top to bottom) - System B-3(2).

H. Clarifiers

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete tank walls from floor to top of tanks, including exterior and interior of concrete launder - System L-2.
4. Submerged steel and ductile iron pipe and equipment, or subject to spray and splash, including influent feed well, center platform support, drive platform, sludge collection box, sludge scraper arms, and scum trough- System B-3(1).
5. Steel piping and equipment not exposed to splash and spray, including steel walkway, scum ejector pumps, and exterior steel and ductile iron piping - System B-2(1).

I. Sand Filters:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete walls - System A-2.
4. Aboveground steel and ductile iron equipment, including pipe and supports, backwash equipment, slide gates, not subject to spray or splash - System B-2(1).
5. Submerged steel and ductile iron equipment, or subject to spray and splash - System B-4.

J. Filter Blower/ Compressor Building No. 4:

1. Exterior concrete masonry walls above grade - System A-3.
2. Interior masonry walls - System A-5.
3. Concrete floor - System M-3.
4. Miscellaneous exterior steel items - System B-1.
5. Interior and exterior wood surfaces - System E-2.
6. Miscellaneous interior steel items - System B-2(1).

K. Reclaimed Water Pumps and Piping:

1. Pumps, valves, piping and supports above concrete slab - System B-2(1)
2. Steel pumps parts submerged in water or subject to splash and spray - B-3(1).

L. Final Clarifier Sludge Boxes:

1. Exterior of concrete box walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete box walls above a point 6-inches below finish grade to top - System A-3.
3. Interior concrete box walls (entire height) and floor - System B-3(2).
4. Steel floor stands, ductile iron pipe, weirs, and supports in box - System B-3(1).

M. Return and Waste Activated Sludge Pumps and Piping:

1. Above grade miscellaneous concrete - System A-2.
2. Aboveground pumps, piping, valves, and supports - System B-2(1).

N. Sludge Holding Tanks, Sludge Thickeners, and Thickened Sludge Pumps:

1. Exterior of concrete tank walls below a point 6-inches below finish grade to bottom - System L-1.
2. Exterior of concrete tank walls above a point 6-inches below finish grade to top, concrete columns, bottom of concrete second floor - System A-3.
3. Interior concrete tank walls (entire height) and floor - System B-3(2).
4. Ductile iron and steel pipe supports and equipment inside tank - System, B-3(1).
5. Sludge thickeners - System B-3(1).
6. Thickened sludge pumps, aboveground piping, valves, supports, and equipment outside of tanks - System B-2(1).
7. Top of concrete floors on first and second floors - System M-3.
8. Structural steel beams and columns - System B-1.
9. Miscellaneous wood surfaces - System E-2.

O. Monorail Hoist for Return Activated Sludge Pumps

1. Exterior concrete and concrete masonry walls, columns, beams and foundations aboveground - System A-3.
2. Structural steel columns and beams - System B-1.
3. Steel and iron equipment - System B-2(1).

P. Main Electrical Building:

1. Above grade concrete interior walls and ceilings - System A-1.
2. Exterior concrete and concrete masonry walls aboveground - System A-3.
3. Interior concrete masonry walls - System A-5.
4. Structural and miscellaneous steel, interior and exterior - System B-1.
5. Steel and ductile iron piping and equipment - System B-2(1).
6. Miscellaneous galvanized, aluminum and other non-ferrous metals - System C-1.
7. Miscellaneous interior and exterior wood surfaces - System E-2.
8. Concrete floors - System M-3.
9. Steel frames, embedments, and lintels - System B-5.

Q. New Aerators in Existing Aeration Tanks:

1. Steel and ductile iron equipment subject to submergence, spray, and splash in wastewater - System B-3(1).
2. Concrete walls, ceilings and floors subject to submergence, spray, and splash in wastewater - System B-3(2).
3. Equipment and miscellaneous steel items above concrete top of aeration tank - System B-2(1).

END OF SECTION

SECTION 09902 - PIPE / EQUIPMENT PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes pipe painting and identification as required for this project.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PAINTING AND IDENTIFICATION

A. Exposed piping (except stainless steel) shall be painted. Metal pipe shall be painted System B-2, B-4 or K-1 depending on location. Seal coats shall be used over bitumen coated surfaces as applicable. Plastic pipe shall be painted in accordance with pipe manufacturer's recommendations.

B. General Notes and Guidelines:

1. All color numbers and names herein refer Tnemec to master color card. Colors of specified equal manufacturers may be substituted with approval of the Engineer.
2. Pipe lines, equipment, or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.
3. When color coding is specified or directed by the Engineer, it shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.
4. Description on titles (Abbreviated Code on Pipe/Equipment) to be lettered on pipes or equipment will be black or white to contrast with color of pipes and equipment and shall be stenciled applied, as approved by the Engineer.
5. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange #2016.
6. All safety equipment shall be painted in accordance with OSHA standards.
7. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color.
8. All pipe hangers and pipe support floor standards shall be painted.
9. All conduit shall be painted to match its background surface.
10. Building surface colors shall be painted as scheduled in the Finish Schedule or as selected by the Engineer.

11. Doors and frames shall be painted as scheduled in the Finish Schedule or as selected by the Engineer.
12. Wood casework, frames, doors, etc. shall be finished with urethane as specified except as specifically noted otherwise.

2.2 PAINT COLOR CODE SCHEDULE

Description of Title to be Lettered on Pipes and Equipment	Color of Title Letters	Pipe and Equipment Color	
		Color Name	Color Number
EQUIPMENT			
Conveyors, Sludge Hoppers, & Related Equip.	White	Safety Orange	2016
Bar Screens	White	Safety Orange	2016
Grit Collector Housing and Screw Conveyors	White	Safety Orange	2016
Sump Pumps	White	Safety Red	2008
Bridge Cranes, Monorails and Track	White	Safety Orange	2016
Blowers	Black	Cypress Green	2032
Sluice Gate Operators	White	Safety Orange	2016
Scum Pumps	White	April Green	2034
Pneumatic Ejectors	White	April Green	2034
Air Compressors	White	Palm Green	2033
Waste Sludge Pumps	White	Tan Bark	2012
Air Filter Housings	White	Cypress Green	2032
Chlorine Scales and Trunnnions	Black	Safety Yellow	2025
Effluent Pumps	White	Pantone Purple	522-C
Effluent Reuse Pumps	White	Pantone Purple	522-C
Filter and Effluent Sample Pumps	White	Aquamarine	2037
Flash Mixers	White	Safety Orange	2016
Flocculator Drives	White	Safety Orange	2016
Filter Carriages	White	Safety Orange	2016
Clarifier Bridges and Pumps	White	Safety Orange	2016
Odor Control System and Blowers	Black	Egg Shell	2010
Alum Feed System	Black	Safety Orange	2016
Polymer Feed System	Black	Oriental Yellow	2027
Polymer Tanks and Mixers	Black	Oriental Yellow	2027
Polymer Pumps	Black	Oriental Yellow	2027
Grit Screw Conveyor	White	Safety Orange	2016
Sludge Pumps	White	Antique Brown	2006
Conduit	White	Cypress Green	2032
Conduit Trays	White	Cypress Green	2032
Fans	White	Egg Shell	2010
PIPES			
Raw Wastewater Pipe	White	Light Gray	2050
S. Steel Air Pipe Appurtenances	Black	Silver	Match S. Steel
Scum Pipe	White	April Green	2034
Waste Sludge Pipe	White	Tan Bark	2012
Sump Pump Pipe	White	Safety Red	2008
Chlorine Pipe and Header	Black	Safety Yellow	2025
Effluent Pipe	White	Pantone Purple	522-C

Effluent Reuse Pipe	White	Pantone Purple	522-C
Chlorine Sample Pipe	Black	Safety Yellow	2025
Polymer Pipe	Black	Oriental Yellow	2027
Thickened Waste Sludge Pipe	White	Antique Brown	2006
Cold Water	Black	Azure	2044
Hot Water	Black	Azure	2044
Soil Pipes	White	Light Gray	2050
Waste and Vent Pipes (Interior)	White	Match Background	

A. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be painted on one of the pipes at approximately 30-inch intervals. The name of the liquid or gas should also be painted (stenciled) on the pipe in a contrasting color. In some cases, it may be advantageous to paint arrows indicating the direction of flow.

2.3 PAINTING OF EXISTING STRUCTURES, PIPING, VALVING AND EQUIPMENT

A. Touch up existing structures and equipment where finish has been damaged by new construction.

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 09981 - CEMENTITIOUS COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation, including crack repair, and application of cementitious coating systems to scheduled surfaces.

1.3 PERFORMANCE REQUIREMENTS

A. Provide cementitious coating systems with the following properties as determined by test methods indicated:

1. Compressive Strength: Not less than 4000 psi at 28 days according to ASTM C 109/C 109M.
2. Flexural Strength: Not less than 800 psi at 28 days according to ASTM C 348.
3. Water-Vapor Transmission: Not less than 12.0 perms according to ASTM E 96.
4. Accelerated Weathering: No failure after 5000 hours according to ASTM G 26.

1.4 SUBMITTALS

A. Product Data: For each cementitious coating system specified.

1. Manufacturer's Information: Manufacturer's technical information, including basic material analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for each type of finish coat material indicated.

1. Finish color shall be selected by Owner.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Test Reports: From a qualified independent testing agency indicating compliance of cementitious coatings with requirements indicated based on comprehensive testing within the last two years of current product formulations.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for the Project and with a record of successful in-service performance.

B. Source Limitations: Obtain cementitious coating materials from one source and by a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Manufacturer's stock number and date of manufacture.
3. Contents by volume, for pigment and vehicle constituents.
4. Application instructions.
5. Color name and number.
6. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F . Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

1.7 PROJECT CONDITIONS

A. Temperature Conditions: Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F, unless otherwise permitted by manufacturer's written instructions. Do not apply coatings if ambient or surface temperatures are expected to fall below 45 deg F within 12 hours.

B. Weather Conditions: Do not apply cementitious coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above dew point. Allow surfaces to attain temperature and conditions specified before proceeding with or continuing coating operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the Coating Schedule.

B. Manufacturers Names: The following manufacturers are referred to in the Coating Schedule by use of a shortened version of their names, which are shown in parentheses:

1. W. R. Bonsal Company (Bonsal).
2. Tamms Industries Co. (Tamms).
3. Thoro System Products, Inc. (Thoro).

2.2 CEMENTITIOUS COATING MATERIALS, GENERAL

A. Material Compatibility: Provide crack fillers, cementitious finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Material Quality: Provide the manufacturer's best-quality cementitious coating material. Material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance of proposed substitutions.

C. Colors and Textures: Match colors and textures indicated by reference to manufacturer's standard designations for cementitious coating systems.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with the Applicator present, under which cementitious coating systems will be applied for compliance with application requirements.

1. Notify the Architect in writing about anticipated problems using coating systems specified.
2. Proceed with coating application only after unsatisfactory conditions have been corrected.
3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

1. After completing coating operations in each area, reinstall items removed using workers skilled in trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.

1. Schedule cleaning and coating application so dust and other contaminants from cleaning operations will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to the manufacturer's written instructions for the particular substrate conditions, and as specified.

1. Cementitious Surfaces: Prepare concrete, concrete masonry, and similar surfaces to coated. Remove efflorescence, chalk, dust, dirt, release agents, grease, oil, and similar substances by abrasive or water blasting, followed by a clear-water rinse.

   a) Remove mildew and neutralize surfaces according to the manufacturer's written recommendations before patching materials are applied.
   b) Roughen to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
   c) If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   d) Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in the manufacturer's written instructions.
   e) Remove existing paint residue from substrates that have been previously painted.

2. Crack Repair: Repair cracks according to the manufacturer's written recommendations before coating surfaces.

   a) Cracks Larger Than 1/32 Inch: Cut out static cracks, voids, or honeycombing larger than 1/32 inch and patch with materials recommended by the coating manufacturer. Identify dynamic cracks and treat according to the manufacturer's written recommendations before beginning application.

D. Material Preparation: Carefully mix and prepare materials according to the coating manufacturer's written instructions to achieve a smooth, heavy-batter consistency.

1. Mix the two components in a clean container by hand or with a heavy-duty, slow-speed drill with a mixing paddle. Follow manufacturer's written instructions.
2. After mixing, allow coating material to sit for approximately 10 minutes. Remix before beginning application.
3. Apply material within 40 to 60 minutes of mixing.

3.3 APPLICATION

A. General: Apply cementitious coatings to exposed surfaces indicated. Coating colors, surface treatments, and finishes are indicated in the schedules in the Contract Documents.

1. Colors: Where an item or surface is not specifically mentioned in the schedules, coat with same color as similar adjacent materials or surfaces. If a color is not designated, the Architect will select a color from standard colors available.

B. Application Procedures: Apply cementitious coatings by brush or spray according to manufacturer's written instructions.

1. Dampen substrate of surfaces to receive cementitious coatings one hour before beginning application to prevent surface drag. Immediately before applying coatings, redampen substrate. Substrates shall be saturated surface dry at time of application.
2. Brushes: Use tampico or masonry brushes best suited for material being applied.
3. Spray Equipment: Use spray equipment recommended by the manufacturer for material and texture required.

C. Minimum Coating Thickness: Apply each material at not less than the manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended by the manufacturer.

1. Number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by the manufacturer.

D. Brush Application: Brush-out and work brush coats into surfaces in an even film, filling all pores and voids at rate recommended by the manufacturer to achieve cured material thickness indicated. Finish coat with smooth, horizontal strokes.

E. Spray Application: Where spray application is used, apply each coat according to the manufacturer's written recommendations to provide the equivalent hiding of brush-applied coats. Follow spray application with a general light brooming of coated surface to impart a slight texture.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when coating operations are being conducted:

1. The Owner will engage the services of a qualified independent testing agency to sample the coating used. Samples of material delivered to the Project site will be taken, identified and sealed, and certified in presence of the Contractor.

2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

   a) Quantitative material analysis.
   b) Compressive strength.
   c) Flexural strength.
   d) Resistance to wind-driven rain.
   e) Water-vapor transmission.
   f) Accelerated weathering.
   g) Impact resistance.
   h) Alkali resistance.
   i) Abrasion resistance.
   j) Mildew resistance.

3. If results show that materials do not comply with requirements, the Contractor may be directed to stop work, remove noncomplying materials, pay for testing, recoat surfaces coated with rejected materials, or remove rejected materials from previously coated surfaces if, on recoating with specified materials, the two coatings are not compatible.

3.5 CLEANING

A. Cleanup: Clean spilled or spattered materials from adjacent surfaces not to be coated, immediately before coating has achieved an initial set. Do not scratch or damage adjacent finished surfaces.

1. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the Project site.
2. Clean tools, brushes, and containers at the end of each workday.

3.6 PROTECTION

A. Protect the work of other trades from damage, whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by the Architect. Leave the work in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.7 COATING SCHEDULE

A. Provide the following cementitious coating systems for substrates indicated:

1. Apply additional coats when undercoats or other conditions show through final coat until cured film is of uniform coating finish, color, and appearance.

B. Above-Grade Concrete and Masonry: Two finish coats with total cured thickness not less than 40 mils.

1. First Coat: Apply polymer-modified cementitious coating material at the rate of 2 lb/sq. yd. to achieve a total cured thickness of 25 mils.

   a) Bonsal: Surecoat.
   b) Tamms: Tamoseal.
   c) Thoro: Thoroseal.

2. Second Coat: Apply cementitious coating material to achieve a total cured thickness of 15 mils.

   a) Bonsal: Primer and Marblesil 1/8 inch thick or as recommended by manufacturer.
   b) Tamms: Tamms Stucco Finish.
   c) Thoro: Thoroseal.

END OF SECTION

SECTION 10200 - LOUVERS AND VENTS

1.1 GENERAL

A. Structural Performance: Provide louvers capable of withstanding the effects of wind and normal thermal movement without evidencing permanent deformation of blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure of 40 lb/sq. ft. acting inward or outward.
2. Thermal Movements: Movements resulting from 100 deg F change in ambient and 180 deg F change in surface temperatures.

B. Submittals: In addition to Product Data, submit the following:

1. Shop Drawings: For louver units and accessories not completely described in Product Data.
2. Samples of each type of metal finish.
3. Product test reports indicating amount of free area and flow rate with filters in place.

C. Field Measurements: Verify louver openings by field measurements before fabrication.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airolite Co.
2. Arrow United Industries.
3. Construction Specialties, Inc.
4. Hart & Cooley, Inc.; Reliable Metal Products Division.
5. Ruskin Manufacturing; Tomkins Industries, Inc.
6. Swartwout.

B. Materials: As follows:

1. Aluminum Extrusions: ASTM B 221 alloy 6063-T5 or T-52.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, 0G90 zinc coating, mill phosphatized.
3. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304.
4. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel. Do not use metals that are incompatible with joined materials.
5. Bituminous Paint: Asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or asphalt emulsion complying with ASTM D 1187.

C. Fabrication, General: Fabricate louvers to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.

1. Join frame members to one another and to fixed louver blades with fillet welds concealed from view.
2. Join frame members to one another and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer.

D. Fixed, Extruded-Aluminum, Horizontal Louvers: Provide louvers with extruded-aluminum frames and blades.

1. Structural supports shall be designed to carry a minimum wind load of 40 pounds per square foot. All supports shall be designed in accordane with Section 1205 of the Standard Building code or Section 2306 of the South Florida Building Code.
2. Heads, sills, jambs and mullions are to be one piece structural members constructed of 6063-T52 alloy extruded aluminum. 0.125 inches thick with integral caulking slot and retaining beads. Mullions hsall be sliding interlock type with integral internal drains. Drainable fixed blades shall be minimum 0.081 inches thick with front lip gutter designed to catch and direct water to jamb and mullion drains. Closed cell PVC compression gaskets to be provided between bottom of mullion or jamb and top of sill to insure leak-tight connections.
3. Where shown on the drawings, louvers shall be furnished with operating blades in addition to the fixed blades. Operating blades shall be a minimum of 0.125 inches thick. Pivots shall be 0.50-inch diameter Zarmac alloy pinions ooperating in self-lubricated nylon bearings. Operating Louver blades shall be operated by concealed drive arms at each jamb and assembled with stainless steel shoulder rivets. Drive arms shall be connected by a 0.615-inch minimum diameter torsion bar operating in nylon bearings.
4. All louver blades shall be equipped with jamb gaskets riveted to blade ends. When closed, air leakage through the operative louvers shall not exceed 1.0 CFM per square foot of face area ata wind velocity of 30 MPH.
5. The louvers shall pass 850 FPM free area velocity at a pressure drop of less than0.125-inch water gauge. Water penetration shall be less than 0.005 ounces of water per square foot of free area at 850 FPM during standard AMCA 500 test. Submitted data shall also show the 4 feet x 4 feet unit to have a minimum of 7.1 square feet of free area.
6. All louvers shall be furnished with 0.125-inch (3.18mm) mesh, 0.028-omcj (0.71mm) diameter 304 stainless steel wire screen secured within a heavy-duty two piece extruded anodized aluminum frame. The frame shall be mounted on the inside face of the louver and shall be attached by means of self-tapping stainless steel wing screws. Wing screws shall have at least 5/8-inch diameter exposed surface for ease of removing by hand.
7. All fasteners shall be stainless steel or aluminum series 5000 or 6000.
8. All louvers shall have a Dark Bronze Duranodic finish.
9. Louvers shall be equal to fixed blade units manufactured by Construction Specialties, Inc. No. 6157 with 6-inch louvers.

1.3 EXECUTION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

F. Seal around perimeter edge of the louver assembly with sealant as specified elsewhere.

END OF SECTION

SECTION 10522 - FIRE EXTINGUISHERS, CABINETS & ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Cabinets.

C. Accessories.

1.2 RELATED SECTIONS

A. Section 09900 - Painting: Field paint finish.

1.3 REFERENCES

A. NFPA 10 - Portable Fire Extinguishers.

B. UL 299 - Dry Chemical Fire Extinguishers.

C. UL 711 - Rating and Fire Testing of Fire Extinguishers.

1.4 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.

B. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

1.5 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Two copies Operation and Maintenance Data.

B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.7 QUALITY ASSURANCE

A. Provide units conforming with UL 711.

1.8 REGULATORY REQUIREMENTS

A. Conform to NFPA 10 for requirements for extinguishers.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Potter-Roemer Model 7044-A Alta Series, full glazing with 3010 extinguisher.
2. Larsen AL-2712-SM, full glazing with MPIO extinguisher, surface mounted.
3. J. L. Industries, Academy Series 1023-F, with Cosmic 10E extinguisher.

2.2 EXTINGUISHERS

A. Dry Chemical Type: UL 299, Cast steel tank, with pressure gage; Class A, B, C; 10 pound.

B. Extinguisher Finish: Stainless steel enamel to red color as selected.

C. Where called for on drawings provide brackets for 20 #APOC extinguisher mounting without cabinet.

2.3 CABINETS

A. Metal: Formed aluminum.

B. Configuration: Semi-recessed type, sized to accommodate accessories.

C. Door Glazing: Plastic, clear, 1/4 inch clear acrylic.

D. Cabinet Mounting Hardware: Appropriate to cabinet.

E. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.

F. Pre-drill for anchors.

G. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

H. Weld, fill, and grind components smooth.

I. Glaze doors with resilient channel gasket glazing.

J. Finishing Cabinet Exterior Trim and Door: Anodized to clear color.

K. Finishing Cabinet Interior: White polyester coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify wall backup for cabinet are correctly installed and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 5'-0" from finished floor to handle of extinguishers.

C. Secure rigidly in place.

D. Place extinguishers in cabinets on wall brackets.

3.3 LOCATIONS

A. Provide four (4) fire extinguishers in the following locations:

1. Electrical Building - Emergency Generator Room Expansion.
2. Electrical Building - MCC Room Expansion.
3. MCC/Blower Building #2 - MCC Room.
4. MCC/Blower Building #3 - MCC Room.
5. MCC/Blower Building #4 - MCC Room.

END OF SECTION

SECTION 11289 - FLOW CONTROL GATE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. There shall be furnished one flow control gate for the new Carrousel aeration basin suitable for installation on the concrete wall as shown on the Drawings. Each mechanism shall be of the handwheel driven gear drive type, with 112.5 degree travel in forward and reverse direction.

B. The equipment furnished for each gate mechanism shall include: stand, gear reducer, rotating shaft, positioning plate/arm and lock pin, guide bearings, flow vane, stops, fasteners and anchor bolts.

C. The equipment's purpose shall be to direct and control the flow from the aeration basin to the anoxic basin in accordance with the process design and Operation & Maintenance instructions for the process.

D. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall be 1/4" minimum thickness and reinforced as required. Stainless steel 303 anchor bolts and 304 fasteners with necessary hex nuts and washers, shall be provided for all parts of the gate assembly.

1.2 REFERENCES

A.	ASTM A36	Structural Steel Specification
B.	ASTM A 303/304	Stainless Steel Bolt Specification
C.	AWS	American Welding Society Current Standards

1.3 QUALITY ASSURANCE

A. Velocity gate including the frame, stem, guides and operator shall be furnished by one manufacturer.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to the following:

1. Rodney Hunt Company
2. Hydro Gate Company
3. EIMCO Process Equipment Company

1.4 SUBMITTALS

A. The Contractor shall submit a complete set of shop drawings of all components furnished in this Section.

B. Shop Drawing Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions, anchor bolt locations, and field connections.
2. Descriptive literature, bulletins, and catalogs of the equipment.
3. Installation, operation, and start-up procedures including lubrication requirements.
4. Total weight of the equipment including the weight of the single largest item.
5. A complete bill of materials for all equipment with the O&M manual. No samples will be required.

1.5 DELIVERY

A. Fabricated assembles shall be shipped fully assembled except for attachment of the gear reducer, stand, shaft and guide bearings. The unit shall be designed to allow adjustment for concrete tolerances of ± 1/2". The unit shall be erected and lubricated in strict accordance with instructions from the manufacturer.

PART 2 - MATERIALS AND EQUIPMENT

2.1 WORM GEAR REDUCER

A. The worm gear operator shall be of heavy duty construction, totally enclosed in a cast iron housing and provided with adequate seals to protect the interior of the housing. The housing shall be designed so that all gears and bearings are grease packed and factory sealed to prevent condensate formation. The gear shall be designed to operate under the full load as applied from the rotating gate. The reducer shall be equipped with a 20-inch stainless steel hand wheel and require no more than 25 revolutions to rotate the gate a full 112.5 degrees in one direction.

B. The gear reducer shall be of helical-bevel design and have the ability to backdrive without locking of the worm.

2.2 GATE COMPONENTS

A. The reducer mechanism shall be fitted to the gate shaft with a sleeve and key for ease of assembly and disassembly.

B. The reducer shall be supported on a steel stand that is anchored to the concrete floor or side wall by cinch type 303 stainless steel anchors. The stand shall be of proper height to allow the operator a convenient grip on the handle for clockwise or counter clockwise turning.

2.3 ROTATING GATE ASSEMBLY

A. Each gate shall be constructed from 1/4" steel plate properly stiffened with rib extensions and end flares. The gate shall include a revolving shaft assembly fixed between three guide bearings mounted to the floor, mid-point and stand. The floor bearing shall be a thrust type alignment bearing, supporting the entire weight of the

unit. The upper guide bearing shall be an integral part of the support stand and shall be mounted just below the worm gear reducer. The center guide bearing shall be mounted just above the water surface on the lower part of the shaft and shall be field aligned after installation of all other components, assuring proper rotational capability.

B. The revolving shaft shall be supported at each end in such a manner that a slight vertical or horizontal misalignment shall not interfere with the smooth operation of the gate. The shaft shall revolve from the turning of the gear unit.

C. The gate shall be designed to operate smoothly under the flow conditions existing in the Carrousel ® aeration basin. The gate shall include a position lock, lock pin with retention chain and shall be adjustable in 22.5 degree increments over a 112.5 degree range. The gate shall include a wall stop bracket, complete with 303 stainless steel wall anchors.

2.4 PAINTING AND SURFACE PREPARATION

A. Unless otherwise noted, all ungalvanized fabricated iron and steel surfaces shall receive a shop-cleaned surface preparation equivalent to SSPC-SP-10 immediately prior to shop-priming. Shop-priming shall consist of one (1) coat of Tnemec 161-1211 Epoxoline primer or equal to 3.0 - 5.0 mils DFT. Touch-up and finish painting shall not be the responsibility of the equipment manufacturer.

B. Gear reducers shall be furnished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The flow control gate shall be installed in accordance with the manufacturer's written recommendations. The Contractor shall be responsible for assuring proper alignment and tolerances as set forth in the installation instructions.

3.2 SERVICE

A. Prior to start up of the equipment, the manufacturer of the flow control gate shall provide the services of a trained, qualified factory service representative for a total of one (1) day for the purpose of inspecting the installation. Each gate shall be checked for lubrication, alignment, and rotation. The representative shall notify the Contractor and Engineer of anything in the installation which might render the manufacturer's guarantee null and void. The manufacturer's representative shall also instruct the operating personnel as to the proper method of operation and the recommended lubrication and maintenance procedures.

B. Inspection by a service representative of the manufacturer who is not a direct, full-time employee of the manufacturer will not be acceptable.

END OF SECTION

SECTION 11290 - SLIDE GATES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work shall include furnishing and installing rising stem, aluminum slide gates. Each complete with integral frame, stem, stem guides and operator. The requirements for gates, with corresponding operators, has been summarized in the Gate Schedule on the Drawings.

B. Location shall be as shown on the Drawings.

C. Related Work Specified Elsewhere:

1. Section 05500 - Metal Fabrication
2. Section 09900 - Painting and Coatings

1.2 QUALITY ASSURANCE

A. Slide gate including the frame, stem, guides and operator shall be furnished by one manufacturer.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Rodney Hunt Company
2. Hydro Gate Corporation
3. Washington Aluminum Company
4. Whipps, Inc.
5. Or Equal

1.3 SUBMITTALS

A. Submit shop drawings, fully dimensioned with installation details.

PART 2 - MATERIALS AND EQUIPMENT

2.1 SLIDE GATE

A. The slide gates, where shown on the Drawings, shall be fabricated aluminum self-contained type with the disc arranged to lower or raise to open and with the guides designed to mount on the face of or embedded in concrete. All parts of the gates shall be a minimum thickness of 1/4-inch.

B. The guides shall be of extruded aluminum incorporating a dual slot design. The primary slot shall accept the plate of the disc and the secondary slot will be sufficiently wide to accept the reinforcing ribs of the disc. The guides shall be designed for maximum rigidity, shall have a weight of not less than three pounds

per foot and will be provided with holes for anchor bolts every 18-inches for face mounted units or embedding key ways for embedded units. Guides shall extend beneath the opening a sufficient amount to support the disc in the fully down or open position for downward opening gates. The guides shall be furnished with high density polymer seats for ease of operation. The seat material shall be made of ultra-high molecular weight polymer having an intrinsic viscosity of at least 14. The seats shall be firmly welded in a dovetail groove in the frame and shall be placed on both sides of the gate disc. The seats shall extend up to the top of the two vertical guides above the operating floor.

C. An aluminum angle shall be welded to the guides across the invert of the opening on face mounted gates and up both sides of all gates. A hollow bulb J-seal shall be attached to this angle with stainless steel strips and attaching bolts. The seal shall be arranged so that it will deflect a minimum of 1/16-inch.

D. The invert of embedded unit frames shall have an angle welded to the lower ends of the guides to form a seating surface for a resilient seal mounted on the disc or may install the rubber seal in the bottom frame.

E. Where guides extend above the operating floor, they shall be sufficiently strong so that no further reinforcing will be required. Where required, the yoke to support the operating benchstand shall be formed by two angles welded at the top of the guides to provide a one piece rigid frame. The arrangement of the yoke shall be such that the disc and stem can be removed without disconnecting the yoke.

F. Disc: The disc or sliding member shall be of aluminum plate reinforced with ("U" shaped) aluminum extrusions welded to the plate not more than 16-inches apart. The disc shall not deflect more than 1/360 of the span of the gate under the design head. Reinforcing ribs shall extend into the guides so that they overlap the seating surface of the guide. A specially shaped resilient seal shall be mounted on the bottom of the disc to provide flush-bottom closure. The shape of the seal shall produce a seating surface having a minimum width of 3/4-inch, and the seal shall extend beyond the seating surface of the frame. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners.

G. Stem: The operating stem shall be Type 304 stainless steel designed to have an L/r of less than 200 and to withstand in compression at least twice the rated output of the benchstand. The stem shall be connected to the disc by means of a bolted connection. The rising stem shall be provided with a clear butyrate plastic stem cover with mylar positioning markers.

H. All necessary attaching bolts and anchor bolts shall be 304 stainless steel and shall be furnished by the slide gate manufacturer.

I. Operator: Unless noted otherwise on the Drawings, operation of the gate shall be by means of a handwheel or crank operated benchstand mounted on the yoke of the gate. The benchstand shall be fully enclosed, equipped with roller bearings above and below the operating nut. On a crank operated benchstand, the pinion shaft shall be cadmium plated and supported on roller bearings. A mechanical seal shall be provided around the pinion shaft where it extends from the hoist enclosure.

J. Both crank-operated and handwheel-operated benchstands shall be designed to operate slide gates with an effort not exceeding 40 lbs. and shall be designed to withstand, without damage, at least a 100 lb. effort.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the drawings and the manufacturers instructions.

3.2 FIELD TESTING

A. The slide gate shall be tested by operating it to fully open and back to fully closed.

END OF SECTION

SECTION 11291 - SLUICE GATES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work shall include furnishing and installing flanged back rising stem, cast iron sluice gates. Each complete with integral frame, wall thimble, stem, stem guides and lift.

B. Location shall be as shown on the Drawings.

C. Requirements shall be as shown in the Gate Schedule on the Drawings.

D. Related Work Specified Elsewhere:

1. Section 05500 - Metal Fabrication
2. Section 09900 - Painting and Coatings

1.2 QUALITY ASSURANCE

A. Sluice gate including the frame, stem, guides and crank-operator shall be by one manufacturer.

B. The sluice gate shall conform to AWWA C501.

C. Available Manufacturer: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Rodney Hunt Company
2. Hydro Gate Corporation
3. Waterman
4. Or Equal

1.3 SUBMITTALS

A. Submit fully dimensioned shop drawings and installation details.

B. Submit manufacturer's Certificate of Compliance with the specified standard.

1.4 WARRANTY

A. The Contractor shall furnish the Owner a full one year warranty for service and parts.

PART 2 - MATERIALS AND EQUIPMENT

2.1 SLUICE GATE

A. Materials used in construction of gates shall be of type best suited for the application and shall conform to the following ASTM Specifications:

1. Frame, slide, wall thimble, pedestal, gear housing, wall brackets, and stem brackets - Cast iron per ASTM A26, Class B
2. Wedges, thrust nut and lift nut - Bronze per ASTM B584, Alloy C86500 or C86700
3. Seating Faces - Bronze, ASTM B21, Alloy C48200
4. Stems and Stem Couplings - Stainless steel, ASTM A276 Type 304
5. Fasteners - Stainless steel, ASTM F593/F594, Alloy group 1
6. Flush Bottom Seal - Neoprene, ASTM D2000
7. Flush Bottom Retainer - Stainless steel, ASTM A276 Type 304

B. Rising stems shall be of the size and length to meet the operating conditions set forth in the Gate Schedule. A clear, butyrate plastic stem cover with mylar position markings shall be provided. Stem material shall be stainless steel, Type 304.

C. Wall thimble, where required, shall be the size and shape shown on the Drawings.

D. Lifts shall be of the handwheel type or enclosed gear type which requires a maximum crank effort of 40-pounds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the drawings, AWWA C501 and the manufacturers instructions.

3.2 FIELD TESTING

A. The sluice gate shall be tested by operating it to fully open and back to fully closed.

B. Leakage: Leakage shall not exceed 0.1 gpm per foot of seating perimeter, seating or unseating head.

END OF SECTION

SECTION 11294 - LONG MOVABLE WEIRS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing all labor, materials, equipment and incidentals required for installing and field testing the long movable weirs complete and ready for operation as shown on the Drawings.

1.2 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Rodney Hunt Company
2. Washington Aluminum Company (WACO)
3. Hydro Gate Company
4. Whipps, Inc.

1.3 SUBMITTALS

A. Submit shop drawings, fully dimensioned with installation details.

PART 2 - MATERIALS AND EQUIPMENT

2.1 WEIR CONSTRUCTION

A. Long movable weirs shall comply with all of the requirements listed in Section 11290 for slide gates as modified herein.

B. Long movable weirs shall consist of a slotted weir plate, a frame or seating surface, operating stems and interconnected bench stands.

C. The drive unit shall be by manual bench stand. The drive unit shall consist of two benchstand mounted, interconnected gearboxes. The gearboxes shall be fully enclosed in a high strength housing with bronze lift nuts, roller-type bearings and mechanical seals around the operating nut and around the stainless steel pinion shafts where they extend from the case. The gearboxes shall be interconnected by means of stainless steel or extruded aluminum tubing with flexible couplings at each connection.

D. The weir plate shall be aluminum suitably reinforced to withstand the seating head conditions. It shall be slotted to allow full travel of the weir. The operating stem shall be connected to the weir plate by means of bolted connections.

E. The seat or frame shall consist of structural aluminum angle embedded in the concrete with anchors to secure it. The angle at the invert shall form a seating surface having a minimum width of 3-inches. The side frame members shall extend upward a sufficient amount so that the weir shall contact the side seats at all positions.

F. Anchor bolt inserts shall be poured in the concrete to accept shoulder bolts with special washers for holding the movable weir to the wall. The bolts shall pass through the slotted grooves in the disc.

G. The operating stems shall be stainless steel. At least two stems shall be used for operation of the weir.

H. The actuators shall be bench stands. The gear reduction shall be fully enclosed with mechanical seals around the operating nut and around the pinion shafts where they extend from the case.

I. All pinion shafts shall operate on roller bearings. The units shall be interconnected by means of steel tubing or shafting with flexible couplings at each connection. Initial setting of the weir shall be performed by crank operating the bench stands prior to interconnecting.

2.2 PAINTING

A. All iron and steel surfaces shall be shop cleaned by commercial grade sandblasting, equivalent to SSPC-SP-6, immediately prior to shop priming. Shop priming shall consist of one coat of chemical resistant polyamide cured epoxy resin to provide 1.5 mils dry thickness. Touch up and finish painting shall be performed in the field by the General Contractor in accordance with Section 09900 - System B-3 (2).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the Drawings and the manufacturers instructions.

3.2 FIELD TESTING

A. The adjustable weirs shall be tested by the Contractor by operating them to fully open and back to fully closed. The test shall be witnessed by the Owner and/or the Owner's Representative.

B. The supplier of the adjustable weirs shall provide 4 hours of operation and maintenance instructions to SERWTP operating personnel.

END OF SECTION

SECTION 11308 - SUBMERSIBLE WASTEWATER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing non-clog submersible centrifugal Wastewater pumps for the plant drain pump station, flow splitter box pump station and reject pond pump station in the wastewater treatment plant. Pump operating characteristics shall conform to the requirements shown on the attached data sheets.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 13300 - Controls and Instrumentation

B. Division 16 - Electrical

1.3 QUALITY ASSURANCE

A. Pumps shall be the product of a manufacturer with a minimum of five years of experience in the design and building of such pumping equipment. All workmanship and materials throughout shall be of the highest quality.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work limited to the following:

1. Flygt Corporation
2. ABS
3. KSB

1.4 SUBMITTALS

A. Obtain shop drawings showing dimensions. Incorporate in piping drawings. Verify dimensions and make necessary adjustments in installations.

B. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

C. Submit certified copies of reports of factory tests specified in this section and required by referenced standards. Include performance data and physical characteristics.

D. Submit dimension data, manufacturer's parts list, operation and maintenance literature and instructions as part of Record information.

1.5 EXPERIENCE AND WORKMANSHIP

A. After hydrostatic or other factory tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

B. Each box or package shall be properly marked to show its net weight in addition to its contents.

C. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.

1.6 SOURCE QUALITY CONTROL

A. Provide certified field performance test curves for specified conditions based upon most recent tests of similar pump.

1.7 WARRANTY

A. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall be solely responsible for the warranty of the submersible pumps and all components.

B. The pump manufacturer shall warrant the units to the Owner in writing against defects in workmanship and material covering parts and labor for a period of five years or 10,000 hours from date of acceptance.

C. In the event a component fails to perform as specified or is proven defective in service during the warrantee period, the manufacturer shall provide and install a replacement part without cost to the Owner.

1. Motor thermal protection shall be provided using thermal sensors imbedded in the windings. These shall be interfaced to the Motor Controls as described herein. NO OTHER protective devices shall be allowed. Pumps which require additional protective measures shall not be considered.

PART 2 - MATERIALS AND EQUIPMENT

2.1. NON-CLOG SUBMERSIBLE CENTRIFUGAL PUMPS

A. The pumps shall be capable of handling raw, unscreened sewage. The design shall be such that the pumps will be automatically connected to the discharge elbow when lowered into place. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastenings to be removed for this purpose.

2.2. PUMP CONSTRUCTION

A. Major pump components, including volute, casing, motor housing, stator casing and impeller shall be made of cast iron, ASTM A48, Class 35B or better. All external parts coming into contact with wastewater shall be protected by a coating of an acrylic dispersion zinc phosphate primer with a polyester resin paint finish. All external bolts and nuts shall be constructed of 304 stainless steel.

B. Impellers shall be constructed of gray cast iron, Class 35B, statically and dynamically balanced, non-clog design, capable of passing solids, fibrous material and heavy sludge, and constructed with a long through-way with no acute turns. Impellers shall be non-overloading over the entire range. The impeller shall be keyed to the shaft, retained with an expansion ring and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

C. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of either 230 Brass ASTM B-43 held by a 300 series stainless steel fastener or an AISI 304 stainless steel wear ring and/or nitrile rubber ring with a steel insert at the pump inlet.

D. The impeller shall be driven by a shaft of AISI type 420 stainless steel and shall rotate on three grease lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The two lower bearings shall consist of at least one roller bearing for radial forces and one angular contact ball bearing for axial thrust. The minimum B_{10} bearing life shall be 100,000 hours at any point along the usable portion of the pump curve at maximum product speed. The pump and motor shaft shall be a solid continuous shaft. Couplings shall not be acceptable. The pump shaft shall be completely isolated from the pumped liquid.

E. The pump volute shall be of single-piece design and shall have smooth fluid passages capable of handling all pumped media which flows through the impeller.

F. Each pump shall be provided with a tandem double mechanical shaft seal each operating independently. The seals shall be oil lubricated. Each lower seal unit shall contain one stationary ring and one positively driven rotating ring, each of tungsten carbide. The lower seal shall be independent of the impeller hub. The seals shall operate in an lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. Each upper seal unit shall contain one stationary tungsten carbide seal ring and one rotating tungsten carbide seal ring. Each mechanical seal shall be held in contact with its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily replaceable and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal. Shaft seals without rotating members or conventional double mechanical seals containing either a common single or double spring are not acceptable.

1. The oil chamber shall be designed to assure that air is left in the chamber to compensate for the expansion of the oil due to temperature variations. The drain and inspection plugs, with positive anti-leak seal, shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load. Seal lubricant shall be FDA Approved, non-toxic.

2. Pump/motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.

2.3. MOTOR CONSTRUCTION

A. The pump motor shall be a close-coupled squirrel-cage, induction, shell-type design, housed in an air-filled watertight chamber, NEMA Design B. Stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155/C (311/F). The stator shall be dipped and baked in accordance with Class F requirements. The rotor bars and short circuit rings shall be made of aluminum. Motors shall be designed for continuous duty, submersible pump usage, capable of sustaining a minimum of fifteen starts per hour with a 1.15 service factor, and capable of pumping a media with a temperature up to 40^{o}C (104^{o}F).

B. A minimum of two thermal sensors shall be imbedded in the motor winding. These sensors shall be wired to the control panel for use in conjunction with the external motor overload protection. Sensors shall be set to trip at not more than 125/C. Should high temperature occur, the thermal switches shall open, stopping the motor and activating an alarm.

C. Pump motor cable shall be suitable for submersible pump application and shall be sized in conformance with NEC and ICEA specifications for pump motors. A ground check conductor shall be provided. Also, a multi-conductor submersible cable will be provided to convey pump monitoring devices signals. The power cable shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of at least 65 feet.

D. The cable entry water seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a feed through type terminal board of non-hydroscopic material, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

1. The junction chamber shall contain two distinct and separate terminal boards. The first terminal board shall be used for the connection of the pilot sensor leads with the pilot sensor cable. The second terminal boards shall be utilized for the line power connection to the motor stator leads. This power terminal board shall use threaded compression type binding posts to connect the cable conductors and motor stator leads. The power terminal board shall separate and seal the junction chamber from the stator housing. The use of wire nuts or crimping type connectors is not acceptable. The motor and pump shall be produced by the same manufacturer.

2. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

3. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.4. COOLING SYSTEM

A. Each pump/motor unit shall be provided with an integral, self-supplying internal cooling system. After passing through a classifying labyrinth, the impeller back vanes shall provide the necessary circulation of the cooling liquid, a portion of the pumpage, through the cooling system. The cooling system shall provide for continuous submerged or completely non-submerged pump operation in liquid or in air having a temperature of up to 40°C *(104°), in accordance with NEMA standards. Restrictions limiting the ambient or liquid temperatures at levels less then 40°C are not acceptable.

2.5. ACCESSORIES

A. Discharge Base Elbow: A discharge base elbow, designed to mount directly on the sump floor, shall be supplied for each pump. It shall have a standard 125 pound flange faced and drilled on the outlet side, with a machined mating inlet connection. The design shall be such that the pump to discharge connection is made without the need for any nuts, bolts or gaskets. The base elbow shall also anchor and align the two guide rails.

B. Sealing Flange with Rail Guide: A sealing flange/rail guide bracket shall be mounted on each pump discharge. It shall have a machined mating flange which matches the base elbow discharge connection. Sealing of this discharge connection shall be accomplished by simple linear downward motion of the pump culminating with the entire weight of the pumping unit supported entirely by the base elbow.

C. Guide Bars: 316 stainless steel guide bars of the size shown on the Drawings shall be furnished for each pump. The guide bars shall be of adequate length to extend from the lower guide holders on the pump discharge elbow to the upper guide bar bracket mounted on the access frame.

D. Upper Guide Bar Bracket: The 316 stainless steel upper guide bracket shall align and support the two guide rails at the top of the sump. It shall bolt directly to the hatch frame and incorporate an expandable rubber grommet for secure rail installation.

E. Guide Bar Brackets: Where guide bar lengths exceed 20-feet, guide bar brackets, fabricated from 316 stainless steel, shall be furnished and installed.

F. Lifting Cable: Each pumping unit shall be provided with a lifting cable, and be of sufficient length to extend from the pump to the top of the wet-well. The access frame shall provide a hook to attach the cable when not in use. The lifting cable shall be sized for a working load of 50% greater than the pump unit weight and be 316 stainless steel.

G. Access Frame and Door: A separate access frame assembly shall be supplied with a separate hinged door for removal of each pump sized as shown on the Drawings. The frame assembly and door shall be aluminum with 304 stainless steel hinges and hardware. The aluminum door shall be raised tread plate to provide a skid-proof surface. The frame shall support the float mounting bracket (where required). A recessed handle shall be provided with each door, as well as a safety latch to hold the door in an open position. Design loading shall be 300 pounds per square foot.

H. Float Mounting Bracket: A float mounting bracket shall be provided with strain reliefs that support and hold the level control cords. Continuous cords are to run from pump(s) and level controls to a control panel or junction box. No splices shall be made in the wiring. The bracket shall be fabricated from 316 stainless steel and attached to the access frame with 316 series stainless steel fasteners. A dielectric space shall be installed when bolting to an aluminum access frame.

1. Power and Cable Supports: Power and pilot cable supports shall be provided and shall consist of a wire braid sleeve with attachment loops or tails for connection to the underside of the access frame.

2.6. PUMP CONTROL PANELS

A. The Plant Drain Pump Station shall be provided with an exterior triplex control panel mounted adjacent to the wetwell. The Control Panel shall be as specified in Paragraph 2.7 below. The submersible pumps for the Flow Splitter Box Pump Station shall have their control panels mounted in an interior location at the proposed Blower/Electrical Building No. 2. The Control Panels shall be fabricated as specified in Division 16 and as shown on the Electrical Drawings. The Reject Pond Pump Station shall be provided with an exterior duplex control panel mounted adjacent to the wetwell. The Control Panel shall be as specified in Paragraph 2.7 below with the following exceptions:

1. The control panel shall be for duplex pumps and controls.
2. An alternator shall be provided for 2 pumps.
3. Reject pumps shall be controlled by the treatment plant PLC as described in Division 13.
4. The level sensor shall be ultrasonic.

B. Panel Description

1. The Plant Drain Pump Station control panel shall be a Manatee County standard lift station control panel, float controlled, with controls and starters as shown on the electrical drawings.
2. The Reject Return Pump Station control panel shall include all ancillary controls and starters as required to permit starting and stopping from the plant control system as described in Division 13.

2.7. EXTERIOR CONTROL PANEL

A. Construction: The electrical control equipment shall be mounted within a NEMA Type 3R, dead front enclosure with 3-point latch, constructed of not less than 14-gauge stainless steel. The enclosure shall be equipped with a door and shall incorporate a removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. The panel shall be mounted on 3" galvanized pipe supports, with stainless steel Unistrut channel attached with stainless steel fasteners. The support posts shall be anchored in concrete adjacent to the lift station wetwell. No fittings shall enter from the back of control panel. All fittings entering the side of the panel shall be sealing locknuts or Myers Hubs. The minimum panel size shall be 30" x 30" x 8". All panels shall be equipped with main and emergency circuit breakers (Min. 100 amp). All power conductors from the main breaker to the emergency and pump breakers shall be connected via a power distribution block. Controls shall be rated for 480 volts, 3-phase, 60 Hz, equipped with individual pump breakers, across-the-line magnetic starters, 3-phase overload protection, lightning arrestor on incoming power source mounted on the exterior and wired to the load side of the safety switch, Furnas type 47AB10AF alternator, overload reset, HAND-OFF-AUTO pump operation selector switches, 24 volt control circuit transformer, 24 volt KP-12 relays with 8-pin sockets, and terminal board with connections for high level alarm. Also, furnish and install six liquid level switches equipped with a continuous length of flexible 600 volt, type S.O. cable to make all connections inside the control panel (NO SPLICES SHALL BE PERMITTED). Each station shall have one flashing type red alarm light mounted on top of control panel, one adjustable audible alarm with silent switch, and one emergency generator receptacle of the appropriate type listed below with a safety catch between the main and emergency circuit breakers to prevent backfeed. All test switches will be of the momentary contact type. All neutral wiring shall be connected via a neutral assembly (Square D #SN12-125 or equal).

B. Generator Receptacles: 0-200 amp, 460 volt - Russell Stoll JRSB2034ER

C. Components:

1. All motor branch circuit breakers, motor starter and control relays shall be highest industrial quality, securely fastened to the removable back panels with screws and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
2. A magnetic air circuit breaker, Type KA as manufactured by Square D Company, or approved equal, shall be furnished for each pump motor. Circuit breaker shall be adjustable. Circuit breaker shall be adequately sized to meet the pump motor and station operating conditions.
3. A mechanical disconnect mechanism shall be installed on each circuit breaker to provide a means of disconnecting power to each pump motor.
4. An open frame, across-the-line, NEMA rated, magnetic starter, Class 8536, as manufactured by Square D, or approved equal, shall be furnished for each pump motor, sized as shown on the plans. Motor starter shall be equipped to provide under-voltage release and overload protection on all three (3) phases using three overload relays of the melting alloy type (Square D or ITE preferred). Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. No starter smaller than NEMA size 1 shall be used. Overload reset pushbuttons shall be located on the exterior of the control compartment doors.
5. Control relays shall be plug-in type with contacts rated at 300 VAC, 10 amperes, noninductive. Time delay relays shall be electric type.
6. Provide surge protection as shown on the drawings.

D. Operating Controls and Instruments:

1. All operating controls and instruments shall be securely mounted on the control compartment door. All controls and instruments shall be clearly labeled to indicate function.
2. Pump mode selector switch shall be Hand-Off-Auto type to permit override of automatic level control and manual actuation of shutdown of each pump motor. Operation of pump in manual mode shall bypass all safety shutdown circuits except pump motor overload shutdown. Switches shall be oil-tight, as manufactured by Allen-Bradley, or approved equal, providing three (3) switch positions, each of which shall be clearly labeled according to function. Separate indicator lamps, which shall operate at 120 volts input shall be provided mounted above H.O.A. selector switches. Lamps shall be easily replaceable from the front of control compartment door without removing switch modules from their mounted positions.
3. Indicator lamps shall be mounted in oil-tight modules, as manufactured by Allen-Bradley, or approved equal. Lamp modules shall be equipped to operate at 120 volt input. Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.
4. A six (6) digit, nonrest elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in "hours"

and "tenths of hours". The elapsed time meter shall be Bulletin 705, HK Series as manufactured by Eagle Signal or approved equal.

5. An alternator shall be provided for the three pumps such that any one of the pumps can be selected as the lead pump. Pump starting sequences shall be 1-2-3, 2-3-1, and 3-1-2.

E. Phase Monitor

1. The 3-phase power monitor shall measure the main incoming power to the control panel. The monitor shall be a UL recognized component capable of detecting loss of phase, phase reversal, and low voltage on any phase. It shall feature an adjustable voltage range between -15% to +25% of the service voltage, with an adjustable trip delay from 2 to 20 seconds.
2. Reset shall be automatic.
3. Monitors shall be diversified electronics model "SLA".

F. Boxes and Covers

1. Boxes and covers shall be bolted together and gasketed.
2. Conduit openings shall be tapped.
3. Doors shall have a vault handle and 3-point catch, interlocked with circuit breaker. Door hinges shall be concealed. Two (2) keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

G. Control Components: The pumps shall be controlled based on level in the wetwell. Liquid level in the wetwell shall be sensed by polypropylene weighted floats. Floats shall be heavy duty type, with hermetically sealed non-mercury switch inside the float. Weights shall be 20 ounces minimum. Floats shall be secured at the top of the wetwell via a stainless steel hatch mounted bracket designed specifically for float installations. Floats shall be B/W 7000 Series or approved equal. High and low station levels shall be alarmed.

H. Manufacturer: Control Panel shall be manufactured by STA-CON, Quality Controls or approved equal.

I. Installation:

1. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 5 feet above the floor, properly aligned and adequately supported independent of the connecting raceways.
2. All wiring in the control panel shall be neatly formed, grouped, and identified to provide a neat and orderly appearance.
3. All nameplates shall be properly secured.
4. Ground Resistance - Tests shall be made on the entire grounding system for the continuity of connections and for resistance to the flow or current through ground connections. The ground resistance of conduits, equipment cases, and supporting frames shall not vary appreciably from that of the system as a whole. The ground resistance of the system shall not exceed 10 ohms."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the pump to be sure all passages are clean and clear of obstruction and that impeller rotates freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.2 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation. See Section 01700 - Contract Closeout.

B. The Contractor shall submit a certification from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.3 TESTING

A. Pumps: After all pumps have been completely installed and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that pump operation conforms to these specifications. Field tests shall include all pumps under this section. Supply all water or wastewater, labor, equipment and incidentals required to complete the field tests.

B. If the pump performance does not meet these specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified.

C. Motors: The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

D. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.4 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qualified manufacturer's service representative for 5 days to inspect equipment and installation and to perform required field tests. Refer to Section 01660 - Testing, Adjusting and Balancing.

3.5 TOOLS AND SPARE PARTS

A. One set of all special tools for each pump station required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 - Contract Closeout.

3.6 OPERATING CONDITIONS

A. Provide pumps which will operate under the following conditions when installed as shown:

PUMP CHART

LOCATION: SERWTP - Plant Drain Pump Station

MANUFACTURER: Flygt

MODEL: CP-3152, Imp. 454HT (6" Volute)

TYPE: Non-Clog, Submersible, Centrifugal

QUANTITY: 3

Pump Characteristics.

Item	Unit	Design Point	Other Design Points	
Total Dynamic Head	Ft.	65	97	30
Capacity (each pump)	GPM	750	200	1,200
Shut Off Head	Ft.	110	----	----
Minimum Size Solid Sphere Passed	Inch	3	----	----
Minimum Motor Size	Hp	20	----	----
Maximum Speed	RPM	1750	----	----
Minimum Efficiency at Design Point	%	62	30	50
Electric Power				
Volts	460	----	----	----
Phase	3	----	----	----
Hertz	60	----	----	----

PUMP CHART

LOCATION: SERWTP - Reject Pump Station

MANUFACTURER: Flygt

MODEL: CP-3127, Imp. 411LT

TYPE: Non-Clog, Submersible, Centrifugal

QUANTITY: 2

Pump Characteristics.

Item	Unit	Design Point	Other Design Points	
Total Dynamic Head	Ft.	29.5	37	17
Capacity (each pump)	GPM	800	400	1,400
Shut Off Head	Ft.	44	----	----
Minimum Size Solid Sphere Passed	Inch	3	----	----
Minimum Motor Size	Hp	10	----	----
Maximum Speed	RPM	1750	----	----
Minimum Efficiency at Design Point	%	63	43	62
Electric Power				
Volts	460	----	----	----
Phase	3	----	----	----
Hertz	60	----	----	----

PUMP CHART

LOCATION: SERWTP - Flow Splitter Box
Flow Equalization Tank Recirculation Pumps

MANUFACTURER: Flygt

MODEL: CP-3170, Imp. 442MT

TYPE: Non-Clog, Submersible, Centrifugal

QUANTITY: 2

Pump Characteristics.

Item	Unit	Design Point	Other Design Points	
Total Dynamic Head	Ft.	81	105	40
Capacity (each pump)	GPM	800	400	1,600
Shut Off Head	Ft.	125	----	----
Minimum Size Solid Sphere Passed	Inch	3	----	----
Minimum Motor Size	Hp	30	----	----
Maximum Speed	RPM	1740	----	----
Minimum Efficiency at Design Point	%	81	43	56
Electric Power				
Volts	460	----	----	----
Phase	3	----	----	----
Hertz	60	----	----	----

PUMP CHART

LOCATION: SERWTP - Flow Splitter Box
Flow Equalization Tank Return Pumps

MANUFACTURER: Flygt

MODEL: CP-3127, Imp. 411LT

TYPE: Non-Clog, Submersible, Centrifugal

QUANTITY: 3

Pump Characteristics.

Item	Unit	Design Point	Other Design Points	
Total Dynamic Head	Ft.	29	37	13
Capacity (each pump)	GPM	800	400	1,600
Shut Off Head	Ft.	44	----	----
Minimum Size Solid Sphere Passed	Inch	3	----	----
Minimum Motor Size	Hp	10	----	----
Maximum Speed	RPM	1750	----	----
Minimum Efficiency at Design Point	%	64	43	56
Electric Power				
Volts	460	----	----	----
Phase	3	----	----	----
Hertz	60	----	----	----

END OF SECTION

SECTION 11311 - WASTE SLUDGE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing four (4) waste sludge pumps as shown on the Drawings and as specified.

B. Pump locations shall be as shown on the Drawings. Each pump shall be equipped with all the usual accessories including bases, lifting eye bolts, pressure taps, and suction and discharge gages. Each pump shall be variable speed using a variable frequency drive.

1.2 QUALITY ASSURANCE

A. Design, fabricate, install and test in accordance with Standards of Hydraulic Institute.

B. The pumps are intended to be pumping equipment of proven ability as manufactured by reputable manufacturers having long experience in the production of identical pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. To assure unity of responsibility, each pumping unit in this Section shall include the pump, motor, baseplate, and belt drive, and shall be furnished and coordinated by one pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the pump unit as a system. The electric motor shall be compatible with a variable frequency drive.

D. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Aurora Pump Model 611 - 4x5x10
2. Goulds Pump Model HS - 3x3x10
3. Allis-Chalmers Model 150 - 4x4x7.5
4. Or Equal.

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

B. Submit certified copies of reports of factory tests specified in this section and required by referenced standards.

C. Submit shop drawings showing all dimensions, also include performance data and physical characteristics.

D. Submit manufacturer's parts list, operation and maintenance literature and instructions.

E. Submit six copies of the operating and maintenance manuals prepared specifically for this installation. Manuals shall include all required cuts, drawings, equipment lists, descriptions and similar items that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

F. Certified Factory Tests. Each pump shall be given a complete certified performance test to include head/capacity, Hp and efficiency to prove that the pumps supplied conform to the requirements of this specification. The curves shall be plotted from no flow at shut-off head to maximum flow at minimum head specified. No shipment of the pumps is to be made until after the Engineer's approval of the testing is obtained.

1.4 DELIVERY, STORAGE AND HANDLING

A. After hydrostatic or other factory tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

B. Each box or package shall be properly marked to show its net weight in addition to its contents.

C. Finished iron or steel surfaces not painted, shall be properly protected to prevent rust and corrosion.

D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.

E. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

F. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

G. All equipment and spare parts shall be properly protected against any damage during a prolonged period at the site.

1.5 WARRANTY

A. The equipment manufacturer shall provide a one-year warranty, and shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship. In the event the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling and shipment costs).

PART 2 - MATERIALS AND EQUIPMENT

2.1 WASTE ACTIVATED SLUDGE PUMPS

A. Pumps shall be belt-driven, horizontal, single-stage, single end suction, split casing, non-clog, centrifugal pumps designed for pumping waste activated sludge in an outdoor installation. Pumps shall be designed to perform satisfactorily with a reasonable service life when operated either continuously or intermittently in typical sludge pumping services.

B. All four pumps shall be of standard dimensions such that parts will be interchangeable between like units.

C. Casing shall be close-grained cast iron of sufficient strength, weight and metal thickness to insure long life, accurate alignment, and reliable operation. Volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow. A large clean-out opening with removable cover, having its interior surface matching the volute contour, shall be located on the casing at the impeller centerline, to allow access to interior of the impeller. Casing shall be split perpendicular to the shaft, with removable suction cover and stuffing box cover. Machined fits for these parts shall be accurately aligned and identical so that casing may be installed for either clockwise or counter-clockwise direction of rotation. Casing shall be so arranged that the impeller may be removed without disturbing either suction or discharge piping.

D. Suction and discharge connections shall be ASA 125-pound flat face flanges. All flange bolt holes shall be slotted for ease of assembly and disassembly. Each suction and discharge flange shall be drilled and tapped for gage connections. A ½-inch IPS tap shall be supplied in the suction cover, and a 3/4-inch IPS tap in the discharge nozzle. The tap in the discharge nozzle shall serve as a vent when the gage is not used.

E. A replaceable 12%-13% chrome steel suction cover wear plate, providing 1/4-inch minimum wear, shall be installed with its wear surface parallel to the end of the impeller.

F. Impeller shall be of the single-suction enclosed type with two vanes, made of close-grained cast iron. Impeller shall be particularly designed with smooth water passages to prevent clogging by stringy or fibrous materials. Impeller shall be statically, dynamically and hydraulically balanced, keyed and secured to the shaft by a bronze nut locked in place and readily removable without the use of special tools.

G. Pump shall have provisions for adjustment of axial clearance. This adjustment shall be made through the use of shims placed between the frame and outboard bearing housing.

H. Stuffing box cover shall be made close-grained cast iron with integral stuffing. (packing only.) The stuffing box shall consist of five rings of white asbestos or cotton plaited packing, a stainless steel seal cage, and a split-type gland to permit

easy removal and access to packing. Sealing liquid connection to stuffing box shall be tapped in a convenient location. Ample space shall be provided for repacking the stuffing box.

I. A double mechanical seal in a cast iron cartridge shall be installed as the stuffing box. The mechanical seal shall be a double John Crane Type 21 or equivalent. The cartridge which surrounds the mechanical seal shall be fitted into the back cover. The mechanical seal shall be fabricated for operation with a water seal flushing system.

J. Pump shaft shall be high-strength carbon steel, SAE #1045 minimum, accurately machined and of sufficient size to transmit full drive output. It shall be protected from the pumped liquid by a shaft sleeve in the stuffing box area. A seal shall be provided, using a selastic compound (RTV) between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump.

K. Renewable shaft sleeve, which extends through the stuffing box and under the gland, shall be provided. Shaft sleeves shall be of corrosion-resistant material, approximately 500 Brinnell hardness.

L. Pump bearing frame shall be one-piece rigid cast iron construction. Frame shall be provided with a cast iron bearing housing at the outboard end, and a cast iron end cover at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants. Frame shall be provided with a 3/4-inch IPS tapped hole, located as low as possible to drain the leakage for the packing gland.

M. Bearings shall be designed for 20,000 hours minimum life at 50% of B.E.P. Radial inboard bearing shall be ball or roller type suitable for all loads encountered in the service conditions. Axial thrust outboard bearings shall be deep groove single row ball or angular contact double row ball type suitable for thrust loads in two directions. Bearings shall be grease lubricated with provisions for the addition and relief of grease.

N. Two removable supporting feet shall be supplied under the pump. The foot bolted to the casing shall completely support when the pump rotating element is removed. The frame shall be supported by a bolted foot located directly under the inboard bearing for added rigidity and dampening of vibration in the frame.

O. Baseplate shall be fabricated steel drip lip type, sufficiently rigid to support the pump, belt drive and motor in proper alignment. A 1-inch tapped hole shall be provided near the pump end for draining.

P. Rotation. Pump shall be arranged to rotate in the direction as shown on the drawings.

Q. Motor: Motor shall be horizontal TEFC, built in accordance with the latest NEMA, IEEE, ANSI and AFBMA Standards. A belt drive shall be provided with an enclosed belt-guard of fabricated steel or fiberglass. Motor shall be premium efficiency, inverter rated duty, and conform to all requirements of Section 16150.

R. A seal water system piped as shown on the Drawings shall be provided for each pump. The Contractor may use as much of the existing two seal water systems as possible for two of the pumps. The other two pumps shall need completely new seal water systems. A seal water drain system from the stuffing box of each pump shall be provided as shown on the Drawings. Provide one ½ inch brass Asco solenoid valve with open/close operation for each seal water system interfaced with each pump motor starter.

PUMP FUNCTION: Waste Activated Sludge Pumps

LOCATION WAS Pump Station

TYPE: Horizontal, Non Clog, Centrifugal

QUANTITY: 4

S. Capacities and Characteristics. Pumps and their motor drives shall have the following capacities and characteristics:

Item	Unit	Capacity
Design Static Head	Feet	12
Design TDH	Feet	45
Design Capacity	GPM	250
Suction Diameter	Inch	5
Discharge Diameter	Inch	4
Minimum Size Solid Passed	Inch Sphere	3
Maximum Motor Size	HP	10
Maximum Motor Speed	RPM	1,750
VFD Speed Range	RPM	800-1,750
Pump Speed Range	RPM	800-1,750
Voltage	Volts	460
Phase	Phase	3
Design Minimum Efficiency	%	49

2.2 VARIABLE FREQUENCY DRIVES (VFDs)

A. The pump supplier shall coordinate with the Contractor to insure that the VFD's furnished under Section 16370 are suitable for operation with the pumps furnished.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the pump to be sure all passages are clean and clear of obstruction and that the impeller rotates freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.2 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation, seal water systems and seal water drain systems. See Section 01700 - Contract Closeout. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. All motors shall be connected to the electrical conduit system by means of a short section (18-inch minimum) of weatherproof flexible conduit unless otherwise indicated. For connections of No. 6 A.W.G. and smaller wire size, the Contractor shall furnish flexible conduit with an approved grounding conductor inside the flexible section. For connections of No. 4 A.W.G. or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

C. The Contractor shall submit a certification from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.3 PAINTING

A. Shop Painting. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill, scale, rust, grease, dirt and other foreign matter.

1. All pumps, motors and drives shall be shop primed with a primer compatible with field painting.
2. Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

B. Field Painting. Field painting is specified under Section 09900 - Painting and Coatings. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.

C. All nameplates shall be properly protected during painting.

3.4 TESTING

A. Pumps. After all pumps have been completely installed and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that pump operation conforms to these specifications. Field tests shall include all pumps under this section. Supply all water or wastewater, labor, equipment and incidentals required to complete the field tests.

1. If the pump performance does not meet these specifications, corrective measures shall be taken or pumps shall be removed and replaced with

pumps which satisfy the conditions specified. A twenty-four hour operating period of the pumps will be required before acceptance.

B. Motors. The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

1. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.5 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qualified manufacturer's service representative to inspect equipment and installation, to perform required field tests, and to provide operation and maintenance instructions. Refer to Section 01660 - Testing, Adjusting and Balancing. The manufacturer's representative shall provide a minimum of three (3) days services on site.

3.6 TOOLS AND SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 Contract Closeout.

B. The manufacturer shall furnish a complete list of recommended spare parts necessary for the first five years of operation of the pumping system, which shall include at least the following:

1. Two complete sets of gaskets for each pump size supplied.
2. Two complete sets of mechanical seals for each pump size supplied.
3. Two complete sets of packing for each pump size supplied.
4. Two complete sets of shaft sleeves, keys and accessories for each pump size supplied.

C. All spare parts shall be properly protected for long periods of storage and packed in containers which are clearly identified with indelible markings as to the contents.

END OF SECTION

SECTION 11312 - THICKENED SLUDGE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing six (6) progressive cavity pumps in the Sludge Holding Tank area as shown on the Drawings and as specified.

B. Each pump shall be equipped with all the usual accessories including bases, lifting eye bolts, pressure taps, and suction and discharge gages.

1.2 QUALITY ASSURANCE

A. Design, fabricate, install and test in accordance with Standards of Hydraulic Institute.

B. The pumps are intended to be pumping equipment of proven ability as manufactured by reputable manufacturers having long experience in the production of identical pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. To assure unity of responsibility, each pumping unit in this Section shall include the pump, motor, and drive shafting, and shall be furnished and coordinated by one pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the pump unit as a system.

D. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Robbins & Myers Moyno 2000 (Basis of Design)
2. Netzsch
3. Or Equal.

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

B. Submit certified copies of reports of factory tests specified in this section and required by referenced standards.

C. Submit shop drawings showing all dimensions, also include performance data and physical characteristics.

D. Submit manufacturer's parts list, operation and maintenance literature and instructions.

E. Submit six copies of the operating and maintenance manuals prepared specifically for this installation. Manuals shall include all required cuts, drawings, equipment lists, descriptions and similar items that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

F. Certified Factory Tests. Each pump shall be given a complete certified performance test to include head/capacity, Hp and efficiency to prove that the pumps supplied conform to the requirements of this specification. The curves shall be plotted from no flow at shut-off head to maximum flow at minimum head specified. No shipment of the pumps is to be made until after the Engineer's approval of the testing is obtained.

1.4 DELIVERY, STORAGE AND HANDLING

A. After hydrostatic or other factory tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

B. Each box or package shall be properly marked to show its net weight in addition to its contents.

C. Finished iron or steel surfaces not painted, shall be properly protected to prevent rust and corrosion.

D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.

E. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

F. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

G. All equipment and spare parts shall be properly protected against any damage during a prolonged period at the site.

1.5 WARRANTY

A. The equipment manufacturer shall provide a one-year warranty, and shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship. In the event the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling and shipment costs).

PART 2 - MATERIALS AND EQUIPMENT

2.1 THICKENED SLUDGE PUMPS

A. The Contractor shall provide and install six (6) progressive cavity pumps in the Sludge Holding Tank area. Each pump shall be used to feed a belt filter press or to feed a rotary screen sludge thickener.

B. The solids content in the aerated sludge shall range from 0.35% to 4.00%.

C. Each progressive cavity pump shall be furnished with a motor and drive arranged in the piggyback belt and pulley arrangement as a complete pump/drive unit factory mounted on a fabricated steel baseplate.

D. Each pump shall be variable speed using a variable frequency drive.

E. Each thickened sludge pump shall be of the heavy duty, positive displacement, single stage, progressive cavity type. The pump shall be cradle mounted to allow the normally vertical suction port to be rotated in any angle perpendicular to the centerline to facilitate piping connections.

F. The bearing and suction housings of the pump shall be thick-walled ASTM A48 Class 35 cast iron. All cast parts shall be free of sand holes, blow holes and other defects. The suction housing shall incorporate two rectangular inspection ports, 180 deg. apart, to permit access to the suction housing interior without disconnecting piping.

G. The suction and discharge connections shall be flat faced flanges with bolt hole dimensions and spacing to ANSI B16.1, Class 125 standards. The suction and discharge piping shall be 6-inch diameter with 125 lb flanges.

H. The AISI 4150 alloy steel rotor shall be a machined and polished single helix hardened to minimum Rockwell C-57 with a nominal chrome plate thickness of .010 inches hardened to minimum Rockwell C-70 for maximum abrasion resistance.

I. The stator shall be of double helix configuration with the molded Nitrile elastomer chemically bonded to a steel tube. The stator shall be fastened to the suction housing and discharge flange with removable clamp rings to facilitate stator removal. The stator seals shall be designed to prevent the material being pumped from contacting the stator bonding and tube.

J. The gear joints shall be of the grease lubricated crowned gear type, totally enclosed and protected by a wire reinforced elastomeric seal. Mechanical components of the gear joints shall be designed to operate for 10,000 hours at the manufacturer's published maximum speeds and pressures. Pin joints shall not be acceptable.

K. A rigid, splined connecting rod shall connect the gear joints of the chrome-plated high alloy steel drive shaft and eccentrically moving rotor. The connecting rod shall pass through the shaft seal area inside the hollow drive shaft quill so that no eccentric loads are imparted on the shaft seal area.

L. The drive shaft shall be of one piece construction through the bearing and shaft seal area. This design shall permit disassembly of the universal joints without

affecting the alignment of the shaft in the shaft sealing area. Flexishaft design shall not be acceptable.

M. The quill portion of the shaft shall be hard chrome plated.

N. The bearings shall be of the grease lubricated, tapered roller bearing type with diverging pressure angles for maximum shaft stability. Bearings shall be designed for a minimum B-10 life of 30,000 hours under maximum operating conditions and will not require periodic relubrication. The bearings shall be protected from contaminants by means of a bearing cover plate bolted to the bearing housing.

O. The stuffing box shall be equipped with a ductile iron gland, split 316 stainless steel lantern ring, and shall be suitable for continuous water seal flush lubrication. The packing shall be grafoil dye formed packing rings. Two 1-inch NPT connections shall be provided for the sealing water supply and stuffing box drain. Construction of the stuffing box shall permit use of a mechanical seal in lieu of packing. The construction shall be such that the gland may be adjusted or the pump repacked without dismantling any other part of the pump.

P. The pump seal shall be a single mechanical seal by John Crane, Dura-Metallic, or Equal, suitable for operation using a seal water flushing system.

Q. A seal water system piped as shown on the Drawings shall be provided for each pump. A seal water drain system from the stuffing box of each pump shall be provided as shown on the Drawings. Provide one ½-inch brass Asco solenoid valve with open/close operation for each seal water system interfaced with each pump motor starter.

R. Each pump motor shall be totally enclosed, fan cooled (TEFC) suitable for outdoor operation. Motors shall be premium efficiency, inverter rated duty, conforming to all requirements of Section 16150.

S. The belt and drive guard shall be aluminum or stainless steel.

T. Protective Devices: A pressure switch assembly shall be provided and installed at each pump. The sensor shall be mounted downstream of each pump. Pressure switch assembly shall consist of flanged sensor/isolator which uses silicone oil as the pressure sensing fluid. The pressure sensor shall consist of a pressure switch and a pressure gauge piped in a common mainfold. The Pressure switch shall be a snap action switch, housed in a Nema 4X enclosure. The pressure range shall be chosen appropriately for the application. The pressure switch shall be wired to the plant SCADA system, where it shall provide logic for automatic shut-down in case of over-pressure alarms.

2.2 MATERIALS

A. Pump Body - Cast Iron

B. Internals, including Rotor - Alloy Steel

C. Stators - Nitrile

2.3 CAPACITIES AND CHARACTERISTICS

A. Robins & Myers Moyno 2000, Model 1FO5OG1, Type CDQ, Trim AAA (Basis of Design)

Description	Unit	Capacity
Design Capacity	GPM	125
Design Total Dynamic Head	Feet	50
Design Max. Pump Speed	RPM	280
Maximum Motor Horsepower	HP	10
Electrical Voltage	Volts	480
Electrical Phase	Phase	3
Electrical Cycles	Hertz	60
Other Design Points at 280 RPM		
Capacity	GPM	125
Total Dynamic Head	Feet	0
Capacity	GPM	95
Total Dynamic Head	Feet	185

B. Each pump shall be furnished with a mounted accessible revolution counter, which shall register up to 100,000 revolutions. Each pump shall be equipped with a brass rating plate indicating gallons pumped per revolution. Letters and numbers shall be stamped into the plate.

2.4 VARIABLE FREQUENCY DRIVES (VFDs)

A. The pump supplier shall coordinate with the Contractor to insure that the VFD's furnished under Section 16370 are suitable for operation with the pumps furnished.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the pump to be sure all passages are clean and clear of obstruction and that the rotor rotates freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.2 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation. See Section 01700 - Contract Closeout. Anchor bolts shall be set in accordance with the manufacturer's recommendations. Installation shall include the water seal system and the water drain system from the stuffing box for pump as shown on the Drawings.

B. All motors shall be connected to the electrical conduit system by means of a short section (18-inch minimum) of weatherproof flexible conduit unless otherwise indicated. For connections of No. 6 A.W.G. and smaller wire size, the Contractor

shall furnish flexible conduit with an approved grounding conductor inside the flexible section. For connections of No. 4 A.W.G. or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

C. The Contractor shall submit a certification from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.3 PAINTING

A. Shop Painting. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill, scale, rust, grease, dirt and other foreign matter.

1. All pumps, motors and drives shall be shop primed with a primer compatible with field painting.
2. Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

B. Field Painting. Field painting is specified under Section 09900 - Painting and Coatings. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.

C. All nameplates shall be properly protected during painting.

3.4 TESTING

A. Pumps. After all pumps have been completely installed and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that pump operation conforms to these specifications. Field tests shall include all pumps under this section. Supply all water or wastewater, labor, equipment and incidentals required to complete the field tests.

1. If the pump performance does not meet these specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified. A twenty-four hour operating period of the pumps will be required before acceptance.

B. Motors. The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

1. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.5 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qualified manufacturer's service representative to inspect equipment and installation, to perform required field tests, and to instruct WTP personnel in operation and maintenance. Refer to Section 01660 - Testing, Adjusting and Balancing.

B. The manufacturer's representative shall provide a minimum of three (3) days on-site for the above services, not counting travel time.

3.6 TOOLS AND SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 Contract Closeout.

B. The manufacturer shall furnish a complete list of recommended spare parts necessary for the first five years of operation of the pumping system, which shall include at least the following:

1. Two complete sets of gaskets for each pump size supplied.
2. Two complete sets of mechanical seals for each pump size supplied.
3. Two complete sets of packing for each pump size supplied.
4. Two complete sets of shaft sleeves, keys and accessories for each pump size supplied.

C. All spare parts shall be properly protected for long periods of storage and packed in containers which are clearly identified with indelible markings as to the contents.

END OF SECTION

SECTION 11313 - VERTICAL TURBINE TRANSER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section includes furnishing and installing two (2) line shaft vertical turbine pumps in the locations shown in the Chlorine Contact Tanks on the Drawings. The pumps shall be suitable for pumping the specified quantity of reclaimed water at specified pressures when installed and operating under the conditions shown.

1.2 QUALITY ASSURANCE

A. Design, fabricate, install and test in accordance with the Standards of the Hydraulic Institute.

B. Subject to compliance with the requirements of this Section, manufacturer's offering products which may be incorporated in the work include the following:

1. Fairbank Morse
2. Aurora Vertiline
3. Paco/Johnston
4. Floway
5. Or approved equal.

C. Pumps shall conform to the requirements of ANSI/AWWA E101 except as modified in these specifications.

D. Vibration limits shall be in accordance with the Hydraulic Institute Standards. The pump manufacturer shall insure that the first critical frequency of each vertical turbine pump is a minimum of 25% above the maximum operating speed and the second critical frequency is a minimum of 25% below the minimum anticipated operating speed (80% of maximum).

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

B. Submit certified copies of reports of factory tests specified in this section and required by referenced standards.

C. Submit results of vibration testing on the pumps provided or on similar pumps recently manufactured and tested.

D. Submit shop drawings showing all dimensions, also include performance data and physical characteristics.

E. Submit manufacturer's parts list, operation and maintenance literature and instructions.

F. Submit three copies of Service Representative's Report of Field Tests.

PART 2 - MATERIALS AND EQUIPMENT

2.1 LINE SHAFT VERTICAL TURBINE PUMPS CONSTRUCTION

A. Bowl Assembly: Pump bowls shall be made of ASTM A48 Class 30 close grained cast iron, free from blow holes, sand holes and all other faults. Bowls shall be accurately machined and fitted to close dimensions. The bowl design shall be heavy walled to withstand the pressure developed by the pump and shall have sufficient lateral design to accommodate hydraulic shaft stretch when the pump is operating. The discharge case shall be fitted to attach to the discharge column. The suction case shall be fitted with a cast iron suction bell to reduce entrance losses to a minimum. Pump bowls or impellers shall be provided with replaceable bronze wear rings in accordance with manufacturer's standard. Porcelain enameled bowls may be utilized.

B. Impeller: Pump impellers shall be ASTM B584 (alloy 83800) bronze, of heavy construction, accurately fitted and statically and dynamically balanced. Impellers shall be securely fastened to a pump shaft of 416 stainless steel. The shaft shall be sized to provide minimum deflection. Bronze sleeve bearings shall be provided in each bowl and in the suction bell. Bowl bearings shall be lubricated by the pumped liquid. Suction bell bearing shall be packed permanently with a non-soluble grease and fitted with a bronze sand collar.

C. Column Assembly: Discharge column pipe shall be ASTM A53 Grade B steel pipe with flanged connections, line shaft, line shaft coupling, bearing retainer, and bearing. Column pipe shall be interchangeable, and not over 10' in length for 1800 RPM and 5' in length for 3600 RPM.

D. Line Shafting: Line shafting shall be 416 stainless steel with stainless steel keyed line shaft couplings or with threaded Monel metal or stainless steel couplings of a different alloy to prevent galling. Shaft diameter shall be sized to conform with ANSI/AWWA Specifications for the motor horsepower. Line shafts shall be furnished in interchangeable sections not over 10' in length at 1800 RPM or 5' in length at 3600 RPM. The shafts shall be machined so that maximum runout in 10' shall not exceed 0.005 inch and so that maximum permissible axial misalignment of the thread axis within the shaft axis is 0.002 inch in 6 inches.

E. Bearings: Column shaft bearings shall be spiral grooved C425-65 fluted rubber for lubrication by the pumped liquid. Bearings shall be supported by "spider" type bronze retainers installed between each length of discharge column to insure proper shaft alignment. Maximum spacing shall be 10' at 1800 RPM and 5' at 3600 RPM. Bearing retainers shall be so constructed as to allow field reversal; such reversal will result in the bearing surface on the shaft to be completely relocated. The suction and case bearings shall be bronze. Bearings for intermediate bowls shall be dual bronze and rubber.

F. Surface Discharge Head Assembly: Discharge heads shall be of close grained cast iron (ASTM A48-76 Class 30) or fabricated steel (ASTM A53 & A36) with an integral discharge flange.

G. Discharge flanges shall be flat face type faced and drilled for ANSI B-16.1 Class 125.

H. The discharge head base shall be of sufficient size to span an opening of such dimensions as to permit removal of the complete pump unit connected below. Lifting lugs with capacity to support the weight of the entire pump shall be provided. Discharge head mounting base shall be a round flange type with accurately machined surfaces. The top of the head shall be machined with a register fit for locating the driving motor. Cast discharge heads shall be so designed that casting sections supporting the motor shall form a "tee" section for maximum torsional rigidity. Adequate openings shall be provided to permit easy access to the stuffing box and shaft coupling.

I. Stuffing box shall be of cast iron fitted with a mechanical seal. Mechanical seals shall be of the type recommended by the seal manufacturer for the application. Mechanical seals shall be replaceable without removing the motor, disassembling the pump, or disturbing the piping.

J. Stuffing Box Housing: Stuffing box housing shall be one piece construction made of cast iron. It shall have an accurately machined pilot located in a close tolerance counterbore in the discharge head. Pump stuffing box shall be located on this pilot and clamp the bearing housing in place. A bronze sleeve bearing shall be provided in the bearing housing.

K. Head shaft shall be Type 416 stainless steel. Impeller adjustment shall be provided at the top of the head shaft by an adjustable flanged headshaft coupling with bronze adjusting nut and set screws.

L. Pumps shall be supplied with the pump manufacturers standard fabricated steel sub-base plate. The steel sub-base plate shall be of sufficient thickness to support the pump discharge head and motor and suitable for grouting with a smooth surface for mounting the discharge head. Anchor bolts and all hardware for securing the head to the base plate shall be furnished or approved by the pump manufacturer.

M. Pump Driver: Pumps shall be driven by vertical hollow-shaft or solid shaft electric motors. Motors shall be provided with non-reverse ratchets. When mechanical seals are provided for pumps, a solid shaft motor with a flanged adjustable spacer to allow easy removal of the seal without removal of the motor shall be used. Drive motors shall be suitable for installation in a corrosive atmosphere at the locations shown without additional protection. The motor horsepower shall be non-overloading for all conditions of head and flow. Motors shall be premium efficiency NEMA B motors. Motors shall be rated for inverter duty and meet all the requirements of Section 16150.

N. Variable Frequency Drives (VFDs). The pump supplier shall coordinate with the Contractor to insure that the VFD's furnished under Section 16370 are suitable for operation with the pumps furnished.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pumps to be sure all passages are clean and clear of obstructions and that impellers rotate freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.2 INSTALLATION

A. Install pump in accordance with specifications, drawings and manufacturer's written instructions. Install units level and plumb. Securely anchor units. Insure that stress is not applied to discharge connection by piping. Make sure all connections are tight.

3.3 TESTING

A. The pump manufacturer shall provide five copies of certified performance curves of the most recent certified performance test for each pump size of a similar pump.

B. The discharge head and bowl assembly shall be hydrostatically tested to 100 psig at the factory. Certification of the hydrostatic testing and the test results shall be submitted.

C. After installation, test each pump in accordance with the Hydraulic Institute Standards. The pumps shall be field tested to establish field head and overall efficiency. Report and test shall include voltage and amperage measurement.

3.4 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qualified manufacturer's service representative to inspect equipment and installation and to perform required field tests of each pump and to instruct the Owner in the operation and maintenance of the pumps.

3.5 TOOLS AND SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 - Contract Closeout.

B. The manufacturer shall furnish recommended spare parts necessary for the first five years of operation of the pumping system, which shall include at least the following:

1. Two complete sets of gaskets for each pump size supplied.
2. Two complete sets of mechanical seals for each pump size supplied.
3. Two complete sets of shaft sleeves, keys and accessories for each pump size supplied.

3.6 PUMP CHARACTERISTICS

A. Pump shall have the following capacities when operating at the design conditions shown. Motor horsepower, efficiency, and speed may vary from that shown depending upon manufacturer of the vertical turbine pump. Manufacturer shall meet the design condition listed. The additional points of the pump curve may vary.

B. Pump shall operate satisfactorily within the operating range indicated below:

3.7 VERTICAL TURBINE PUMP DATA SHEET

		Additional Points	
	Design Condition	**Point No.1**	**Point No.2**
Manufacturer & Model	Fairbanks-Morse		
(Basis of Design)	Model 7000-21H		
Quantity	2		
Pump Nos.	1, 2		
Design Point:			
Capacity - GPM	4,000	2,000	6,000
TDH - Feet	225	260	136
Max Speed - RPM	1,170	1,170	1,170
Type of Speed	Variable		
Maximum Horsepower	300		
Minimum Efficiency at Design Point	80		
Shutoff Head- Feet	332		
Column Size - Inches	16		
Pump Discharge Size - Inches	16		
Discharge Pipe Size - Inches	16		
Barrel or Can Required	No		
NPSH Required - Feet	19		
Motor Voltage - Volts	480		
Type of Motor Drive	Variable Frequency		
Range of Speed - RPM	500-1,170		

END OF SECTION

SECTION 11314 - VERTICAL NON-CLOG CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Return Activate Sludge Pump Station has three existing variable speed non-clog centrifugal pumps, each an Aurora Model 613-10x10x15 with a 15" impeller and rated at 2,400 GPM at 26 feet TDH at 715 RPM. The proposed work consists of completely replacing each pump with a larger one to provide a capacity of 4,400 GPM at a TDH of 44 feet for each pump. In addition, the existing magnetic variable speed drives will be replaced by Variable Frequency Drives to accommodate the pump upgrades. The construction plans have been prepared assuming that Aurora Model 613-12x14x22, 700 RPM, 75 HP, 17¾-inch impeller will be installed. Other manufacturers of similar pumps may provide this equipment if it can fit into existing space conditions.

B. Pump locations are as shown on the drawings. Each pump shall be equipped with all the usual accessories including bases, lifting eye bolts, pressure taps, and suction and discharge pressure gauges with isolation and air bleed-off valves.

C. Related Work Specified Elsewhere:

1. Section 13300 - Controls and Instrumentation
2. Section 15062 - Ductile Iron Pipe and Fittings
3. Section 15100 - Valves and Accessories
4. Section 16050 - Electrical General Provisions
5. Section 16150 - 480 Volt Motors
6. Section 16370 - Variable Frequency Drives
7. Section 16921 - 480 Volt Motor Control Center

1.2 QUALITY ASSURANCE

A. Design, fabricate, install and test in accordance with Standards of Hydraulic Institute.

B. The new items of equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. To assure unity of responsibility, the three (3) pumping units in this Section shall be furnished and coordinated by one pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the pump units as a system.

D. Available Manufacturers: Subject to compliance with requirements, the manufacturer offering pumps which may be incorporated in the work shall be limited to:

1. Aurora Pump, No. Aurora, IL.
2. Allis-Chalmers, Cincinnati, OH
3. Fairbanks-Morse, Kansas City, KA
4. Or equal

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

B. Submit certified copies of reports of factory tests specified in this section and required by referenced standards.

C. Submit Shop drawings showing all dimensions, also include performance data and physical characteristics.

D. Submit manufacturer's parts list, operations and maintenance literature and instructions.

E. Submit six (6) copies of the operating and maintenance manuals prepared specifically for this installation. Manuals shall include all required cuts, drawings, equipment lists, descriptions and similar items that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

F. Certified Factory Tests: Provide certified factory performance test curves based upon most recent tests of similar pumps to include head/capacity, HP and efficiency to prove that the equipment supplied conforms to the requirements of the specification. The curves shall be plotted from no flow at shut-off head to maximum flow at minimum head specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Finished iron or steel surfaces not painted, shall be properly protected to prevent rust and corrosion.

C. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.

D. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

E. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

F. All equipment and spare parts must be properly protected against any damage during a prolonged period at the site.

1.5 WARRANTY

A. The equipment manufacturer shall provide a one-year warranty, and shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship. In the event the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling and shipment costs).

PART 2 - PRODUCTS

2.1 VERTICAL CENTRIFUGAL PUMPS

A. The proposed pumps are vertical, close-coupled, single-stage, single-suction, centrifugal pumps designed specifically for municipal, institutional, commercial, and industrial sewage applications. Proposed pumps provided shall be designed to perform satisfactorily with a reasonable service life when operated either continuously or intermittently in wastewater service.

B. Pump casings shall be close-grained cast iron of sufficient strength, weight and metal thickness to insure long life, accurate alignment, and reliable operation. Volute shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller and provide smooth unobstructed flow. A large clean-out opening with removable cover, having its interior surface matching the volute contour, shall be located on the casing at the impeller centerline, to allow access to interior of the impeller. Casing shall be arranged so that the impeller may be removed without disturbing either suction or discharge piping.

C. Suction and discharge connections shall be ASA 125 pound flat face flanges. Each suction and discharge flange shall be drilled and tapped for gauge connections. A 1/2 inch IPS tap shall be supplied in the suction nozzle, and a 3/4 inch IPS tap in the discharge nozzle. The tap in the discharge nozzle shall serve as a vent when gauge is not used.

D. A replaceable 12% - 13% chrome steel suction cover wear plate, providing 1/4 inch minimum wear shall be installed with its wear surface parallel to the end of the impeller.

E. The new impeller shall be single-suction enclosed type with 2 vanes, made of close-grained cast iron. Impeller shall be particularly designed with smooth water passage to prevent clogging by stringy or fibrous materials, and shall be capable of passing solids having a maximum sphere size as shown. Impeller shall be statically, dynamically and hydraulically balanced. Impeller shall be keyed and secured to the shaft by a stainless steel key and locknut, and shall be readily removable without the use of special tools.

F. Pump shall have provision for adjustment of axial clearance. This adjustment shall be made through the use of existing shims placed between the frame and outboard bearing housing.

G. A replaceable 12%-13% chrome steel "L" shaped wear ring shall be provided. The ring shall be mounted on the impeller to provide a renewable surface opposite the suction cover wear plate.

H. A mechanical seal shall be installed in the stuffing box. The mechanical seal shall be a balanced seal of the self cleaning anti-clog type fabricated for operation with a seal water flushing system. The seal shall be Model 880 seal as manufactured by A.W. Chesterton Co., Stoneham, MA or equal.

I. The pump shaft shall be high-strength carbon steel, SAE #1045 minimum, accurately machined and of sufficient size to transmit full driver output. It shall be protected from the pumped liquid by a shaft sleeve in the stuffing box area. A seal shall be provided, using a selastic compound (RTV) between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump. The shaft shall be tapered at the impeller end and shall be threaded for an impeller nut.

J. A renewable shaft sleeve, which extends through the stuffing box and under the gland, shall be provided. Shaft sleeve shall be of corrosion-resistant material, approximately 500 Brinnell hardness.

K. The Pump bearing frame shall be of one-piece rigid cast iron construction. The Frame shall be provided with a cast iron bearing housing at the outboard end, and a cast iron end cover at the inboard end. Both ends of the existing frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants. The Frame shall be provided with a 3/4 inch IPS tapped hole, located as low as possible to drain the leakage from the packing gland.

L. The bearing frame shall be designed so that the complete rotating element can be removed from the casing without disconnecting piping.

M. Bearings shall be designed for 100,000 hours minimum life at 50% of B.E.P. Bearings shall be suitable for all loads encountered in the service conditions.

N. Bearings shall be grease-lubricated with provisions for the addition and relief of grease.

O. Each pump shall be supported by a cast iron pedestal base with openings large enough to permit access to the suction elbow and clean-out handhole. Pump base shall be cast with a square footing to prevent legs being broken during shipment. Pedestal shall be designed to support the assembled weight of the pump, shafting and motor.

P. Pump base shall safely withstand all stresses imposed thereon by vibration, shock and all possible direct and eccentric loads. Base shall have adequate horizontal dimensions, foundation contact area, and anchorage facilities.

Q. The pedestal shall be of sufficient height such that the suction elbow will not touch the floor or foundation upon which it stands.

R. Each pump shall be provided with a clean-out type cast iron suction elbow which is bolted directly to the pump suction flange. The clean-out handhole shall be provided with a removable cover of the largest possible size. The inner surfaces of each handhole cover shall generally conform to the curvature and radius of the suction elbow. A 1/4 inch tapped hole for gauge connection shall be provided in the elbow near the suction flange. A 2-inch tapped hole shall also provided in the side of the elbow for use in applying water pressure to unclog the pump is case of blockage.

S. Each pump shall be furnished with a cast iron motor bracket which shall be bolted to a separate pump adapter. The motor bracket shall be machined with a register fit to insure proper alignment of motor and pump shaft.

T. The driving motor shall be provided with a ring base of adequate height to permit access to the coupling, between the motor and intermediate shafting. The motor mounting surface shall be designed for standard NEMA "P" flange motor. Motors shall be TEFC, inverter duty rated, and conform to all requirements of Section 16150.

U. A seal water system piped as shown on the drawings shall be provided for each pump. Existing seal water piping shall be used as much as possible. A seal water drain system from the stuffing box of each pump shall be provided as shown on the drawings using existing piping as much as possible. Provide one ½-inch brass Asco solenoid valve with open/close operation for each seal water system interfaced with each pump motor starter.

V. Upgraded pumps shall rotate in the same direction as existing pumps.

1. PUMP FUNCTION: Return Activated Sludge
2. MANUFACTURER: Aurora Pump
3. LOCATION: RAS Pump Station
4. TYPE: Vertical, Non-Clog, Centrifugal, Close - Coupled
5. Model: 12x14x22 - 17¾" Imp.
6. QUANTITY: 3

W. Capacities and Characteristics: Upgraded pumps and their motor drives shall have the following capacities and characteristics:

ITEM	UNIT	CAPACITY
Design Capacity and Head		4,400 GPM @ 44-ft at 100% of Full Load Speed
Capacity and Head at other points at Full Load Speed		2,000 GPM @ 55-ft 6,000 GPM @ 33 ft.
Impeller Size	Inch	17¾
Suction Diameter	Inch	14
Discharge Diameter	Inch	12
Minimum Size Solid Passed	Inch Sphere	6
New Maximum Motor Size	Hp	75

Maximum Speed	RPM	700
Minimum speed	RPM	300
Shut-Off Head at Full Load Speed	Feet	57
Minimum Efficiency at Full Load Speed	%	80

X. Variable Frequency Drives (VFDs). The pump supplier shall coordinate with the Contractor to insure that the VFD's furnished under Section 16370 are suitable for operation with the pumps furnished.

PART 3 - EXECUTION

3.1 COORDINATION

A. The Contractor shall prepare and execute a Sequence of Construction to allow two (2) pumps to be in operation at all times while one (1) pump is being replaced.

B. The Contractor shall coordinate with the Manatee County SERWTP Chief Operator before placing any of the wastewater pumps in or out of service.

3.2 EXAMINATION

A. Examine the pump to be sure all passages are clean and clear of obstruction and that impeller rotates freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.3 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation.

B. Installation shall include using as much of the existing seal water system and stuffing box drain system for each existing pump to provide a seal water system for each new pump. The Contractor shall provide whatever additional piping and valves necessary for a complete system as shown on the Drawings.

C. All motors shall be connected to the electrical conduit system by means of a short section (18-inch minimum) of weatherproof flexible conduit unless otherwise indicated. For connections of No. 6 A.W.G. and smaller wire size, the Contractor shall furnish flexible conduit with an approved grounding conductor inside the flexible section. For connections of No. 4 A.W.G. or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

D. The Contractor shall submit a certification from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.4 PAINTING

A. Shop Painting:

1. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill, scale, rust, grease, dirt and other foreign matter.
2. All motors and drives shall be shop primed with a primer compatible with field painting.
3. Gears, bearing surfaces and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

B. Field Painting:

1. Field painting is specified under Section 09900. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
2. All nameplates shall be properly protected during painting.

3.5 TESTING

A. Pumps:

1. After all pumps have been completely upgraded and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that pump operation conforms to these specifications. Field tests shall include all pumps under this section. Supply all water or wastewater, labor, equipment and incidentals required to complete the field tests.
2. If the pump performance does not meet these specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified. A twenty-four hour operating period of the pumps will be required before acceptance.

B. Motors:

1. The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.
2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.6 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qualified manufacturer's service representative for 5 days to inspect equipment and installation and to perform required field tests. Refer to Section 01660 - Testing, Adjusting, and Balancing.

3.7 TOOLS AND SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 - Contract Closeout.

B. The manufacturer shall furnish to the Owner a complete list of recommended spare parts necessary for the first five years of operation of the pumping system. The Contractor shall furnish the following spare parts in addition to other spare parts recommended by the equipment manufacturer:

1. Two complete sets of gaskets for each pump size supplied.
2. Two complete sets of mechanical seals for each pump size supplied.
3. Two complete sets of shaft sleeves, keys and accessories for each pump size supplied.

C. All spare parts shall be properly protected for long periods of storage and packed in containers which are clearly identified with indelible markings as to the contents.

END OF SECTION

SECTION 11330 - RAW SEWAGE SCREENING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The equipment to be furnished and installed shall be a fully automatic self-cleaning filter screen capable of removing miscellaneous suspended objects greater in any dimension than 6 mm from wastewater. The equipment shall be of the latest design and shall be fabricated of materials and in a fashion which will fully perform the functions described below. The screen shall be provided with an enclosure.

1.2 RELATED WORK:

A. Section 03300 - Concrete

B. Section 09900 - Paintings and Coatings

C. Division 16 - Electrical Work

1.3 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Parkson, Inc., Ft. Lauderdale, FL (AquaGuard MODEL AG-S-A)

1.4 SUBMITTALS

A. Submit manufacturer's shop drawings.

1.5 FACTORY TEST AND DELIVERY

A. The screen shall be factory assembled and tested for a minimum of 16 hours prior to delivery, and shall be delivered to the site fully assembled (other than the motor/reducer unit, drive chain, chain cover, discharge chute and support legs). It shall be capable of being set in place and field erected by the Contractor with minimal field assembly.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The heavy duty, fully automatic, mechanical self-cleaning, filter screen shall be suitable for installation and operation in a flow channel measuring 3 ft.-6 in. wide x 5-ft. deep, as measured from the base of the screen to the level at which it is supported (downstream depth). The angle of inclination shall be 75° from horizontal.

B. The point at which all collected material will fall off the discharge chute shall be 2-ft. 6-in. above the top of the channel. This is the available clearance for a receptacle to collect the debris. The total discharge height of the screen as measured from its base to the top of the discharge chute shall be 10-ft. The overall height of the screen from its base to the drive motor shall be ±16-ft. The basis of design shown on the Drawings is based on Parkson Aquaguard. Any revisions of the proposed structure required for the other equipment alternatives shall be the responsibility of the Contractor.

C. The screen shall be capable of passing a maximum of 12 MGD of domestic sewage with a maximum upstream water depth of 2 ft.-9 in. in a channel 3 ft.-6 in. wide. The loss of head at the maximum flow shall not exceed 1 ft.-8-in. of water and the screen shall be capable of presenting a clean filtration surface to the oncoming liquid stream at all times during operation.

2.2 SCREEN

A. The screen shall provide continuous dual filtration of all materials in order to minimize compaction of captured materials and to minimize head loss through the screen. The coarse horizontal openings shall be 14mm and the first opening the flow stream contacts as it passes through the screen. The fine filtration shall provide clear horizontal spacing not exceeding 6mm and clear vertical spacing not exceeding 25mm. In addition to the fine and coarse filtration the screen shall be capable of removing trash up to 7-inches in diameter which shall be automatically transported by the screen for deposit into the conveyor system. The unit shall be capable of conveying 3-cu. yd./hr. of screenings.

B. Screen shall be automatically self-cleaning through the interaction of the filter elements without requiring any water or external mechanical devices (including the drive sprocket) to remove the captured materials from the screen surface. The screen shall be jam-proof and is to have no rake mechanisms in close proximity to the screen. It shall be designed to totally prevent jamming or blinding by forcing the captured material into the fixed apertures of the bar screen by the moving trash rake teeth.

C. Screen shall require no mounting, or fastening to the side walls or bottom of the channel. It shall be possible to pivot or remove the screen from the channel for inspection or service without dewatering the channel. The screen shall be capable of running backwards for short periods of time during maintenance.

2.3 EQUIPMENT CONSTRUCTION

A. All moving wetted parts, or all wetted parts on which the moving parts ride, which includes the shafts, side plates, chain links, straight guide rails and drive sprocket inserts, shall be fully corrosion-resistant, and shall be made of 316 stainless steel except as noted. EXCEPTIONS: The screening elements shall be of one piece, molded, high impact ABS plastic construction. Metal screening elements shall not be used to prevent shredding of trash. The rollers, upper guide rails and bushing shall be 400 series stainless steel (heat treated); plastic is not acceptable. The frame, which is stationary, shall be of stainless steel plate

not less than 1/2-inch thick, this includes the cross support members. The main drive shaft and sprockets shall be constructed of 316 stainless steel. The take-up screws shall be 316 stainless steel. The brush shaft and the brush hubs shall be stainless steel. The front seal brush and rotating brush shall have nylon bristles. The side seals will be made of neoprene rubber with stainless steel supports. All nuts and bolts shall be 316 stainless steel. The discharge chute shall be 316 stainless steel. All other appurtenances including drive supports, chains, chain guard, brush sprockets, bearing housing, and similar items shall be of manufacturers standard coated material. The drive shaft bearings shall be self-aligning, double-roller bearing pillow blocks.

B. The 400 SS screening rollers shall be a minimum 1-3/4-inches in diameter and shall ride on 1/2-inch thick, 316 stainless steel rails. A submerged curved stainless steel rail shall be provided at the foot of the screen. No submerged bearings or sprockets shall be allowed. In order to prevent deflection, the filter shafts shall have a minimum thickness of 3/4-inch diameter and shall be made of 316 stainless steel.

C. Except for manufacturer's standard stainless steel items, all stainless steel items mentioned above shall be 316 stainless steel alloy.

2.4 DRIVE UNIT

A. The drive unit shall be a Winsmith, Browning or equivalent reducer with a 750:1 double reduction worm gear equipped with anti-friction bearings and designed in accordance with AGMA recommendations for 24 hour, Class II service. The motor shall be no larger than 1.5 HP, TEFC, designed for outdoor operation on 3 phase, 230/460V, 60 cycle current. Overload protection shall be provided by a shear pin hub with alarm contact.

2.5 ELECTRICAL

A. NEMA 4X stainless steel control panel including liquid level actuated timer, main breaker, H/O/A switch, repeat cycle timer and running light to operate the screen on a liquid level control signal, timed or continuous basis.

B. The control panel shall properly interface with the limit switches on the screen to provide proper operation of the equipment. The automatic operation of the screen shall be controlled by an appropriate time clock and timers to provide user-adjustable operating service. The automatic control of the proposed common conveyor shall operate the conveyor each time the new screen and/or existing screen operate, and continue to run for 5 minutes after the screen has stopped.

C. The electrical panel shall be interfaced with the motor control center to operate the screen motor starter.

D. The electrical panel shall also be interfaced with the plant annunciator system, by providing normally open contacts for each of these conditions: 1. High level alarm in screen influent channel 2. Screen running.

E. All components in the Electrical Panel shall be heavy duty industrial quality, oil-tight, NEMA 4X, Allen Bradley Bulletin 800H. All relays shall be heavy grade machine tool relays, Allen Bradley Type N. Plug in relays shall not be accepted.

F. The control panel shall be capable of interfacing to the plant SCADA system for status and alarms.

2.6 LUBRICATION SYSTEM

A. A manual central lubrication system shall be provided with nylon lubrication lines and brass grease fittings extending from all grease points to a centrally located area accessible from the operating floor to facilitate lubrication of the equipment.

2.7 DISCHARGE CHUTE

A. The screen shall be provided with a 14-gage, 316 stainless steel discharge chute, and a flexible hypalon extension chute enclosed to direct the screenings into a conveyor. All fasteners and anchor bolts shall be 316 stainless steel.

2.8 TOOLS AND SPARE PARTS

A. Special tools, if required for normal operation and maintenance, shall be furnished with the equipment by the Manufacturer. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

B. The following spare parts shall be provided:

1. Twenty-five (25) 6mm, ABS filter elements.
2. Four (4) 316 stainless steel side plates.
3. Four (4) ¼" diameter Delrin 500 washers.
4. Eighteen (18) 1-3/8" diameter stainless steel snap rings.
5. Eight (8) 1-¾" diameter stainless steel snap rings.
6. One (1) rotating helical brush.
7. One (1) set front seal brush.
8. One (1) pair service fixtures.
9. Ten (10) shear pins.
10. One (1) year supply of lubricants.
11. One (1) set of bulbs and fuses.
12. One (1) set of plug-in relays.
13. One (1) set of limit switches.

C. Spare parts shall be properly bound and labeled for easy identification without opening the packaging and suitably protected for long-term storage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions.

3.2 SERVICES OF MANUFACTURER

A. The manufacturer of the screening equipment shall provide the services of a trained, qualified representative for at least two days for the purpose of inspecting the installation. The screen shall be checked for lubrication, alignment, rotation, vibration and the representative shall notify the Contractor and the Engineer of anything in the installation which might render the manufacturer's guarantee null and void. The screen shall also be checked for proper interfacing and coordination with the screenings conveyor. The manufacturer's representative shall also instruct the operating personnel as to the proper method of operation and the recommended lubrication and maintenance procedures.

END OF SECTION

SECTION 11342 - PNEUMATIC SCUM EJECTORS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing all labor, materials, equipment and incidentals required to install, place in operation, and field test two pneumatic ejectors, one for each new clarifier, as shown on the Drawings and as specified. Each system shall be complete with ejector, ejector controls, connections and appurtenances, tested and ready for service.

B. The intent of these specifications is to give a general description of what is required, but not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the ship testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units whether specifically mentioned in these Specifications or not.

C. Furnish and install all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not, that would be required for an installation incorporating the highest standards for this type of service.

1.2 DESCRIPTION OF SYSTEM

A. Each Pneumatic Scum Ejector System shall be composed of pneumatic ejector unit, ejector controls and accessories capable of handling the scum skimmings from one clarifier with a minimum of clogging and shall operate continuously, if required, at the design flow of 100 GPM at a total head of 25-feet.

B. Under normal operation, each ejector will automatically commence operation whenever the ejector pot reaches its maximum level.

C. Air for operation of the ejectors will be supplied from the air compressors at 13 to 18 psig, minimum to maximum.

1.3 QUALITY ASSURANCE

A. ***Available Manufacturers.*** Subject to compliance with requirements, provide from the following:

1. Clow Corporation - Model Yeomans Type SDV
2. Ralph B. Carter Co.
3. James Equipment and Manufacturing Co.

B. The ejectors covered by these Specifications are intended to be standard equipment of proven ability as manufactured by a reputable manufacturer having long experience in the production of such equipment.

C. The ejectors furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. All equipment shall be new and unused, shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified for a minimum of five years.

D. The ejector units, ejector controls and accessories shall be furnished by a single manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire ejector systems, including ejectors, ejector controls and accessories.

E. The control system shall have an established record of successful performance for similar service.

1.4 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide three sets of final drawings and installation instructions (include setting drawings and templates for location and installation of items and anchorage devices) to Engineer for use in observing installation and for record purposes.

B. Submittals shall also include:

1. Data on the characteristics and performance of each ejector unit. The total weight of the equipment including the weight of the single largest item.
2. A complete total bill of materials of all equipment.
3. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Part 3, with manufacturer's current price for each item.

C. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

1.5 DELIVERY, STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.

C. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished surfaces of all exposed ejector openings shall be protected by wooden blanks, strongly built and securely bolted to the opening.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage and handling.

G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.6 WARRANTY

A. All equipment supplied under this section shall be warranted for a period of one year by the Contractor and the equipment manufacturers.

B. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

C. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. Each ejector unit shall be rigidly and accurately anchored into position. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the manufacturer for installation by the Contractor.

B. Ample room shall be provided for inspection, repairs and adjustments.

C. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head and all other pertinent data shall be attached to each ejector unit.

2.2 EJECTORS

A. The single pneumatic ejector receivers shall be mounted as shown on the Drawings and shall consist of a cast iron receiver, special inlet and discharge check valves, and mechanical controls. Air shall be supplied by an existing remote compressed air system.

B. Contractor shall provide piping and connections between proposed ejectors and existing compressed air system.

C. Ejector receivers shall be cast iron, have a minimum capacity of 100 gallons, and be designed for 50 psi working pressure. Each receiver shall have a 5-inch inlet, 5-inch discharge, and 16-inch diameter manhole in the top. The inlet and discharge openings shall be flanged for attaching the inlet and discharge check valves. Except for the control equipment, there shall be no moving parts in the receiver.

D. Inlet check valves shall be special angle drop type with bronze flaps and removable seats and a handhole opening. Discharge check valves shall be horizontal, nonclog swing check design with solid bronze flap and hinges and removable seats. Mechanical controls for each ejector shall consist of two 35-pound cast iron bells; one 50-pound cast iron counterweight, counterweight lever, stainless steel bell rods, bronze pilot valve, and bronze piston valve. Controls shall be entirely mechanical and no electrical connections will be approved.

E. Actuation of the pilot valve shall be by the rise and fall of the liquid in the receiver causing the bells to rise and fall, the travel not to exceed 1-1/2-inches, and, with the counterweight, a force in excess of 30 pounds will be exerted. The pilot valve for each ejector will be mounted above the ejector receiver and shall have a bronze body with lapped bronze seat and slide.

F. The bronze piston valve shall be mounted as required and shall have a bronze body, bronze pistons, stainless steel piston rod, and cast iron end caps. Discharge plug valves, air lines connecting the pilot and piston valves, and inlet and discharge connecting piping shall be furnished by the Contractor.

G. The ejector manufacturer shall size and furnish fittings and appurtenances required for the inlet air lines, including the following:

1. plug type shut-off valves
2. globe type throttling valves
3. pressure reducing valves
4. pressure gauges complete with pulsation dampers
5. isolation valves
6. pressure relief valves
7. line strainers
8. check valves
9. pressure regulating valves.

H. All valves shall be bronze construction.

I. The contractor shall furnish the air piping, fittings, union, etc. to the size specified by the ejector manufacturer.

J. An air exhaust line, one size larger than the exhaust valves shall be installed as shown on the drawings to vent to the atmosphere.

2.3 EJECTOR CONTROL SYSTEM

A. The ejector units shall be designed to receive scum from the secondary clarifiers and discharge the same automatically when the ejector receivers have 100 gallons in them, without start-stop control from any other place. Air operated automatic valves between the existing remote compressed air system and the ejectors shall automatically control admission and exhaust of air to and from ejectors. All valve equipment shall be entirely mechanical without the use of electrical devices or connections.

B. Each ejector shall have a rated capacity as specified above and shall be capable of one operation per minute continuously when supplied with the recommended quantity of air at the recommended pressure.

C. A high water level sensor shall be installed in each Pneumatic Scum Ejector. An alarm light will be activated in the plant control panel if the water level in the ejectors reach the "high water level". The alarm and lights will be de-energized when the water levels fall below the "high water level". The sensor shall be as manufactured by B&W mounted in a type E1 holder. The sensor shall be provided with a Type L induction relay mounted in a NEMA 4 enclosure.

D. The ejector manufacturer shall furnish an interlocking system for installation in the pilot air lines to prevent simultaneous discharge of any of the four ejectors. The interlocking valves shall be of the diaphragm type.

E. Provide a remote control panel with a hand-off-auto switch located adjacent to each ejector for manual operation and lockout.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations (see Section 01700 - Contract Closeout). Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. The Contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.2 SHOP PAINTING

A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All ejectors and accessories shall be shop primed, with primer compatible with field painting as specified in Section 09900.

C. All nameplates shall be properly protected during painting.

D. Bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

3.3 FIELD PAINTING

A. Field painting is specified under Section 09900. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.

B. All nameplates shall be properly protected during painting.

3.4 INSPECTION AND TESTING

A. ***General.*** The Engineer shall have the right to inspect, test or witness tests of all materials or equipment to be furnished under these Specifications, prior to their shipment from the point of manufacturer.

B. The services of a factory representative who has complete knowledge of proper operation and maintenance shall be furnished for two days to inspect the final installation and supervise a test run of the equipment. These services may be combined with those provided under Paragraph 3.5, OPERATING INSTRUCTIONS. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

C. ***Ejector Units.*** After the ejectors and accessories have been installed, and working under the direction of the manufacturer, conducted in the presence of the Engineer, such tests are necessary to indicate that ejector efficiency and discharge conform to the Specifications. Field tests shall include all ejectors included under this Section. Supply all labor, equipment and incidentals required to complete the field tests.

D. If the ejector performance does not meet the Specifications, corrective measures shall be taken or ejectors shall be removed and replaced with ejectors which satisfy the conditions specified. A 24-hour operating period of the ejectors will be required before acceptance.

3.5 OPERATING INSTRUCTIONS

A. Six (6) operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions and similar items that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in Section 01700 - Contract Closeout.

B. In accordance with Section 01660 - Testing, Adjusting and Balancing a factory representative who has complete knowledge of proper operation and maintenance, shall be provided for two days to instruct representatives of the Owner and the Engineer on proper operation and maintenance. With the Owner's permission this work may be conducted in conjunction with the inspection of the installation and test run as provided under Paragraph 3.4. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

3.6 TOOLS AND SPARE PARTS

A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 - Contract Closeout.

B. The manufacturer shall furnish a complete set of recommended spare parts necessary for the first five years operation of the ejector system. The Contractor shall furnish the following spare parts:

1. Two (2) extra sets of all gaskets, seals, packing, diaphragms and related components.
2. Two (2) spare piston or Diaphragm Valves and two (2) spare pilot valves.

C. Spare parts shall be properly bound and labeled for easy identification without opening and packaging and suitably protected for long-term storage.

END OF SECTION

SECTION 11350 - COARSE BUBBLE AIR DIFFUSER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install a coarse bubble air diffuser system in the two new sludge holding tanks. Each tank is 92 ft. diameter, with 19.5-ft. SWD (side water depth), and 2-ft. freeboard as shown on the Drawings. The Drawings and Specifications direct attention to certain required features of the equipment but do not purport to cover all details entering into the design and construction. The Contractor shall furnish and install the mechanisms complete in all details and ready for operation. The air diffuser system in each tank shall be capable of providing 4010 SCFM, or 15.2 SCFM per diffuser. Each diffuser shall be capable of providing a peak airflow of 50 SCFM.

B. ***Related Work Specified Elsewhere:***

1. Section 15100 - Valves and Appurtenances

1.2 QUALITY ASSURANCE

A. The equipment described in this Section shall form an integrated system and be furnished by one supplier, who is fully experienced and qualified in the manufacturing of the equipment to be furnished.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Wilfley Weber, Inc., Denver, Colorado
2. Parkson, Inc., Fort Lauderdale, Florida
3. Sanitaire, Milwalkee, WI
4. Aercor, Sterling, MA

1.3 SUBMITTALS

A. Submit shop drawings and manufacturer's literature.

PART 2 - MATERIALS AND EQUIPMENT

2.1 AIR DIFFUSER ASSEMBLIES

A. The air diffuser manufacturer shall supply the diffusers, supports, support pedestal, anchor bolts, flanges, gaskets and other necessary appurtenances. The diffusers shall be Wilfley Weber Model CBS-24-OB, or equivalent.

B. The Contractor shall furnish and install the 14-inch Sch 10-304 stainless steel supply main, 14-inch butterfly valve, and the 8-inch Sch. 10-304 stainless steel header pipes at the location shown on the Drawings. The air diffuser assemblies shall be connected to the 8-inch header as shown on the Drawings. Two Hundred Sixty-four (264) open bottom diffusers (closed bottom diffusers are not acceptable) shall be required in each sludge holding tank.

C. Each diffuser header shall be 8-inch and attached to the 14-inch supply main by means of a flanged fitting. Supports as shown on the Drawings shall be provided to assure proper alignment and stability of the air diffuser assemblies while in service.

D. Each diffuser assembly shall maintain adequate headloss through the diffuser orifices to ensure self-cleaning headloss through the diffuser orifices. The headloss through diffuser orifices shall not be greater than 12-inches nor less than 8-1/2-inches of water column when operating at the specified air flow rate. The diffusers shall be fabricated and mounted on the diffuser header in such a manner as to ensure that any liquid in the piping will be readily evacuated when air diffusion is started.

E. All materials used in the air diffuser assemblies shall be suitable for continuous or intermittent use when diffusing low-pressure air at ambient temperatures. Air diffuser assemblies shall be designed for operation with minimum plugging and ease of servicing.

F. All nuts, bolts, washers, and other connecting or anchoring appurtenances used in the air diffuser assemblies shall be 316 stainless steel.

G. Coarse Bubble Diffuser Check Valve: The diffuser shall have an integral check valve to prevent solids and fluids from entering the pipe work. The check valve material shall be EPDM rubber that is resistant to wastewater fluids. The check valve shall be mounted inside the cast end-cap of the stainless steel diffuser. The check valve shall fit the inside dimensions of the end-cap and be secured with all stainless fittings. The check valve shall lay flat on the inside of the cap to ensure full sealing during shutdown. A stainless flapper clip shall be used to position and support the check valve under operational pressures. The flapper clip is to be held in place by stainless attachment to the cast end-cap.

2.2 TOOLS AND SPARE PARTS

A. Spare parts provided by the manufacturer shall include the following as a minimum.

1. Ten (10) spare diffusers.
2. Three (3) spare gaskets for each pipe size.

B. All special tools required for normal operation and maintenance of the equipment shall be furnished by the manufacturer.

C. All tools and spare parts shall be furnished in containers, clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for storage. All tools shall be furnished in steel tool boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions.

3.2 SERVICES OF MANUFACTURER

A. Furnish services of a qualified manufacture's representative, who has complete knowledge of the proper operation and maintenance of the equipment for a period of 2 days to inspect the final installation and supervise testing of the equipment.

B. Each piece of equipment shall be subjected to a test run under conditions approximating actual operating conditions. The equipment shall operate smoothly, quietly and without vibration.

C. In the event of improper installion or improper operation all defects shall be corrected, at no expense to the Owner, until the equipment operates to the satisfaction of the Engineer.

END OF SECTION

SECTION 11352 - CLARIFIER EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install (2) clarifier mechanisms designed and furnished for installation in two (2) concrete tanks. Dimensions of each tank shall be 110 feet diameter with a side water depth of 14 feet, free board and bottom slope as shown on the drawings. Each mechanism shall be center column supported, center feed, peripheral overflow type with a center drive mechanism rotating a suspended cage with two rake arms supporting the PVC sludge pick up pipes attached.

B. The equipment furnished for each clarifier mechanism shall include: truss type walkway, center assembly with drive motor, center support/feed column with inlet openings, center cage, truss scraper arms with PVC sludge removal pipes, scraper blades and squeegees, sludge collection box with PVC sludge valves, skimmers, scum drop box, alarm, weirs, baffles and anchor bolts.

C. The equipment's purpose shall be to collect settled sludge from the tank floor and discharge it to sludge the withdrawal collection drum. Scum shall be discharged through the scum withdrawal pipe connected to the scum box.

D. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of 1/4". Galvanized steel anchor bolts, with necessary hex nuts and washers, shall be provided for all parts of the clarifier mechanism to be secured to the tank. All fasteners for the mechanism to be ASTM A 325 high strength and Grade 5 for secondary connections. All hand-rail bolts will be 304 stainless steel.

1.2 REFERENCES

A.	ASTM A 36	Structural Steel Specification
B.	ASTM A 325	Fastener Specification
C.	ASTM A 304	Bolt Specification
D.	ASTM A 316	Bolt Specification
E.	ASTM A 48	Cast Iron Specification
F.	ASTM A 536	Cast Iron Specification
G.	ANSI 4142	Heated Treated Steel Specification
H.	AGMA 6034-E88	Practice For Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors

I. AGMA 2001-B88 Fundamental Rating Factors and Calculation Methods For Involute Spur and Helical Gear Teeth

J. AWS American Welding Society Current Standards

1.3 QUALITY ASSURANCE

A. The manufacturer shall modify his standard equipment to meet the minimum values specified for dimension, design and intent of this specification.

B. The complete machine shall be of sufficient strength to sweep in 2" grout on the tank bottom under its own power. Such grouting shall be done in strict accordance with the manufacturer's instruction.

C. Consideration shall be given to suppliers who have in operation at least twenty (20) similar clarifiers and have been supplying similar clarifier equipment for the past fifteen (15) years. Installation lists shall be available upon request.

D. Equipment shall be manufactured by Baker Process (EIMCO), Envirex (US Filter) or Walker Process.

1.4 CONTRACTORS SUBMITTALS

A. The contractor shall submit complete shop drawings of all equipment furnished in this section.

B. The contractor shall submit to the "Engineer" for review and approval the supplier's calculations substantiating the output torque rating of the drive selected, including all gears and pinions in the drive train.

C. The calculations shall clearly specify the values used for the following design parameters for surface durability and strength ratings:

1. Worm and Worm Gear Diameters
2. Number of Pinions
3. Actual Face Width
4. Tooth Geometry Factor (I and J factors)
5. Load Distribution Factor
6. Allowable Contact Stress
7. Allowable Bending Stress
8. Pinion Pitch Diameter
9. Tooth Diametrical Pitch
10. Hardness Ratio Factor
11. Elastic Coefficient
12. Life Factor

D. The load distribution factors cm & km per AGMA 2001-C95 shall be calculated as defined but in no case shall the values be less than 1.32. The net face width for surface durability calculations shall not exceed the actual face width of the narrowest of the two mating gears. For parameters which are material dependent, such as allowable contact stress, the calculations shall include a full description of the materials and heat treatment used.

E. The manufacturer shall submit design calculations substantiating the minimum deflections and stresses torques of the combined cage and rake arms as listed under the center cage and rake arm section of this specification.

1.5 DELIVERY

A. Fabricated assembles shall be shipped in the largest sections permitted by Carrier regulations, properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the manufacturer's field engineer.

PART 2 - PRODUCT

2.1 GENERAL

A. Each clarifier mechanism shall be of the center-drive type, supported on a stationary center support/feed column. The clarifier shall be designed to remove sludge uniformly from the bottom of the tank.

2.2 CENTER ASSEMBLY

A. The center assembly shall consist of the drive-unit with main bearing, suitable lubrication fittings, support points for the drive unit with main bearing and attachment points for the rotating center cage. The drive unit shall consist of a primary speed reducer which is driven by the electric motor, a roller chain, an intermediate gearset consisting of a worm and worm gear, and a low speed gearset consisting of a pinion and internal spur gear. The worm gear assembly shall be driven by a minimum 3/4 HP totally enclosed gear motor with 1.15 safety factor through roller chain and sprockets enclosed in a fabricated steel guard. The gear box shall have an AGMA class II rating.

B. The drive unit main gear shall be designed for a momentary peak torque of 82,000 ft. lbs. Mechanism rated strength shall be 42,000 ft. lbs. (mechanism rated strength equals the output torque of the main spur gear at which the drive control indicator will register 100% load). The drive shall be rated to operate continuously at a minimum torque of 21,200 foot-pounds for twenty-four (24) hours per day for twenty (20) years at the specified output speed of 0.025 rpm.

C. The main gear and worm assembly shall be enclosed in a ASTM A48 cast iron housing and provided with adequate seals to protect the interior of the housing. Fabricated steel housings are not considered equal. Housing shall be designed such that gears and bearings are oil bath lubricated. For spur gear teeth which are not fully submerged in oil, the tooth mesh shall be designed to force lubricant to the upper portion of the tooth face. Housings must be provided with oil level sight gauges, oil fill and valved drain connections and valved condensate drain connections from the low points of the oil reservoir.

D. The main gear housing shall be bolted to the top of the stationary influent column and shall be capable of transmitting the mechanical design strength. The rotating center cage to which the rake arms are attached shall be bolted to the main gear.

E. The main gear material shall be cast iron - ASTM A536 grade 80-55-06 minimum, and shall have a minimum pitch diameter of 40 inches and shall be supported by and rotated upon the main bearing. The minimum spur gear tooth height shall be 6.0 inches. No exceptions are allowed to this requirement. Spur gear surface area shall be a minimum of 753 square inches. Spur gear surface area is defined as the spur gear pitch diameter multiplied by the spur gear face width multiplied by 3.14.

F. The main gear shall be of solid one-piece construction. If split gear is utilized, mating sections shall be machined and a minimum of two (2) dowels on each side shall be used to insure proper alignment of the gear teeth. All bolts used shall be 316 stainless steel. For split gear construction, the allowable stress used in the calculations shall be reduced to 85% joint efficiency.

G. The main gear bearing shall be a radial-thrust type ball bearing with renewable strip liner races. The strip liner design shall be such that the B-10 life of the linear is a minimum of 20 years based on the specified mechanism speed and a uniformly distributed load on the rotating mechanism. Drives which do not use carbon corrected, vacuum degassed, high carbon steel liners (B-10 Life 250,000 hours) must provide two (2) complete spare bearing assemblies with the necessary seals as spare parts. Drives using integral bearing and gear assemblies must have replaceable bearing balls and liners independent of the gear without removing the gear.

H. The main bearing life shall be based upon the life to initial pitting of the linear element. Bearing diameter shall be a minimum of 45 inches.

I. The complete drive shall be assembled in the clarifier manufacturer shop and tested to assure the drive is running properly and to calibrate the drive control. A complete test report shall be sent to the Engineer verifying that the drive meets the quality assurance of the manufacturer and Engineer.

2.3 WORM, WORM GEAR AND PINION

A. The secondary reducer unit shall be constructed using ASTM A48 cast iron housing with a minimum pitch diameter worm gear of 21.5 inches. The worm shall be made of AISI 4142 heat treated steel ground and polished, driving a centrifugally cast manganese bronze worm gear. The worm and worm gear shall be designed based upon the requirements of AGMA standard 6034-E88 for the torque specified. Planetary gear units are not considered equal in design.

B. The pinion shall be constructed of steel, heat treated and precision cut to provide adequate tooth mesh for the values used in the calculations. The pinion must rotate in a lower taper roller bearing assembly and similar upper bearing encasement machined into the worm gear housing. The lower bearing pocket shall not be the collection point for condensation. Pinion shafts shall be one piece extending through the worm gear without intermediate couplings.

2.4 GEAR DESIGN AND RATING CRITERIA

A. Gearing shall be designed and rated using the criteria established by the following American Gear Manufacturers Association (AGMA) Standards:

1. AGMA 2001-C95 Fundamental Rating Factors and Calculation Methods For Involute Spur and Helical Gear Teeth

B. The output torque rating of the drive shall be based on the smaller of the two values determined from the above AGMA standard.

2.5 HOUSINGS

A. All gear housings shall be constructed using proper wall thickness' to resist the full drive peak loads without any deflections. The gear housing (turntable base) shall be designed with an integral, composite, side wall. The turntable side wall shall be built up sufficiently to ensure a secure oil bath compartment. A hardened raceway assembly, bolted to a flat plate, shall not serve as the oil containment barrier.

B. The main gear housing shall be designed with a condensate collection sump located beneath the main bearing assembly. The sump shall be the collection point for sediment, filings, condensate and other contaminants.

C. Before assembly, the base shall be thoroughly inspected for seep holes or inclusions and given a full hydrostatic test to ensure no leaks in the oil containment area. Copies of material certification sheets for the drive materials, as well as records of shop inspections shall be made available to the Consulting Engineer for review.

2.6 ALARM

A. An alarm horn shall be furnished by the equipment manufacturer and installed on the mechanism bridge by the contractor. The alarm shall be enclosed in a weatherproof housing with a non-corrodible industrial-type horn, relay, and reset button. The alarm unit shall be wired for operation on 110-volt, single-phase current.

2.7 OVERLOAD PROTECTION

A. The drive unit shall be equipped with an electrical- mechanical overload control device. The device shall be activated by thrust from the worm shaft. A calibrated spring will react to the worm thrust and allow axial movement of the worm shaft to activate a pointer. The pointer shall be covered by a plexiglass window providing a visual reading of the relative main gear output torque on a 0 to 100 percent graduated scale. The device shall also activate an alarm switch and motor cut-out switch. Exposed linkage bars, rods or revolving secondary worm gear housings will not be considered for this application.

B. The alarm and motor cut-out switches in the control device shall be factory calibrated and set to the required torque. The setting shall be as follows:

1. Alarm Torque set at 40% of Mechanical Design Strength.
2. Motor Cut-out set at 85% of Mechanical Design Strength.
3. Motor Back-up safety switch (or shear pin) set at 100% of Mechanical Design Strength.

C. The pointer, control switches, and electrical terminals shall be mounted in a NEMA 4 rated enclosure that is integral to the worm gear housing. The enclosure shall be sealed to the housing to prevent moisture from entering either the overload device or drive unit. Amperage and current sensing devices will not be considered equal to the overload device specified.

2.8 CONTROL PANEL

A. Provide for each clarifier a handrail mounted NEMA 4X stainless steel control panel.

B. Provide controls as required by Electrical Drawing No. E-17.

C. Provide local on/off switch.

D. Provide "on', "off", and "alarm" indication lamps.

E. Provide stainless steel mounting hardware.

F. Provide Allen Bradley relays and Allen Bradley Series 800T switches and indicator lamps.

G. Provide control transformer and wire components complete.

2.9 WALKWAY AND DRIVE PLATFORM

A. The clarifier shall be provided with a 36" wide truss walkway with truss side rails. The truss walkway shall be connected to and, supported by the drive platform at its inner end and supported on the opposite end by the tank wall. Walkway shall be designed to safely withstand all dead load plus a live load of 150 pounds per linear foot with a maximum deflection of l/360, over the entire span.

B. The horizontal and vertical truss sections shall be diagonally and laterally braced to resist the wind loads. The walkway surface shall be fiberglass grating.

C. A center drive platform shall be provided. The platform shall be a minimum of 8' x 8' square. The flooring shall consist of 3/8" checkered aluminum floorplate attached to a minimum of 1/4" structural steel frame, with necessary stiffeners and supports, resting on the center assembly and provided with connections to the walkway. Handrails 42" high of 1 1/2" diameter double-row horizontal aluminum pipe shall be placed around all sides the of operating platform. A 4" toe board shall be provided on the drive platform to keep tools from falling into basin.

2.10 CENTER CAGE AND RAKE ARMS

A. The center cage shall be of steel box truss construction, a minimum of 4'-0" square. It shall be provided with the connections for the four (4) sludge scraper rake arms and feedwell supports. The cage top shall be bolted to the main gear which shall rotate the cage with the attached arms and feedwell. The minimum structural angle size used for the cage and rake arms shall be 2" x 2" x 1/4".

B. The mechanism shall include two (2) full radius and two half radius truss-type collection arms. Sludge draw-off pipes shall be located along the arms with blades and squeegees arranged to direct the settled solids to the draw-off pipes and to rake those solids not picked up by the pipes to the center sludge pocket.

C. The rake arms shall rotate in a clockwise direction at a maximum tip speed of 9 ft/min. Each rake arm shall be designed to withstand 55,000 foot-pounds of torque plus all dead loads at the AISC allowable stress.

D. Each rake arm shall be provided with five (5) withdrawal pipes of PVC per ASTM D3034 (Type 1 Grade 1). Elbows with fair curves for change of direction shall be provided as required. PVC pipes shall be arranged for each assembly with minimum trimming. The maximum total sludge return based on utilization of (10) 8" diameter withdrawal pipes shall be 5,000 GPM for each clarifier. The withdrawal pipes shall be attached to the rake arms at their lower end by means of galvanized steel clamps and shall pass along the arms and vertically upward to the rotating sludge discharge well.

E. The torque cage shall be designed such that calculated stresses do not exceed the AISC allowable stress at 110,000 ft. lbs. load, and shall not exceed yield stress by more than 1/3 the AISC allowable stress. The manufacturer shall provide design calculations substantiating the design capacity of the torque cage and rake arm structure.

2.11 CENTER COLUMN

A. A 42 inch diameter x 1/4" wall thickness stationary center column shall be provided which shall serve as an influent pipe as well as the center support column for one end of the walkway and the rotating mechanism. One end shall have a support flange (1- 1/4" minimum thickness) for bolting to the foundation, with a minimum of eight (8) 1-1/4" diameter anchor bolts, and a similar flange at the top of the column for supporting the center assembly. Inlet openings for the influent flow and RAS shall be provided in the upper portion of the column. These openings shall not be less than 135% of the column area in sizing.

B. A minimum 24 inch diameter by 1/4" wall thickness RAS sludge return pipe shall be provided within the center support column to convey the collected sludge. It shall extend from the sludge collection box to within 1 feet of the floor as shown on the contract drawings.

2.12 FEEDWELL

A. The feedwell size shall be 32 feet diameter x 7 feet 1 inches side depth. The feedwell side plate shall be fabricated from 1/4" steel plate. The feedwell shall be supported by steel truss supports attached to the center rotating cage or be supported from the center drive platform.

B. The feedwell reinforcing rim angles, angle stiffeners and supporting brackets shall be structural steel members a minimum of 1/4". Eight (8) scum ports 4" high x 16" long shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level. Scum ports shall be free to allow scum to escape at any time.

2.13 ROTATING SLUDGE COLLECTION DRUM

A. Inside the feedwell, and supported from the rotating cage, shall be provided a sludge collection box. It shall contain a sludge control valve for each sludge draw-off pipe. A neoprene seal shall be provided between the rotating sludge collection box and center column. A peripheral sludge collection ring shall be designed and provided to allow sludge pumping from within the ring.

B. Each control valve shall be fabricated from ASTM D3034 PVC piping with a minimum 3/8" thick top and bottom flanges. Valves shall be assembled using approved PVC welding, solvent welded assemblies will not be allowed. All mounting hardware to be 304 stainless steel. The manufacturer shall provide a control handle to operate the control valves. The handle shall be provided with a length of chain sufficient to attach to the platform handrail.

2.14 SKIMMING EQUIPMENT

A. Each clarifier shall be equipped with two full radius skimmer arm assemblies to collect and discharge surface scum into a full radius scum trough cantilevered from the tank wall.

B. Each skimmer arm shall be either a structural steel truss assembly or a fabricated tube assembly connected to the center cage and cantilevered from the rotating feedwell. Tie rods shall be properly located to allow adjustment of the skimmer arm as well as to resist horizontal forces.

C. Each skimmer arm shall be equipped with a hinged 3/8 inch 65 durometer neoprene wiper blade extending the full width of the arm. The neoprene blade shall be fastened to the arm with stainless steel fasteners with steel back-up bars

D. The full radius scum trough shall be fabricated from 1/4 inch steel plate and shall be supported from the tank wall as shown on the drawings. The trough and support structure should be designed for all dead loads plus a 200 hundred pound point load at the feedwell end of the trough with no more than 1/2 inch deflection. The trough shall be 8 inches wide with a uniformly sloped bottom to allow scum to discharge towards the tank wall. A 6 inch schedule 40 pipe connection shall be provided as shown on the drawings for connecting to the embedded 6 inch scum line.

E. The clarifier equipment manufacturer shall furnish a flush valve assembly for automatic flushing of the scum box and scum pipe. The flush valve assembly shall allow approximately 2 to 5 gallons of clarified effluent to enter the box as the skimmer assembly passes over the scum box. It shall consist of an actuator bar and a pivoting assembly that will lift a ball to open the valve. A counterweight shall return the ball to its closed position after the flush cycle.

F. The clarifier mechanism manufacturer shall furnish for installation by contractor, a spray system attached to the clarifier walkway as shown on the drawings. All nozzles, piping valves and control to operate the spray system shall be included.

2.15 WEIRS AND BAFFLES

A. Effluent weirs shall consist of 9" deep x 1/4" thick FRP sections with 2 1/2" deep 90 degree V-notches at 6" intervals. The weir section shall be fastened to the tank wall with FRP washers, stainless steel anchor bolts and hex nuts to allow vertical adjustment. All joints between walls and weirs shall be given a seal coat of suitable waste resistant mastic by the erection contractor to prevent leakage.

B. The baffles shall consist of sections of 12" deep x 1/4" thick FRP attached to the tank wall by FRP angle brackets, stainless steel anchor bolts and hex nuts to enable vertical and radial adjustment.

2.16 PAINTING AND SURFACE PREPARATION

A. All submerged steel surfaces are to be sandblasted on site, primed and painted on site in accordance with Division 09900.

B. Prior to assembly of the drive unit, the castings shall have been sandblasted and thoroughly cleaned to remove any foreign particles in the drive base. After assembly, the drive mechanism shall be solvent cleaned and power wire brushed as needed prior to application of manufacturer's standard primer.

C. Gear motors shall be furnished with manufacturer's standard enamel.

2.17 SPARE PARTS

A. The intent of this specification is to provide non- interrupted continuous operation for approximately 6-10 years. The manufacturer shall supply any spare parts that are required for the minimum time frame. As a minimum, the following parts are to be furnished:

1. All sight glasses or oil gauges.
2. One (1) set of neoprene skimmer wipers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment shall be erected in strict accordance with manufacturer's recommendations. A 2" layer of grout shall be applied to the tank floor, using screeds attached to the rake arms. The mechanism shall sweep the grout, consisting of a mixture of sand and cement accepted by the Engineer, under its own power.

3.2 SERVICE

A. The equipment manufacturer shall provide a service man properly trained in inspection and operation of the mechanism to approve the installation, certify torque, run the test and instruct the owner personnel on maintenance and operation.

B. This service shall be in the form of one (1) trip to the site and two (2), eight (8) hour days of service. Any additional service shall be provided by the contractor at his expense for improper installation or delayed check-out of operator training.

END OF SECTION

SECTION 11355 - ROTARY DRUM THICKENERS AND POLYMER FEED SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. General: Furnish all labor, materials, equipment, and incidentals required to install, place in operation, and field test two (2) rotary drum thickeners and two (2) polymer feed systems. These specifications are intended to give a general description of what is required, but do not cover all details, which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery, complete installation, and field testing of all materials, equipment, and appurtenances for the complete installation of the rotary drum thickeners and the polymer feed system as herein specified.

B. Rotary Drum Thickeners: Furnish all labor, materials, equipment, and incidentals required to install, field test, and make completely ready for operation two (2) rotary drum thickeners. Each rotary drum thickener shall be capable of thickening a peak flow of 250 gallons per minute of waste activated sludge with a feed dry solids concentration ranging between 0.7 to 1.0 percent by weight. The rotary drum thickeners shall each be capable of thickening the feed sludge to a solids concentration by weight of between 6 to 8 percent.

C. Polymer Feed/Flocculation System: Furnish all labor, materials, equipment, and incidentals required to install, field test, and make completely ready for operation two (2) polymer feed/flocculation systems. Each polymer feed system shall be designed to automatically meter, blend, mix and age concentrated liquid polymers with dilution water.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Materials, and Equipment: Section 01600

B. Field Panels-Division 13

C. Except as otherwise specified herein, electrical work is specified in Division 16.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The rotary drum thickeners shall be the integrated product of a single manufacturer who designs and manufactures the entire assembly.

a) The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

2. Each component and ancillary equipment items furnished under this specification shall be new and unused, and the product of a manufacturer having a successful record of operation, manufacturing and servicing similar duty equipment for a minimum often (I0) years. The rotary drum thickener manufacturer shall also have a minimum of 10 successful installations for similar rotary drum thickener size and duty in the United States, that have each been in operation for at least 10 years.

3. The combination of the rotary drum thickener and polymer feed system shall be furnished by a single supplier who shall be responsible for the coordination of the system design and who shall assume complete responsibility for the proper operation of the system including equipment supplied but not of this manufacture.

B. Tests:

1. The rotary drum thickener and polymer feed equipment manufacturer's representative shall perform the following tests:

a) Test each unit for mechanical and electrical correctness.
b) Hydraulically test each unit.

2. Perform field tests specified in Part 3 of this Section.

C. Equipment Manufacturers: The rotary drum thickener units shall be as manufactured by Jones & Attwood, Parkson Corporation, Moyno Hercules, or approved equal. The polymer feed system shall be as manufactured by Stranco, Norchem, Wallace and Tiernan or approved equal.

1.4 SUBMITTALS

A. Material and Shop Drawings: Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions and Section 01340. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, physical characteristics, dimensions, water and power connections, and anchor bolt locations.

2. Descriptive literature, bulletins, and/or catalog cut sheets of each item of equipment.

3. The total weight of the equipment including the weight of the single largest item.

4. A complete total bill of materials for all equipment.

5. A list of manufacturer's recommended spare parts to be supplied including those specified in Paragraph 2.6, with the manufacturer's current price for each item. Include gaskets, packing, etc. on list. List bearings by the bearing manufacturer's numbers only.

6. Complete motor data as required herein.

7. A detail of the intended support members with certification demonstrating their adequacy for the application and anticipated loads.

8. Performance data and operating experience for the rotary drum thickeners indicating the equipment proposed for this project will comply with the specified thickening requirements.

9. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

B. Operating Instructions:

1. Six (6) copies of an operating and maintenance (O&M) manual shall be furnished. The O&M manuals shall be prepared specifically for this installation and shall include all required catalog cut sheets, drawings, equipment lists, descriptions, and necessary information, that are required to instruct operating and maintenance personnel unfamiliar with such equipment. A complete, corrected and approved copy of the shop drawing submittal shall be included with each manual provided. Special requirements for the preparation of the O&M manuals shall be as specified in Section 01730.

2. In addition to the operating and maintenance manual submittal specified in Section 01730: Operating and Maintenance Data, manufacturers shall submit duplicate data on magnetic media/floppy disks in Microsoft Word, Word Perfect, or text "txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG, or DXF formats. Such data will be utilized by the SCADA systems integrator for compilation into hypertext Window help files. Manufacturers will be required to review hypertext files compiled by systems integrator for accuracy prior to introducing them into the SCADA system.

3. A factory representative with complete knowledge of proper operation and maintenance shall be provided for a total of three (3) separate 8 hour days. One (1) of these days shall be dedicated to instruct representatives of the Owner on proper operation and maintenance of the equipment. This work may be conducted in conjunction with the inspection of the installation and test run as provided herein, with the Owner's permission. If there are difficulties in the operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The rotary drum thickeners and polymer systems shall be factory assembled and tested, and shall be delivered to the site for installation fully assembled. The thickeners and polymer systems shall be capable of being set in place and field erected by the Contractor with only minimal field assembly.

B. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

C. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

D. Protect the equipment from being contaminated by dust, dirt, vibration and moisture. The equipment storage area shall be well ventilated to prevent excessive heat buildup. Rotate the rotary drums, all gear reducer shafts that have bearings and all pump impellers on at least a monthly basis.

E. Exposed openings for connection to piping shall be properly plugged or protected by wooden blanks, strongly built and securely bolted to flanged surfaces.

F. The Contractor shall handle during delivery, storage and installation in a manner to prevent damage of any nature in accordance with the manufacturers approved written instructions and in accordance with instructions given on-site by the manufacturer's representative.

G. Each box, crate or package shall be properly marked to show its net and tare weight in addition to its contents.

1.6 WARRANTY AND GUARANTEES

A. All equipment supplied under this Section shall be warranted for a period of one (1) year by the manufacturer and Contractor. Warranty period shall commence upon Owner acceptance as outlined in the General Conditions.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

D. Refer to the General Conditions and Section 01740 for additional guarantee and warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. The rotary drum thickeners and polymer feed units shall be complete including all specified accessories. All equipment shall be so designed and proportioned so as to have liberal strength, stability and stiffness and to be especially adapted to the work to be done.

B. Each rotary drum thickener shall be constructed entirely of Type 316 stainless steel and shall consist of a welded steel skid base and support columns with an integral drip pan and necessary deck plate, flanged inlet and outlet connections to the unit, a baffled, flocculation tank with covers, a stainless steel wedgewire or perforated sheet sludge thickening element, a trunnion support system for the thickening element with water or grease lubricated bearings, a motor driven mechanical adjustable speed gear drive unit with a belt drive system for the thickener drum, a 1/4-inch thick neoprene gasket shall be attached to a 1-inch wide flange on the tank to provide a seal when the doors are closed.

C. Thickener Assembly:

1. The thickening element shall be a cylinder constructed of Type 316 stainless steel wedgewire, or a perforated stainless steel sheet resistance welded to a substructure network. Each end of the thickener element shall be fitted with a Type 316 stainless end ring welded to the element substructure throughout the circumference. One end will be the feed and the other end the discharge end and incorporate an extended bellmouth to provide the effective discharge thickened solids away from the base of the unit. Each end ring shall also include a track area specifically designed to be supported by the trunnion wheel assemblies.

2. The thickener cylinder utilizing a wedgewire dewatering element structure shall have a slot opening of 0.020-inch with a maximum tolerance of ± 0.004-inch on the slot space. The profile wire shall have a minimum face width of 0.060-inch wide and an approximate depth of 0.100-inch. The profile wire shall run parallel with the longitudinal axis of the thickener cylinder throughout its entire length. The substructure shall be located on 3/4-inch centers with rods having a teardrop or circular cross section with an approximate height of 0.210-inch. The substructure rods shall run circumferential to the cylinder center line. The thickener element shall be equipped with Type 316 stainless steel diverters. The diverters shall be arranged in a helical pattern throughout the length of the thickener causing the solids to continually move forward. The diverter height shall be a minimum of 1/2-inch.

3. The thickener cylinder utilizing perforated sheet dewatering element shall be fabricated of 20-gauge minimum Type 316 stainless steel plate. Perforations in the plate shall be 1.25 mm in diameter with a center to center spacing of 0.099-inches. An adequate number of holes shall be provided in the perforated sheet to provide a minimum of 26 percent open area. An integrally mounted, Type 316 stainless steel, internal helical screw shall be provided to transport thickened sludge out of the drum.

4. The thickener element shall be equipped with a helical hydraulic back stop having a minimum height of 3-inch. The back stop shall allow the accumulation solids on the thickener element for further dewatering. The back stop shall be arranged in a helical pattern to provide continuous thickening as the solids move toward the discharge end of the thickener.

5. Each rotary drum thickener shall be provided with an integral drip pan which extends 6-inches beyond the edges of the thickener. The drip pan spray wash system shall be provided with a high pressure spray pump, piping for spray washdown and water lubrication, and rotary drum thickener control panel.

D. Each polymer dilution/feed system shall consist of an integrated equipment package capable of automatically metering, diluting, activating, and feeding liquid polymer and water. The system shall activate emulsion or solution polymer in a motor-driven multi-zone mixing vessel.

E. Each piece of equipment shall be provided with an engraved Type 316 stainless steel nameplate including the manufacturer's name, model and serial numbers of the unit, capacity, drive horsepower and all other pertinent information. The equipment nameplate shall be attached to the unit with stainless steel screws or rivets in a prominent location.

2.2 ROTARY DRUM THICKENERS

A. General:

1. Provide two (2) rotary drum thickeners complete with all specified appurtenances and accessories. Each rotary drum thickener shall be capable of thickening a peak flow of 250 gallons per minute of waste activated sludge with a feed dry solids concentration ranging between 0.7 to 1.0 percent by weight. Each rotary drum thickener shall be capable of thickening the feed sludge to a solids concentration by weight of between 6 to 8 percent.

2. Each rotary drum thickener shall be fully automatic, internally fed and self cleaning, and shall consist of an inlet flocculation chamber/tank, a cylindrical drum/screen with internal conveyor flights/helical transport screw, drum support trunnions, mechanical adjustable speed gear drive with a belt drive system, an automatic overflow device with an overflow alarm, a spray cleaning system, support frame and leg supports with an integral drain pan, splash covers, and a thickened sludge discharge chute with an adjustable diversion gate.

3. Each rotary drum thickener shall be as specified below and equivalent to a Rotafine Model RST 1100 as manufactured by Jones and Attwood, Inc., a Roto-Guard Model AG-3000A as manufactured by the Parkson Corporation or an equal approved by the Engineer.

B. Inlet Flocculation Chamber/Tank

1. Each rotary drum thickener shall be equipped with an inlet flocculation chamber/tank with a minimum working volume of 500 gallons. The flocculation tank shall be free standing with a sloping floor and with overall dimensions as shown on the Drawings. The tank shall be provided with a 6-inch flanged inlet nozzle at the bottom of inlet side of the tank, an 8-inch flanged outlet nozzle at the top of the outlet side of the tank and a 4-inch flanged nozzle for the drain located at the low end of the tank bottom. Nozzles for pipe connections shall be fabricated of Schedule 10 wall thickness, Type 316 stainless steel pipe. Flanges shall be Type 316 stainless steel with ANSI B16.1, Class 125 dimensions and drilling patterns. The flocculation tank shall be constructed of 12-gauge minimum, Type 316 stainless steel. The tank shall be provided with eight (8) baffle plates to produce a serpentine flow pattern through the tank to the discharge point of the tank.

2. An 8-inch flanged fabricated connection pipe shall be provided to connect the outlet of the flocculation tank to the inlet transition feed box of the rotary drum thickener. The transition collection pipe shall be of all welded construction. The pipe and fittings used to fabricate the connection piece shall be Schedule 10 wall thickness, Type 316 stainless steel pipe. Flanges shall be Type 316 stainless steel with ANSI B16.1, Class 125 dimensions and drilling pattern. A flexible expansion joint shall be provided between the connection piece and the inlet to the thickener feed box. The flexible expansion joint shall be as specified in Section 15050.

3. The waste activated sludge discharged from the flocculation tank shall flow through the fabricated connection pipe to the transition feed pipe/box at the inlet end of each rotary drum thickener. The transition feed pipe/box shall be constructed of minimum Schedule 10 pipe or 12-gauge plate, Type 316 stainless steel. The transition shall be flanged with an 8-inch flange, Type 316 stainless steel, with ANSI B16.1, Class 125 dimensions and drilling pattern, for connection to the connection piece. The transition feed pipe/box shall be welded to the inlet side of the thickener. The transition piece shall be designed to allow the flocculated solids to be discharged gently into the thickener unit with minimal shearing. The transition feed arrangement shall be equipped with a single side discharge and an adjustable weir and shall also be provided with a 4-inch diameter cleanout port for maintenance and drainage purposes.

4. Each flocculation tank shall be provided with two (2) hinged covers as shown on the Drawings. The covers shall be fabricated of minimum 16 gauge stainless steel. Structural stiffeners shall be provided as required to prevent warping and deformation. A continuous stainless steel hinge and two (2) handles shall be provided for each cover. The handles shall be located as shown on the Drawings. The cover hinges shall be attached to and supported by a structural channel spanning across the tank. All materials used to fabricate the covers shall be Type 316 stainless steel.

5. A drip pan shall collect filtrate during operation, spent water from the spray wash system and washwater during cleaning operations. The drip pan shall have a sloped bottom and shall be constructed of 12-gauge minimum, Type 316 stainless steel. The drip pan shall be reinforced with welded structural stiffeners to prevent deformation with the pan full of water. Stiffeners shall be Type 316 stainless steel structural shapes. The low end of the sloped pan shall have a 6-inch flanged nozzle located as shown on the Drawings. The nozzle shall be constructed of minimum Schedule 10, Type 316 stainless steel pipe with a 6-inch flange fabricated of Type 316 stainless steel with ANSI B16.1, Class 125 dimensions and drilling pattern.

6. Each thickener shall be equipped with an automatic overflow system which shall divert flow from the thickener to the integral drip pan. Materials for fabrication of the overflow system shall be Type 316 stainless steel. The thickener shall be provided with a high level alarm to indicate an overflow (excess feed) condition.

C. Base Fame: The base frame shall be constructed of Type 316 stainless steel structural shapes and shall be accurately fabricated to provide a mounting surface for the thickener assembly. The frame shall be designed to withstand all loads imposed by the components plus the weight of the sludge passing through the unit. The base shall also be designed in such a way to allow for 4-point support without deflection exceeding 1/720th of its length. Four (4) anchor-bolt holes and four (4) lifting lugs shall be incorporated into the base. Anchor bolt assemblies shall be Type 316 stainless steel. A cylinder stabilizer assembly shall be provided at the discharge end of the cylinder to maintain proper cylinder position along the longitudinal axis of the unit. This assembly shall consist of two (2) "V" grooved cast trunnions engaging a rolled right angle Type 316 stainless steel section located around the periphery of the thickener element contacting the cylinder flange. The stabilizer assembly shall limit the cylinder movement to ± 0.125-inch.

D. Trunnions: Four (4) heavy duty trunnions shall be provided for each thickener, and shall be accurately mounted to the base frame to provide positive horizontal alignment of the thickener. Each trunnion shall be supported by a minimum 1.5-inch diameter Type 316 stainless steel non-rotating shaft and supported by a Type 316 stainless steel yoke. Internal to each trunnion shall be a nitrile lined sleeve bearing with flushing grooves. Each trunnion bearing shall be 100 percent grease-packed and double-sealed at the factory not requiring lubrication in the field. Each support shall be mounted on a fabricated Type 316 stainless steel pedestal. Trunnion rims shall be solid urethane, polyethylene or nylon supported by a Type 316 stainless steel hub. Trunnion guards shall be integral with the Type 316 stainless steel splash guards to protect the trunnions. The trunnion wheel assembly shall be designed such that the wheel and/or sleeve bearing may be replaced independently of the other wheel parts.

E. Splash Guards: Each thickener shall be equipped with external splash guards constructed of minimum 12-gauge Type 316 stainless steel. These guards shall be located on each side of the thickener element and attached to the base. The splash guards shall be designed to contain and direct the entire flow through the

thickener base discharge opening. The splash guards shall have internal spiral guided flow vanes. The use of rubber or rivets on the splash guards shall not be allowed. The guards shall be designed to be easily removed for maintenance or access purposes. The splash-guards shall be self-supporting throughout their entire length, and shall also support the weight of the external covers/hoods which mount on them.

F. Cover Hoods:

1. A cover hood assembly shall be provided for each thickener. Each cover hood will consist of multiple sections to facilitate handling by the operator or maintenance personnel. Each section shall be sufficiently durable to withstand visual damage from 1" hailstones, and designed for a live load of 40 psf on a horizontal projection plus a 30 psf wind load.

2. Each cover section shall be capable of being opened and locked in the "open" position by the operator. Design calculations shall be submitted as part of detailed shop drawings. Each cover section shall be capable of being totally removed by two operators. Each section of the cover hood shall consist of a panel plus support members, lift off hinge and locking assemblies. Cover panels shall be minimum 16-gauge. Type 316 stainless steel with 0.125-inch minimum thickness. Stiffening angles, base brackets, inspection bars, and all assembly hardware shall be Type 316 stainless steel, and shall be die formed to ensure accurate dimensions of the finished units. Cover hood assemblies shall fasten to and be supported by the splash guards located below them.

G. Solids Discharge Chute and Thickener End Door:

1. Each thickener shall include a heavy duty Type 316 stainless steel solids discharge hopper. The lower part of the hopper shall fit closely beneath the bellmouth discharge of the thickener, so that all solids are captured. The hopper chutes shall have a 2-inch angle welded continuously around the chute to provide a flashing seal at the opening of the concrete deck. The chute bottoms shall extend 6 inches from the underside of the concrete deck. Sloped sides used to form the discharge chutes shall have slopes not less than 60°, from the horizontal. The thickener discharge hopper shall be provided with a hinged horizontal stainless steel cover. A continuous steel hinge and two (2) handles shall be provided for each cover. The cover shall be provided with structural stiffeners to prevent warping and deformation. All materials used to fabricate the discharge hopper, chutes, diversion gate, hinge, cover and hardware shall be Type 316 stainless steel. Plate used to fabricate all but the cover shall be minimum 12-gauge. The cover shall be fabricated of minimum 16-gauge plate. A 1/4-inch thick neoprene gasket shall be attached to a one-inch wide flange on the discharge hopper to provide a seal when the cover is closed.

2. The upper part of the sludge discharge hopper shall completely enclose the discharge end of the thickener element and shall attach to the hood and splash guard assemblies. Two (2) vertical hinged, removable doors shall be provided and, when opened, shall provide full access to the interior of the thickener drum. To minimize leakage, gaskets and a latch shall be provided to secure the doors when closed. All panels shall have a minimum thickness of 12-gauge (0.1054-inch), and support member shall be substantially sized to ensure the access door and hopper assembly is durable and stable under all operating conditions. The doors, hinges, latch mechanism and all hardware shall be fabricated of Type 316 stainless steel.

H. Thickener Drive Unit:

1. Each thickener shall have a drive system consisting of an electric motor, mechanical adjustable speed drive unit, drive sheave, and drive belt which rides on a centrally located drive ring fixed externally onto the thickener. The mechanical adjustable speed drive unit for each thickener shall have an integral electric motor mounted to the unit. The mechanical adjustable speed drive unit shall be a friction disc type, adjustable speed unit with a minimum rating of 3.0 horsepower, Nord Disc Series, as manufactured by Nord Gear Corporation, or an approved equal.

2. The mechanical adjustable speed drive unit shall have an adjustable 6:1 speed ratio and shall be foot mounted with parallel, helical gearing. The unit shall be designed and constructed of materials for severe duty requirements. The drive unit shall have a built-in position indicator to provide quick reference to operating speed. Bearings for the adjustable speed drive unit shall be high capacity, anti-friction type with a B-10 rating of a minimum of I00,000 hours.

   a) Friction Disc Type, Adjustable Speed Unit: The unit shall include a traction ring and a driving disc, all enclosed in a rugged, SAE Class 30 cast iron housing. The traction ring shall be of tough phenolic construction, designed with a self-cleaning friction face. The conical driving disc shall be precision machined for longer life and chrome plated after machining. The driving disc shall be mounted to the motor drive shaft. Speed changes shall be made by a handwheel operating a rugged screw-type control to obtain smooth speed adjustments by changing positions of the motor driven disc in relation to the traction ring. The unit shall provide, constant torque output throughout the entire speed range by utilizing a torque compensator to match the pressure between the driving disc and the traction ring with the torque required by the thickener belt drive.

3. The integral gear reducer gear-case shall be constructed of high strength, SAE Class 30, gray cast iron. Gears shall be carburized and drop forged for durability to a hardness of 58-62 R_c and shall be finish ground to AGMA 13 quality levels to assure minimum backlash, noise and heat buildup, while maximizing efficiency. The gear reducer shall meet AGMA Service Class III requirements with a service factor of 2.0. Shaft seals for

the gear reducer shall be multi-lipped rubber seals with grease encapsulated between the seals to keep oil in and contaminants out. Bearings for the gear reducer shall be high capacity, anti-friction type with a B-10 rating of a minimum of 100,000 hours. The gear reducer shall have easily accessible oil fill and vent plugs, and an oil level indicator.

4. The integral electric drive motor shall be performance matched to the adjustable speed drive and gear reducer combination. The motor shall be a standard "C" face type motor with a mounting flange such that the motor is mounted to the adjustable speed drive unit with four bolts. The motor shall be provided by the mechanical adjustable speed unit manufacturer and shall have the characteristics as specified below. The output shaft of the drive unit shall be keyed for attachment to a belt drive sheave.

5. The mechanical adjustable speed drive unit shall be finish coated at the factory with a two-part, polyamide epoxy coating system suitable for severe, corrosive environments.

6. A cast iron belt drive sheave shall drive a neoprene rubber power belt engaging a continuous Type 316 stainless steel drive ring which is integral to and located around the circumference of the thickener drum.

7. The drive assembly shall be mounted on a Type 316 stainless steel base equipped with an adjustment means to provide proper belt tension for smooth operation and minimum wear. The drive arrangement shall be enclosed in a Type 316 stainless steel, gasketed cover, 0.060-inch thick.

I. Spray System/Pressure Booster Pump:

1. A water spray system constructed of Type 316 stainless steel shall be provided. Three (3) external spray headers shall be mounted on the external splash guards and parallel to the longitudinal axis of the thickener. The header nozzles shall spray at an angle of 90° to ensure the spray penetration between the thickener openings. The three (3) headers shall be equipped with Type 316 stainless steel nozzles and a 2-inch NPT coupling with necessary piping and valving to the pressure booster pump.

2. To provide the necessary pressure for cleaning the thickener drum, a booster pump shall be supplied for each thickener, to increase the service water pressure to the spray system. The booster pump shall be a close-coupled centrifugal booster pump suitable for clear water with temperatures between 32°F and 150°F. The pressure on the inlet side of the pump will range between 35 to 55 psig. The required minimum discharge pressure for the booster pump is 75 psig with a flow of 100 gpm.

3. The booster pump for each thickener shall be a bronze fitted, close-coupled centrifugal pump, equal to a Goulds Model 3656 S-Group. The pump casing and casing adapter shall be manufactured of cast iron in

accordance with ASTM A48, Class 20. The pump impeller and casing wear ring shall be manufactured of bronze in accordance with ASTM B584. The shaft sleeve and impeller key, bolt and washer shall be Type 300 stainless steel. Mechanical shaft seals shall be tungsten-carbide, diamond polished in a bronze carrier. All hardware shall be stainless steel stub bolts and the O-rings shall be of Viton. The pump motor shall operate on 460 volt, 3 phase, 60 Hertz power, and be rated at 5.0 HP operating at 3,500 rpm. The pump and motor shall be coated at the factory with a two-part, polyamide epoxy coating system suitable for severe, corrosive environments.

J. Electric Motors:

1. General:

a) The motors for the mechanical adjustable speed drive units and the spray system booster pumps for the rotary drum thickeners shall be of the horizontal, TEFC design.
b) All motors shall be built in accordance with latest NEMA, IEEE, ANSI, and AFBMA standards where applicable.
c) Motors shall be as manufactured by U. S. Electrical Motors, General Electric Company or Reliance Electric Company.
d) The motor shall be non-overloading, without use of the service factor, at any point on the driven equipment's performance curve.
e) Motors shall meet all requirements as outlined in Section 16150, unless modified herein.

2. Performance Requirements:

a) Motors shall be rated for operation on 3-phase, 460-volt power supply.
b) Each motor shall have a 1.15 service factor.
c) Motors for the mechanical adjustable speed drive units shall be rated at a minimum of 3.0. Motors for the spray system booster pumps shall be rated at a minimum of 5.0 horsepower.
d) Motors shall have a premium duty efficiency.
e) Motors shall be free of objectionable noise and vibration. Units shall operate with a maximum sound level not to exceed 85 dBA as measured 5 feet from any surface.
f) Maximum temperature rise of motor windings shall not exceed 80 degrees C, as measured by resistance, when motor is operated continuously at service factor horsepower, rated voltage and frequency in ambient air temperature of 40 degrees C.

3. Motor Construction:

a) Motors shall be suitable for operation in moist, outdoor air.
b) Motor shall be of all cast iron construction for frame, end brackets, conduit box and fan shroud. Motor shall be of such design and proportions as to hold all motor components rigidly in proper

position and provide adequate protection for the type of enclosure employed.

c) The motors shall be of totally enclosed fan cooled (TEFC) construction. Motors shall have a Class B non-hygroscopic epoxy-sealed insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

d) Motor windings for stator and rotor leads shall be manufactured using solid copper wire. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

e) Neoprene shaft slinger shall be provided and lead wires shall be nonbraided and nonwicking to prevent entrance of moisture and contaminants.

f) All leads shall be brought out to a separate terminal box and shall be marked and identified. The terminal box shall be split construction, double gasketed, containing provisions for grounding the motor and shall comply with NEMA standards for minimum volume.

g) Motors shall have stainless steel breather drains at both ends to allow proper drainage of condensation.

h) The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating.

i) Stator and rotor cores shall be made of low loss, non-aging electrical sheet steel with insulated laminations. Stator coils shall be random wound and of size, shape, insulation and number of turns required. Coils shall be epoxy sealed after fabrication.

j) Motors shall be equipped with shielded, regreasable, vacuum degassed steel ball bearings made to AFBMA Standards, and be of ample capacity for the motor rating. Bearings shall have a minimum B-10 bearing life of 100,000 hours.

k) Nameplates shall be stainless steel fastened with stainless steel pins or screws. Lifting lugs or "O" type bolts shall be supplied on all motors. Enclosures shall have stainless steel screening and shall be protected from corrosion, fungus and insects.

l) All grease plugs, fittings, bolts, nuts, and screws shall be stainless steel. Bolts and nuts shall have hex heads. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.

m) Each motor shall be provided with a heat overload protection device to protect the motor from overheating during operation. The device shall immediately stop the drive motor in the event of excessive heat buildup. The device shall be normally open and close upon detection of a heat overload condition.

K. Rotary Drum Thickener Control Panel

1. General:

a) Provide a control panel for each rotary drum thickener in materials and rating noted below. Panels shall be sized to adequately

dissipate heat generated by equipment mounted inside or on the panel face with minimum dimensions as shown on the Drawings.

Panel Name	Rating	Qty	Material	Power Feed
Rotary Drum Thickener Control Panel	NEMA 4X	2	Stainless Steel	460 VAC, 60 Hz

b) Each panel shall be provided with a floor mounted support. The support shall be fabricated of Type 316 stainless steel structural square tubing and plate. The support shall be fabricated to a height such that when mounted, the center of the control panel shall be 5' - 6" above the mounting slab. The support shall be of sufficient strength to support the panel and withstand a 120 mph wind load.

c) The control panels shall be designed and fabricated in accordance with the requirements of Section 13300, unless modified herein. Exceptions to these specification requirements shall be noted in the shop drawing review and brought to the attention of the electrical subcontractor.

d) Changes to the field wiring requirements shall be fully coordinated by the Contractor and all modifications to field wiring shown on the Drawings, as a result of these changes, shall be provided by the Contractor at no additional cost to the Owner.

2. Finish:

a) Smoothly finish panel face openings for panel-mounted equipment. Cut with counter boring, and provide with trim strips as required to give a neat finished appearance.

b) Stainless steel surfaces shall not be painted. Interior backplate shall be Type 304 stainless steel.

3. Access and Identification:

a) Provide a continuous piano hinge door for ease of access on all control panels. Expose a minimum of 80 percent of the panel interior for door openings. Panel door openings shall be sealed and fully gasketed. Provide print pockets on each door. Panel doors shall be equipped with quick-release latches.

b) All components and terminals shall be accessible without removing other components except for covers.

c) Panels shall have conduit entry from the bottom only.

d) Provide laminated, engraved plastic nameplates for all front-face panel mounted controls to completely define their use.

e) Provide plastic, permanent identification tags and wire number tags for all internal components, wires, and terminals.

4. Corrosion Control: Protect all panels from internal corrosion by the use of corrosion-inhibiting vapor capsules, Hoffman, model A-HCI, or equal. Provide panels with combination drain/breathers, Crouse-Hinds model ECD 18 or equal.

5. Temperature Control: Provide panels with thermostatically controlled space heaters to maintain internal temperatures above due point.

6. Construction: All panels shall be manufactured items, Hoffman Engineering, or approved equal. Minimum metal thickness shall be 14-gauge. Provide stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

7. Electrical:

   a) Provide a main circuit breaker and internal branch circuit breaker for each branch circuit as required to distribute power within each panel from the main power feed. Provide terminal board for termination of all wiring. Provide access to the branch breakers when the panel door is open. Do not exceed an amp capacity of 12 amps for any branch circuit. Provide electrical surge suppressors on all incoming power and control circuits.

   b) All control voltage for the panel shall be 120 volt, single phase. Provide a 120 volt/460 volt, single phase transformer in the panel to provide control voltage. A separate circuit breaker shall be provided for the control transformer.

   c) Design, furnish and install all interior wiring within the control panel and furnish complete wiring diagrams showing the electrical circuits inside the panel and interconnections between the panel and the external instruments and components. Identify and number all terminals and wires. Attach plastic, heat-shrink type numbered tags to each panel wire for identification. Inside each panel, provide a copy of the panel wiring diagram. No power shall be applied until the supplier has approved the installation.

   d) Wiring within panels shall meet the following requirements:

      1) Discrete wiring shall be 600-volt, type TFF/MTW stranded copper, sized for the current carried, but not smaller than No. 16 AWG.
      2) Power wiring shall be 600-volt, type TFF/MTW stranded copper, No. 12 AWG size, for 120V service.
      3) Analog signal wiring shall be 300-volt, stranded copper in twisted shielded pairs, no smaller than No. 16 AWG.
      4) Restrain wiring with plastic ties or ducts. Hinge wiring shall be secured at each end with bend area protected with a plastic sleeve.
      5) Separate analog or dc circuits at least six inches from any ac power or control wiring.

   e) All relays shall be the compact, general-purpose, plug-in type. Contacts shall be rated for not less than 10 amperes at 120 V. Provide relays with neon status lights and test buttons. Time delay relays shall have an integral adjustment knob or dip switches and

rangeability of at least 10:1. All relays shall have permanent, legible identification.

f) Terminal blocks shall meet the following requirements:

1) Provide a minimum of 20 percent unused spare terminals for each panel.
2) Provide terminal blocks for dc and analog signals separate from ac circuit terminal blocks.
3) Screw-type terminal connections shall have locking, fork-tongue or ring-tongue lugs crimped with proper-sized anvil. Terminate no more than two lugs per terminal with no more than one wire per lug.
4) Compression clamp terminal connections shall be stripped and prepared per manufacturer's recommendations. Terminate no more than one wire per screw and yoke.

g) Provide an internal, 120 VAC, 15 amp, ground fault protected duplex receptacle for the panel. Provide an internal fluorescent light fixture in the panel with an on-off switch.

h) Provide all panels with an isolated copper grounding bus or grounding terminals to ground all signal and shield connections. Ground analog signal shield as indicated on the Drawings. Properly ground all surge and transient protection devices. Coordinate grounding system with Division 16, Electrical.

8. Front-Face Panel Instrument Components:

a) Indicating Light, Watertight: Units shall be heavy duty, watertight, push-to-test industrial-type with integral transformer for 120 VAC application. The lights shall be rated for NEMA 4X service. Units shall have screwed-on flat-faced lenses in colors shown and factory engraved legend plates as noted. Units shall be single hole mounted in panel thicknesses of 1/16- to 1/4-inch. Units shall be Square D Type SK-;Allen Bradley Type 800 H; or approved equal.

b) Switch, Maintained Contact, Watertight: Units shall be heavy-duty, watertight, industrial type selector switches with contacts rated for 120 VAC service at 10 amperes continuous. The switches shall be rated for NEMA 4X service. Units shall have factory-engraved legend plates indicating position definition. Operators shall be black knob type. Units shall have the number of positions and contact arrangements as required. Units shall be single hole mounting in panel thicknesses of 1/16- to 1/4-inch. Units shall be Square D Class 9001, Type SK; Allen Bradley Type 800 H; or approved equal.

c) Switch, Momentary Contact, Watertight: Units shall be heavy duty, watertight, industrial type pushbuttons with momentary contact rated for 120 VAC service at 10 amperes continuous. The pushbuttons shall be rated for NEMA 4X service. Units shall have

factory-engraved legend plates indicating service definition. Units shall have contact arrangements as required in colors as shown. Units shall be single hole mounted in panel thicknesses of 1/16- to 1/4-inch. Units shall be Square D Type SK; Allen Bradley Type 80O H; or approved equal.

d) Alarm, Audible Horn: Provide audible horn that generates a loud, audible alarm when activated by 120 VAC power. The horn shall surface mount remotely as noted, suitable for outdoor use. Outdoor units with sealed conduit entry, shall be Ronan Model 350 W, or approved equal.

e) Alarm, Visual Strobe Beacon: Alarm lights shall be flashing type units that produce 360-degree beams of colored light. Flashing rate shall be 60 to 80 flashes per minute. Unit shall use a solid state strobe source. Light color shall be red and unit shall have simple technique for relamping. Unit shall be suitable for panel mounting and shall operate on 120 VAC power, unless otherwise noted or shown. Housing shall be weatherproof, suitable for use in outdoor environments without other protection. General purpose units shall be Benjamin Electric Manufacturing, Series KL-4000; or approved equal.

9. Panel Operation:

a) Indicating lights, switches, audible alarm horn and alarm strobe beacon shall be provided for each control panel as specified. Lights and lens colors, and control switches shall be as indicated below:

1)

Maintained Contact Switches	Switch Type
Rotary Drum Thickener Control	Local-Off-Remote
Spray System Booster Pump Control	Hand-Off Automatic

2)

Momentary Contact Switches	Switch Button Color
Alarm Silence Button	Red
Alarm Reset Button	Black

3)

Indicator Light Condition	Lens Color
Power On	White
Rotary Drum Thickener - Run	Red
Rotary Drum Thickener - Standby	Green
Spray System Booster Pump - Run	Red
Spray System Booster Pump - Standby	Green
High Sludge Level Alarm	Red

b) Manual Operation: When the rotary drum control switch is in the "local" position, the unit will operate manually. Controls when selected for manual operation shall provide access to operate each motor or valve to determine its operation for maintenance or manual control. Necessary interlocks shall be provided to ensure safety of the operation of the high pressure booster pump or other equipment as deemed necessary by the manufacturer.

c) Automatic Operation: The rotary drum thickener system shall be provided with an automatic control function. The automatic control function shall be initiated by a remote set of contacts when the rotary drum thickener control switch is in the "remote" position. When the automatic mode of operation is selected, the necessary interlocks shall be provided for the sequencing of the equipment operation. There shall also be provided a necessary timer for shutdown during automatic operation which will allow the rotary drum thickener and the booster pump to operate and allow the unit to self-clean prior to shutting off.

d) Alarm Condition: If a high sludge level condition occurs for a thickener, the alarm condition will result in the panel alarm indicating light being energized. In addition, the panel audible alarm horn and the panel alarm strobe beacon will be energized. A momentary contact pushbutton switch shall be provided to silence the audible alarm horn. The alarm indicator light and the alarm strobe light shall remain energized until the alarm condition is cleared/corrected. A momentary contact pushbutton "reset" switch shall be provided to reset the controls and alarms before restarting the equipment. Each control panel shall be provided with an extra set of contacts for remote reporting of the rotary drum thickener alarm to the plant computer control system.

2.3 POLYMER FEED/FLOCCULATION SYSTEM

A. Polymer Dilution System:

1. Provide two (2) compact polymer dilution/feed systems to automatically meter, blend, mechanically mix and age concentrated liquid neat polymers with dilution water. The capacity of each unit shall be 0.02 to 4.5 gph of concentrated liquid polymer and 72 to 1,200 gph of diluted polymer solution. Each unit shall be tested hydrostatically at 100 psi for 15 minutes. Each unit shall operate on 110 volt AC power. The polymer metering pump shall be accessible from the outside of the case without disassembly of the unit.

2. The entire dilution/mixing/feed unit shall be housed in a compact package. The unit shall accomplish mixing via a motor-driven multi-zone mixing vessel. The dilution/mixing/feed unit shall provide a diluted polymer, fully activated, without fish-eyes and without degradation of the long-chain polymer molecules.

3. Each polymer blending system shall be equivalent to a Polyblend Model PB 1000-4.5 as manufactured by Stranco, Inc, Norchem, Wallace & Tiernan, or Equal.

B. Polymer Metering Pump: Each polymer dilution/mixing/feed system shall include a diaphragm-type metering pump with variable stroke frequency and stroke

length, capable of pumping polymers with apparent viscosities of up to 40,000 cps.

1. Pump output range shall be 0.02 to 4.5 USGPH.
2. Pump output pressure shall be 100 psig maximum.

C. Dilution Water Equipment and Controls: The system shall have a stainless steel solenoid valve for on-off control of dilution water supply. After the solenoid valve, dilution water supply shall be teed to two separate but identical rotameter-type flow indicators equipped with integral rate-adjusted valves. The first adjustable indicator shall control water flow to the mixing and activation chamber and shall be adjustable over a rate of 0 to 600 USGPH. The second shall control water flow to the post-dilution assembly and shall have a flow rate of 0 to 600 USGPH. Post-dilution flow shall meet the polymer stock solution exiting the mixing and activation chamber in an assembly so configured that adjustment of one rotameter will not affect the flow though the other. After stock solution and dilution water have been combined, they shall pass through a clear PVC static mixer for full blending of the two streams. Water supply input fittings shall be ½" FNPT; stock solution output fittings, ¾" FNPT.

D. Mixing Chamber and Stainless Steel Turbine (Multi-Zone)

1. Mixing energy shall be provided by a motor-driven stainless steel multi-bladed turbine. Turbine shall rotate on a stainless steel shaft supported by stainless steel bearings and seals. Mixing chamber shall be transparent. The turbine, when rotating, shall occupy not less than 30% of the volume of the mixing chamber. All metallic materials of construction shall be 304 stainless steel of electroless nickel-plated brass. Mixing chamber shall be capable of 100 psi working pressure.

2. Mixing Requirements

   a) Polymer mixing system shall be specifically designed to invert, disperse, and activate solution emulsion and dispersion polymers with viscosities from 200-6000 cps.
   b) The mixing device to accomplish the above stated performance shall be dynamic, capable of high fluid shear when required, and variable in mixing energy. This requirement shall insure the necessary flexibility to deal with the wide range of polymers presently available and anticipated to be in use in the future.

E. Metering Pump Controllers: Metering pumps shall be controlled by a device capable of both manual remote control and of proportional control (in response to a 4-20 ma input signal from a monitoring instrument), with device able to be wall-mounted at a distance of up to 1000 feet from the primary polymer dilution/feeding component. The control device shall include an on/off switch, an LCD display showing diaphragm pump operating parameters in strokes per minute or strokes per hour, and a touch pad to adjust polymer input rate to the system by varying stroke frequency of the pump.

F. The system shall include loss of dilution water flow sensor which, sensing that water flow has been interrupted for any reason, will place the polymer pump on standby and will restart it automatically when flow is restored.

G. Electrical: The system electrical requirement shall be single phase, 60 Hertz, 120 VAC. Mixer motor shall be provided with a manually resettable thermal overload protector.

H. Materials of Construction: The system shall be constructed with a 304 stainless steel chassis. All hardware used for component attachment shall be 304 stainless steel. Any component in contact with polymer or water shall be constructed of electroless nickel plated brass, stainless steel, or an inert plastic.

I. Floor Stand: A floor stand shall be supplied to support each polymer blending unit. The stand shall be constructed of Type 316 stainless steel structural tubing, shapes and plate.

J. Calibration Column: A calibration column shall be supplied for periodic calibration of the polymer metering pump. The column shall be specifically sized for the unit provided and shall include an inlet tee with charging valve.

K. Drum Standpipe: A rigid standpipe with adapter fitting shall be supplied for insertion into the bung of a standard 55 gallon polymer drum. The 2" inch fitting on the end of the standpipe shall have a barbed connector to accept 5/8-inch I.D. tubing.

L. Polymer Drum Cart: A combination 55 gallon drum cart and cradle shall be provided. The cart shall have wheels for moving of drums and a cradle to tilt and hold the drum in the horizontal position for complete draining. The cradle frame shall be fabricated of structural steel shapes, with cross-bracing for rigidity. The unit shall have four (4) 2 1/2-inch polyolefin wheels which are oil and chemical resistant. Two (2) of the wheels shall be swivel type caster wheels. The entire unit shall be epoxy coated.

M. Water Pressure Regulator: An inlet water pressure regulator shall be supplied to regulate the water entering the polymer blending unit. The regulator shall be a Watts E-41, Series 3 or equal. Pressure shall be adjustable down to the 35-70 psig range. A 2-1/2-inch stainless steel pressure gauge shall be provided for the inlet water line to each polymer blending unit.

2.4 ANCHOR BOLTS

A. Anchor bolts, nuts, flat washers and lock washers shall be manufactured of Type 316 stainless steel. The nuts shall have a hardness that is lower than that of the bolts, and washers by a difference of 50 Brinnell hardness to prevent galling during installation.

2.5 POLYMER SELECTION

A. The rotary sludge thickener manufacturer shall provide the services of an independent polymer consultant once the equipment has been tested and placed

into operation. The polymer consultant shall be responsible for selecting and optimizing the appropriate liquid polymer specific to this waste activated sludge. The polymer consultant shall coordinate all testing activities with the Contractor and shall work directly with County personnel during the performance testing period.

B. Once a polymer has been selected, the rotary drum sludge thickener manufacturer shall be responsible for providing the first three (3) months supply of liquid polymer. All polymer costs associated during performance testing and for a period of ninety (90) days thereafter shall be borne by the rotary drum thickener supplier.

C. Following liquid polymer screening and selection, the independent polymer consultant shall submit six (6) copies of a complete report to the Engineer offering a complete assessment and cost-effectiveness analysis as to the liquid polymer selected.

2.6 TOOLS AND SPARE PARTS

A. All special tools required for normal operation and maintenance of equipment shall be furnished with the equipment by the manufacturer. All such tools shall be furnished with a heavy duty, thermoplastic tool chest, complete with a padlock and duplicate keys.

B. Spare Parts: Spare parts shall be furnished to assure normal running and maintenance for a period of one (1) year as recommended by the manufacturer of equipment under this Section.

C. The Manufacturer shall recommend and supply all spare parts in addition to the aforementioned necessary for the first year of operation. Spare parts shall be marked with part numbers.

D. All tools and spare parts shall be furnished in containers properly labeled and identified with indelible markings as to their contents. Each container shall be suitably protected for long-term indoor storage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation by the Contractor shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturers recommendations. Anchor bolts shall be Type 316 stainless steel and set in accordance with the manufacturer's recommendations and approved shop drawings.

B. Alignment of the thickener belt drive unit, gear reducer and motor shall be in accordance with the manufacturer's instructions. No more than two shims of proper thickness shall be used to secure proper alignment. All alignments and adjustments made to the thickener shall be by technicians with prior experience and training in making such alignments and adjustments for the specific equipment provided.

C. The Contractor shall provide all necessary anchor bolts, temporary lifting equipment, power, water, labor and all other material and requirements for complete and satisfactory installation.

3.2 FACTORY SERVICE REPRESENTATIVE

A. The Contractor shall provide the services of a trained, competent, qualified and experienced factory field representative during inspection, testing and start-up of the equipment. The factory representative shall have a complete knowledge of proper operation and maintenance of the polymer feed system and the rotary drum thickener equipment. The Contractor shall provide factory representative services for a minimum of three (3), 8 hour days in two (2) separate visits. The first visit will be during installation to check and inspect the equipment. The second visit will be to check out, start up and test the equipment. At least one of the two days for the second trip shall be allocated solely to the instruction of the Owner's personnel in the proper operation and maintenance of the equipment.

B. The purpose of the services provided by the factory representative will be for the performance of the following work:

1. Verify that the Contractor is proceeding properly during the installation of equipment.

2. Following installation, but before the equipment is operated by others, the representative shall inspect the completed installation for soundness, completeness, correctness, alignment, arrangement, proper lubrication, thickener rotation, vibration, equipment setting, and operation of the equipment. The field engineer shall make, or cause to be made, any and all adjustments, corrections or repairs necessary.

3. Start-up of the equipment in the presence of the Contractor and Owner's operating personnel.

4. Training of Owner's operating personnel in proper operation and maintenance procedures, lubrication, startup/shutdown procedures, response to emergency conditions, and troubleshooting. The responsibility of the Contractor and the factory service representative with regard to start-up shall be fulfilled when the start-up is complete, the equipment is functioning properly and has been accepted by the Owner.

   a) The training period for the Owner's operating personnel shall be scheduled at least ten (10) days in advance with the Engineer and shall take place prior to plant start-up and acceptance by the Engineer. The final copies of operation and maintenance manuals

specified in Section 01730 must have been delivered to the Engineer prior to scheduling the instruction period.

C. Upon completion of this work, the manufacturer's field engineer shall submit to the Engineer, six (6) copies of a written report for each polymer feed system and each rotary drum thickener, as a result of his inspection, adjustments, corrections, repairs, start-up and testing. The report shall include descriptions of the inspection, adjustments, corrections and repairs made, testing and start-up, and training of the Owner's personnel. The report shall also include a notarized certification signed by the manufacturer's field engineer that the installed equipment:

1. Has been installed and lubricated per manufacturer's requirements.

2. Has been accurately aligned, set and leveled and proper running clearances set.

3. Is free from undue stress imposed by mounting bolts or equipment setting.

4. The equipment has been tested as required below in paragraph 3.3 and is in conformance with nominal operating parameters. Test procedures and results shall be included in the report.

5. Is ready for permanent operation on a continuous basis, is free from any known defects and that nothing in the installation will render the manufacturer's warranty null and void.

D. The Contractor's attention is directed to the fact that the services specified for the manufacturer's field engineer represent an absolute minimum acceptable level of service, and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall procure, at no additional cost to the Owner, all services required, including additional or extended visits to the jobsite by manufacturer's representatives, to comply with said requirements.

3.3 INSPECTION AND TESTING

A. Upon completion of installation, the Contractor, in the presence of the Engineer and a qualified manufacturer's representative, shall perform tests necessary to indicate polymer feed system and rotary drum thickener equipment operation and efficiency, to ensure the functioning of all component parts and to demonstrate compliance with these specifications. The Contractor shall furnish all labor, equipment, lubricants, water and power required to perform each test.

B. If the polymer feed system and rotary drum thickener equipment performance do not meet these specifications, corrective measures shall be taken or the equipment shall be removed and replaced with equipment which satisfies the conditions specified. A 24-hour operating period of the equipment will be required before acceptance.

C. Motor Testing:

1. The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

2. Motor Field Testing: The mechanical adjustable speed drive unit shall be disconnected from the thickener belt drive unit and run for four (4) hours. Following the run-in test, reconnect the mechanical adjustable speed drive unit to the thickener belt drive unit and reinstall all belt guards.

3. The Contractor shall check all motors for correct clearances and alignment, and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of the motor and rewire connections, if necessary.

D. Equipment Field Testing:

1. Upon completion of all the mechanical work, the Contractor shall conduct testing as specified herein to demonstrate that the equipment performs in accordance with all specifications.

2. The Contractor shall perform initial testing of the equipment to insure himself that the tests listed in the Demonstration Test paragraph below can be completed.

3. The Demonstration Test shall demonstrate that all items of these Specifications have been met by the equipment, as installed, and shall include the following tests:

   a) That the polymer system equipment provides a diluted polymer at the specified flow rates.
   b) That the rotary drum thickeners operate properly at the specified input flow rates and thicken waste activated sludge to the specified solids concentration.
   c) That the spray wash system booster pump provides a water supply to the thickener spray system at the specified discharge head and capacity.
   d) That the thickener flocculation tanks and sludge discharge diversion hoppers operate properly and as specified.
   e) That the polymer feed system and rotary drum thickener equipment controls perform satisfactorily.

4. In the event that the equipment does not meet the Demonstration Test, the Contractor shall, at his own expense, make such changes and adjustments in the equipment which he deems necessary and shall conduct further tests until written certification is received from the Engineer.

E. Approval of the Demonstration Test by the Engineer shall not constitute final acceptance of the equipment furnished until the Owner has performed actual field testing.

F. Upon approval of the Demonstration Test, the Owner shall perform a field test to demonstrate the ability of the polymer feed system and rotary drum equipment to meet or exceed the specified design criteria and properly function for the purpose intended.

G. The field tests on the polymer feed system and rotary drum thickener equipment shall be undertaken with unthickened waste activated sludge. The Owner shall be responsible for providing sufficient unthickened waste activated sludge for the test runs on the equipment. The test runs on the equipment shall determine acceptable normal thickening performance, running noise, vibration, speed and direction.

H. In the event of improper equipment design or installation, the Contractor and the equipment manufacturer shall be responsible for supervising the correction of the work and performing subsequent field tests until all defects are corrected.

I. Within 120 days of initiation of operation of the sludge stabilization basins, the Owner shall perform various tests to determine if under actual operating conditions, sludge thickening parameters, as specified, are being satisfied. If, in the opinion of the Owner and the Engineer, there are complications associated with sludge thickening that are proven to be the responsibility of the equipment manufacturer, the manufacturer shall inspect the installation and perform whatever tests, replacements, repairs or adjustments are necessary as corrective action, at no cost to the Owner. All labor, materials and equipment required for testing of correction of deficiencies shall be provided by the manufacturer. The manufacturer shall work in conjunction with, the Contractor, the Owner and the Engineer towards corrective measures should sludge thickening parameters be in question. The manufacturer shall be responsible for all associated re-testing, should any be required following correction of deficiencies, to verify the effectiveness of the corrective action taken.

END OF SECTION

SECTION 11372 - TRAVELING HOOD FILTER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all labor, materials, tools, and equipment required to furnish and install the traveling hood filters as shown on the Drawings and specified herein. The filters shall be of the traveling hood, one-pump type, and shall provide for end discharge of the filter effluent. The equipment and controls specified in this section shall be provided by a single supplier as a complete package to ensure adequate coordination and system compatibility.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications. Manufacturers proposing to furnish equipment for this Section shall have demonstrated long standing experience and ability in the design, manufacture and installation of similar units conforming to the specifications.

B. Installation lists shall be submitted with the Contractor's bid documenting that the Manufacturer has at least 25 operational wastewater installations and that at least 10 of these are rated for average flows of 5 mgd or greater.

C. Filter system components, including setting, anchor and erection bolts shall be furnished by a single Manufacturer.

D. Available Manufacturers: Subject to compliance with requirements, provide from the following:

1. Eimco/Baker Process, Salt Lake City, Utah

1.3 PROCESS PERFORMANCE WARRANTY

A. A warranty statement shall be provided to the Contractor by the Manufacturer together with his proposal to supply the systems. The Contractor shall include the warranty statement and an unpriced copy of the proposal with his bid so that these documents can be reviewed during the bid evaluation period. The warranty statement shall include words to the effect that the Manufacturer:

1. Has read and reviewed the specified requirements of the Project Manual and the contract drawings.
2. Does not make exceptions to any of the specified requirements for equipment or performance.
3. Warrants that the filtration system furnished shall be capable of complying with the stated performance objectives for effluent quality and backwash water volume when the facilities are properly operated under the flow and solids loading conditions specified.

1.4 EQUIPMENT/INSTALLATION GUARANTEE

A. More generalized requirements describing the warranty and correction period provisions of the contract are specified in other sections of the Project Manual. Separate and apart from those provisions, the filter Manufacturer shall provide a guarantee that the filter underdrain system shall operate without failure for not less than 24 months after Owner assumes beneficial use of the filter system, or not less than 30 months after installation of the filter equipment, whichever occurs first. Failure shall be considered to have occurred if:

1. More than 10 percent of the filter media is lost during any 12-month period due to leakage through the underdrain system.
2. The filter media support system fails structurally by breaking away or deflecting vertically more than 1/4-inch.

B. In the event that either of these conditions occurs within the guarantee period, the filter Manufacturer shall repair or replace, at their option, the filter media support system. The cost of the repair or replacement shall be limited to the actual labor, materials, parts and other related expenses required to effect the corrective action.

C. The labor shall include that needed for removal and disposal of defective components in the underdrain system, as well as labor to reinstall or replace those components complete and ready for operation. Included are media and all other materials for replacement of the defective system, including all tools required for corrective work. Related expenses shall include shipment costs for parts and materials, fees incurred by the Owner for engineering observation of the corrective construction work, and travel and subsistence costs for personnel involved in the repairs.

D. The filter Manufacturer acknowledges that the Owner is required to produce an adequately filtered effluent for disposal purposes, and may be adversely affected from doing so during an underdrain failure condition as defined in this section. Since time is of the essence, the filter Manufacturer shall initiate an immediate response to the Owner's notification of a failure. Within a period of five working days from notification, the filter Manufacturer shall send representatives to the site to investigate the problem and to prepare and deliver a written report to the Owner. As a minimum, the report shall contain a definition of the failure condition, the reasons for its occurrence, a description of required correction action, and a proposed schedule for completing necessary repairs of replacement. The report shall also describe the nature of power or other utility needs to be provided by the Owner to assist in the corrective work. Upon the Owner's concurrence with the report findings, the filter Manufacturer shall immediately and diligently pursue the completion of the corrective work.

E. The equipment/installation guarantee shall be in effect only under the following conditions:

1. The equipment has been paid for in accordance with the terms of the construction contract.

2. The equipment has been operated in accordance with instructions provided by the Manufacturer.
3. The filters are operated under the flow and loading conditions specified in Paragraph 2.01.

F. The filter Manufacturer's equipment/installation guarantee statement, containing words to the effect of those included above, shall be provided to the Contractor with his proposal to supply the systems. The Contractor shall include the warranty statement with his bid so that this document can be reviewed by the Owner during the bid evaluation period.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PERFORMANCE REQUIREMENTS AND TESTING

A. Performance Requirements:

B. The system shall be suitable for filtering suspended solids contained in the clarified effluent from an activated sludge wastewater treatment plant. The filters shall be designed to operate continuously under variable flow and loading conditions defined a follows:

1. Design average hydraulic load = 2.0 gallons per minute per square foot of filter surface area.
2. Design peak hydraulic load = 5 gallons per minute per square foot of filter surface area.
3. Average incoming suspended solids levels = 10 to 25 mg/l.
4. Intermittent and short duration peak incoming suspended solids level = 50 mg/l.
5. The clean bed hydraulic loss through the complete filter assembly including sand and anthracite media, filter underdrain system, and media support system, shall not exceed eleven (11) inches of water at a surface loading rate of five (5) GPM per square foot.

C. Under all design average flow and solids loading conditions above, the filters shall produce a filtered effluent suspended solids concentration less than 5 mg/l, with a corresponding effluent turbidity of less than 2 NTU.

D. Under all design average flow and loading conditions above, the volume of backwash water required to clean the filters shall not exceed 5 percent of the through-put volume.

E. Two (2) filters shall be provided, each for installation in a concrete basin of dimensions 16'-0" wide x 93'-9" long. Each filter shall include the Trac-Vac Tractor, backwash hood and submersible pump, nozzles, partition plates, underdrain, media, indexing tabs, power cable, center guide rail, outer rails, influent ports, backwash discharge launder, festoon system, air compressor and accessories, controls, and any miscellaneous appurtenances necessary for a complete and operational filter system.

F. Performance Testing:

1. After the filter has been constructed and placed into service for 30 days, but before the filter has been determined to be in beneficial use, the Contractor shall undertake a period of performance testing with the concurrence of the Owner and the filter manufacturer to prove the system meets the performance requirements listed above. Over a period of 56 consecutive days, the Contractor shall isolate and test each filter cell at a flow condition equal to the basis of design, 1.3 gpm per square foot with peaking to 4 gpm per square foot. Each filter shall be tested for 14 consecutive days for suspended solids to and from the filter, filter effluent turbidity, backwash water flow, and loss of media upon backwashing. The test procedures required shall be developed and proposed by the Contractor.
2. The performance test period shall not commence until the concurrence with the procedures has been agreed to by the Owner, the Engineer, and the filter manufacturer. If the filter cells pass the performance test period, the filters shall be deemed to be in beneficial use from the end point of the tests. If the filter cells do not pass the performance test requirements, the Contractor shall undertake repairs as necessary at his own expense and perform additional testing until said filter cells meet the performance requirements stated within this paragraph.

2.2 TRAC-VAC PNEUMATIC DRIVE AND BACKWASH HOOD

A. A pneumatically-driven tractor mechanism shall be provided for each filter. Each mechanism shall include the tractor drive system, a pneumatic hood lift system, a hood complete with backwash pump, discharge piping and flow control valve, a starter and control panel with all necessary controls and switches, a pneumatic control panel, and a compressed air supply. Specifications for the required compressed air system are summarized in Section 15483.

B. The tractor shall consist of a self-contained totally pneumatic module that is mounted inside the backwash hood and easily mounts onto the center guide rail. The tractor shall be a device that utilizes friction on the center rail to drive itself along the filter without the aid of cables or any other external means of towing or pushing the hood.

C. The tractor shall be housed inside a 304 stainless steel framework, covered with a shell of 304 stainless steel. All components shall be of welded construction with all welds ground smooth and provided with a smooth finish.

D. The drive assembly shall contain no electrical components. It will drive the suction hood longitudinally in the basin using compressed air to clamp the rail at all times. The direction of travel of the unit shall be reversible at the end of the filter basin in accordance with a program established in the control panel.

E. The drive assembly shall be capable of enduring stall without incurring damage. Mechanical devices subject to wear or replacement such as clutches or shear pins are not acceptable for this service.

F. A hood lift mechanism shall be provided. It shall consist of 304 stainless steel brackets, urethane wheels with Delrin bushings, and pneumatically-powered airstroke actuators to raise and lower the hood. Once activated, the airstroke actuators expand and cause the wheels to press downward against the center rail which causes the hood to lift.

G. Each mechanism shall be provided with a 304 stainless steel backwash hood assembly complete with neoprene lip seals, automatic air vent valve assemblies, four (4) integral rectangular stainless steel headers with orifices hydraulically sized to uniformly collect the backwash water, a 7-1/2 horsepower, 480 volt, 3 phase, 60 Hertz submersible backwash pump with a total dynamic head capacity sufficient to provide a backwash capacity of up to 20 GPM per square foot of filter cell area. Submersible pump shall be as manufactured by FLYGT Corporation, or equal. All fasteners used on the hood assembly shall be 304 stainless steel.

H. Backwash discharge piping shall be provided and shall include an accessible flow control device to adjust the backwash flow rate. Piping shall be sized to accommodate the backwash pump flow rate and shall be fabricated from 304 stainless steel, schedule 10. All fasteners used on the backwash pipe assembly shall be 304 stainless steel. Each tractor drive mechanism shall be fully assembled, prewired, and factory tested before shipment. The assemblies shall be broken down only to the extent necessary for shipment and adequate bracing and supports shall be provided to prevent damage during shipping, unloading and installation.

2.3 MASTER CONTROL PANEL

A. The filter system shall be provided with a master control panel designed to provide operating control and sequencing for all two filters.

B. The filter system shall be provided with a NEMA-3R 304 stainless steel control panel complete with a hinged full front panel door opening and a top mounted red alarm light. The panel shall contain a 480/120 volt control voltage transformer, a programmable logic controller (PLC), a motor starter, and all other necessary controls and wiring for a complete operating unit. The PLC shall be Allen Bradley, model 504. Weather-proof indicating and selection switches shall be provided and be mounted on the door panel face. As a minimum an H-O-A switch for automatic backwash initiation, manual backwash start, and manual hood travel initiation shall be provided. A DC power supply shall be furnished in each main electronic control panel to provide a filtered DC power supply to interface with the 4-way solenoid valves used for pneumatic control.

C. Indicating lights shall be provided to indicate hood travel and operating mode. The PLC shall include LED indicating lights to indicate the status of the unit and functional operations including alarms. The PLC shall include an EPROM for permanent memory in the event of power outages. All necessary operating proximity switches including indexing and hood travel shall be provided. Level sensing probes shall be supplied to provide automatic backwash initiation, high level alarm, and low level shut-down. The panel, switches, and level probes shall be shop installed and tested before shipment.

D. "The control panel shall be equipped with a terminal strip designed to provide status and alarm terminations for a future SCADA system by others. Normally open FORM-C dry contacts shall be brought to a numbered terminal strip. The following contact closures shall be provided as a minimum:

1. Filter Backwashing (each filter)
2. Filter SCOURING (each filter)
3. Low Tank Level
4. High Tank Level Warning
5. Sequence Failure
6. Bridge Fail (bridge stalls between index tabs)
7. Hood Fail (hood fails to reach UP position)
8. Pump Fail (backwash pump overload)
9. Common Alarm (CR-2) closes for any alarm"

E. Manual mode operation shall be completely independent of PLC operation.

2.4 LOCAL PNEUMATIC/ELECTRONIC INTERFACE PANEL:

A. A local pneumatic/electronic interface panel for installation on the traveling hood discharge pipe shall be provided. It shall be of FRP construction conforming to NEMA-3R requirements. It shall be equipped with a hinged front door for panel access.

B. The panel shall electronically interface with the main control panel to provide pneumatic operation of the tractor drive assembly and the pneumatically operated hood lift mechanism. Each pneumatic panel shall be provided with the following:

1. Connection for air supply from the compressor.
2. Connection for air supply umbilicals to the drive assemblies.
3. Four-way solenoid valves for pneumatic control of the drive mechanisms.
4. Air pressure regulator.
5. Terminal strips for the backwash pump power supply.
6. Four-way solenoid valves for pneumatic control of the hood lift mechanism.

C. The local pneumatic/electronic interface panel shall be factory wired and tested. Clearly identified terminal strips for all external field connections shall be provided. Air lines from the local pneumatic/electronic interface panel to the drive units are to be 1/4" polyurethane tubing supplied by the filter Manufacturer.

2.5 GUIDE RAIL

A. The guide rail shall run the length of the filter bay, in the center of the partition plates. It shall be a 2" x 2" (0.120" wall thickness) 304 stainless steel square tube, designed to ensure smooth intersections. Rail sections shall be manufactured of Type 304 stainless steel and shall have a maximum length of 20'-0". Joints shall be accomplished using an internal stainless steel splice bar to ensure a smooth, square fit. Base plates shall be welded to the underside of the rail every 24" and shall be attached to the top of the FRP partition plates by means of 304 stainless steel screws.

2.6 OUTSIDE RAILS

A. The outside rails shall be of 304 stainless steel construction and shall be designed for a long life. They shall be constructed of 3/16" thick stainless steel formed into a T-section and shall be mounted to the top of the FRP partition plates with 300 stainless steel fasteners. The side rails shall also serve as tie bars for the FRP cell sheets.

2.7 AIR SUPPLY UMBILICAL

A. The air supply umbilical shall consist of multiple polyurethane air lines encased in a high density polyethylene ribbed, flexible, protective conduit. The size and quantity of air lines provided shall be sufficient to effectively provide all necessary power and control functions to the drive assembly. Terminations at each end of the air supply umbilical shall permit convenient attachment to the drive assembly and the local pneumatic panel. Each termination shall be color coded to preclude the possibility of an incorrect connection.

2.8 UNDERDRAIN AND PARTITION PLATES

A. The underdrain system shall be of the nozzle type. A series of flanged partition plates (cell dividers) shall divide the filter into 24" wide compartments. The partitions shall be installed such that a common plenum beneath the media support plates results. Each partition shall be of sufficient height to contain the expanded media. The partition plates shall be adequately reinforced by 304 stainless steel tie rods to withstand all loads imposed.

B. The cell dividers shall be at least 30½" high and shall be manufactured by the pultrusion process using glass fibers for reinforcing (minimum 40% fiber) in a polyester binder with a specific gravity of 1.65 minimum. Glass fiber shall be in the form of alternate layers of continuous roving and mat, and shall form a finished plate of 3/8" minimum thickness. Transverse modulus of elasticity shall be a minimum of 1,200,000 psi.

C. The media support plates shall be made of 1/4" thick (nominal) corrugated ABS, designed to tolerate all loads imposed during installation and operation. EIMCO FlexKleen™ nozzles shall be installed on 8" centers (nominal) in the media support plates.

D. Underdrain nozzles shall be provided for uniform effluent collection and for the distribution of backwash water and air scour. The nozzles shall be constructed of ABS plastic and have vertical reverse wedge slots to prevent filter media greater than 0.40mm from passing through, and to be self-cleaning in the filtration mode.

2.9 MEDIA

A. The filter shall be furnished with 12-inches of silica sand and 12 inches of anthracite. High grade silica filter sand shall be provided with an Effective Size of 0.55 to 0.65 mm and a Uniformity Coefficient of no greater than 1.50. Anthracite shall be provided with the Effective size of 0.90 to 1.0 mm and a Uniformity Coefficient of no greater than 1.50. The sand and Anthracite shall conform to applicable Standard AWWA Specifications and written certification shall be provided by the supplier.

B. A 2" deep layer of 1/4" x 1/2" gravel shall be placed around the nozzles.

C. The filter media shall be delivered in one (1) cu. ft. bags on pallets or in "super bags". Media delivery in bulk truck shipment shall be acceptable for sand only.

2.10 POWER AND SIGNAL CABLES

A. A festoon power cable shall be provided. A 4-wire cable shall deliver 480 volt power to the control panel of each traveling hood. A separate signal cable having an adequate amount of wires shall be provided to transmit signals to the local pneumatic panel. Both cables shall be PVC jacketed. The cables shall be field connected to the hood panel and terminate at the junction box furnished by the filter Manufacturer and located near one end of each filter unit, in a fixed location. Electrical connections between the junction box and the control panel shall be provided by the Contractor.

B. A festoon type power cable support system shall be furnished by the equipment supplier and shall consist of a 1/4" stainless steel wire rope with all necessary 304 stainless steel cable fittings. Power cable carriers shall be provided to ride on the festoon cable and support the power cable.

2.11 FESTOON SUPPORTS

A. Two steel festoon supports shall be provided for the installation of the festoon system, one at each end of the filter. They shall be made from 3" diameter schedule 40 pipe, minimum, and shall be provided with stainless steel anchor bolts for attachment to the filter end walls. They shall be designed to tolerate all loads placed upon them by the festoon system installation and shall also be designed for attachment of a junction box. The pipe festoon supports shall be fabricated from 304 stainless steel.

2.12 INFLUENT PORTS

A. Six inch diameter Schedule 40 PVC pipe influent ports shall be furnished and installed in accordance with the Manufacturer's recommendations.

2.13 INDEXING TABS

A. An indexing strip shall be furnished for each unit. The indexing strip shall be of stainless steel construction and shall be designed to last for the life of the filter. Adjustable targets (tabs) shall be placed on the index strip for each cell to position the hood mechanism for backwash. Each tab shall be capable of 1" horizontal adjustment. 304 stainless steel fasteners shall be furnished for attaching the indexing strip, which is attached to the backwash trough. End of travel targets shall be fabricated in a similar fashion and shall be attached to the filter tank wall.

2.14 BACKWASH DISCHARGE LAUNDERS

A. A backwash discharge launder shall be provided for each filtering unit. The launder shall be constructed of 1/4" minimum thickness pultruded FRP, with sufficient stiffness to resist deformation when fully loaded. It shall be a minimum of 12" wide x 12" deep. Stainless steel support brackets shall be provided at a maximum of 9'-0" foot intervals along the launder. The launder shall extend through the wall of the filter at one end and be grouted into the wall by the Contractor. Launder support brackets shall be attached to the wall with 304 stainless steel anchors and fasteners.

B. One Halmi flume shall be installed at the discharge end of each backwash launder for flow measurement. The Contractor shall provide flow measurement and totalizing instrumentation per Specification Section 13300.

2.15 AIR SCOUR SYSTEM

A. Each filter shall be designed for air scour at the rate of 3 scfm/sq. ft. of filter area. Schedule 40 PVC pipe shall be installed in the concrete gullet below the media support plates for the purpose of delivering air to the filter bed and shall be as shown on the Drawings. The pipe shall be sized to convey the air flow evenly without excessive losses and shall be perforated in a manner to deliver air uniformly to each filter cell for adequate air scour. Air piping shall be supported, and anchored to the floor with 304 stainless steel brackets and shall terminate inside the filter box near the concrete wall at one end for connection to the external air supply.

B. Air Sequence of Operation - To initiate air scour for a filter, the plant operator shall manually close the filter influent gate. The air scour button on the filter control panel shall initiate the following sequence:

1. The drain valve opens for the particular filter in air scour
2. The drain valve closes on command from the low water level sensor.
3. The air scour blower is turned on.
4. The air line butterfly valve is opened for the filter in air scour.
5. The blower stays on for a predetermined time.
6. The air line butterfly valve is closed for the filter in air scour.
7. The air scour blower is turned off.

C. Once the air scour operation has been completed, the plant operator shall manually open the influent gate for the filter. Only one (1) filter may be air scoured at a time. Air scour of a filter should always be followed immediately by a backwash of the filter to remove the scoured detritus.

2.16 BACKWASH OPERATION SEQUENCE

A. The programmable controller shall be pre-programmed with the interlocks and sequence logic necessary to provide Hand-Off-Automatic control for the backwash operation.

B. During automatic operation, the backwash cycle shall be started by either the high water level sensor or the pre-set interval timer. The hood travel and hood lowering device are controlled by the indexing tabs and proximity switches. Once backwash has been initiated, the hood travels down the length of the filter, stopping at each cell. The hood lowers and the backwash pump starts. The suction of the backwash pump pulls water up through the nozzles, media, and hood, and discharges it into the waste trough.

C. Flow during backwash shall be controlled by orifices within the suction laterals inside the hood and by the control valve. After backwashing, the pump should stop and the hood should raise and continue to the next position.

D. The backwash pumping time shall be adjustable and can be set manually in tenths of seconds with a timer located in the control panel. The frequency of backwash can also be set manually with a timer that reads in hours.

E. Backwash can also be initiated manually, and the hood can be moved or repositioned manually.

F. An alarm light mounted on top of the control panel shall warn the operator of high water level and equipment malfunction. A non-flashing red light shall signal high water level or PLC failure. A high water alarm shall not shut down the backwash cycle. A flashing red light shall signal an improper hood travel time condition which will shut down the backwash cycle.

2.17 SKIMMER

A. A floating skimmer capable of skimming in one direction shall be provided with each filter. The skimmer shall be designed to float at any fluid level within the basin (with constraints for maximum and minimum levels). It shall be equipped with a center gate capable of being manually moved from an "open" to a "closed" position. When the gate is open, fluid can pass from one side of the skimmer to the other and no skimming occurs. When the gate is closed, skimmings shall be moved to the end of the filter bay as the hood moves. Skimmings shall be pushed to one end of the filter for subsequent removal.

B. The skimmer shall consist of a floating PVC pipe with an opening in the center for the movable gate. The gate shall be made of aluminum. The PVC pipe shall be connected to the backwash hood by 304 stainless steel brackets and assembly bolts. The ends of the PVC pipe shall be equipped with neoprene wipers.

2.18 FACTORY PAINTING

A. All ferrous metal surfaces, except aluminum and stainless steel, shall be shop cleaned by sandblasting to bare metal in accordance with the Steel Structures Painting Council specifications SSPC SP-10 prior to coating (painting). Shop painting (prime and finish) shall be carefully done by the filter Manufacturer and all coatings applied in a workman-like manner in strict accordance with the paint Manufacturer's published recommendation.

2.19 SPARE PARTS

A. The Manufacturer shall supply the following spare parts:

1. Four (4) Sliding Brake Pad
2. Four (4) Sliding Back Pad
3. Four (4) Fixed Brake Pad
4. Four (4) Fixed Back Pad
5. Two (2) Air Stroke Actuators
6. Two (2) Backwash Pumps
7. One (1) Spare PLC

2.20 OPERATION, MAINTENANCE, AND INSTALLATION MANUALS

A. Six (6) Operation, Maintenance, and Installation manuals shall be provided by the equipment Manufacturer at least two weeks prior to the shipment of all major equipment components. Each manual shall be a hard bound, indexed binder conforming to EPA standards for O&M manuals and shall be for the specific equipment provided, rather than general equipment instructions.

B. As a minimum each manual shall contain:

1. A complete bill of materials for the equipment including the weights of major components.
2. Installation and Maintenance instructions for the specific equipment including the erection sequence, maintenance and trouble-shooting check points, and complete lubrication procedures.
3. A list of the Manufacturer's recommended spare parts. The list shall include: Wear items, long delivery items and all items convenient for stocking as optional replacement items.
4. The manual shall include complete wiring diagram which includes all wiring, terminations, devices and components used for the operation and control of the filters. The documentation shall be well ordered and complete and shall reflect the actual wire numbering as installed, based on field verified documentation.
5. Ladder Logic Listing and Documentation: The supplier shall provide a complete listing of the SLC ladder program installed in the SLC 504. The program documentation shall be well ordered and shall include sufficient rung comments and complete tag name definitions and cross reference to provide a well documented listing. The Contractor shall also provide the program development and documentation files for the SLC on floppy disk, using the standard Allen Bradley A.I. software programming package.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RESPONSIBILITIES AND SERVICES

A. The Contractor shall be solely responsible for assuring a complete facility in accordance with provisions of the Project Manual.

B. The Contractor shall employ the services of the Manufacturer prior to and during installation of the filter underdrain system. Specifically, the Manufacturer shall conduct an 8-hour training session on the job site which must be attended by all personnel of the Contractor who may be involved in the construction of the filter tanks, in assisting in the installation of the underdrain components, or in the installation of any other parts of the filter system. Advance notice of training session dates shall be provided to the Engineer to enable his attendance.

C. The Contractor shall have on-site the Manufacturer's Representative for a period of ten (10) consecutive working days during installation of equipment in the initial filter. The Manufacturer's Representative shall also provide periodic inspections during equipment installation in the remaining filter. The Manufacturer shall provide written certification to the Contractor that the following tasks have been performed in accordance with specification requirements.

1. The setting and leveling of the FRP partition plates on each filter side curb.
2. The installation of the ABS underdrain plates and stainless steel tie rods.
3. The placement and sealing of the filter media support panels.
4. The placement of the filtering media.

D. The Manufacturer's certification letter shall be submitted to the Engineer within two (2) weeks after completion of the above tasks. The letter shall certify that equipment in each of the two (2) filters has been properly installed and the filters are ready for operation. The Contractor shall not operate the filters without having provided this certification letter to the Engineer.

E. The Manufacturer shall be additionally responsible for supplying the services of a qualified factory representative for the purposes of final system inspection, startup and testing, and for instructing representatives of the Owner in proper operation and maintenance of the filtration system. A minimum total on-site time of 5 working days shall be provided in a minimum of 2 trips (i.e. 3 days at startup and 2 more days within 1 to 3 months thereafter).

F. Attention is also directed to the fact that the Manufacturer's presence may also be required at times other than those specified above, to coordinate work with the Contractor and ensure that the entire system is properly delivered, stored, constructed, installed, tested and placed into operation. In this regard, the exact division of work between the Contractor and the Manufacturer shall be established by those two parties.

G. All costs for services of the Manufacturer including travel, lodging, meals and incidentals shall be included in the Contractor's lump sum bid price.

3.2 INSTALLATION

A. Install all filter equipment in accordance with the Drawings, these specifications and approved Manufacturer shop drawings and instruction.

B. Field painting shall be as specified in Section 09900.

END OF SECTION

SECTION 11376 - CARROUSEL® SYSTEM SLOW SPEED MECHANICAL AERATORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. There shall be furnished five (5) two-speed (125/93 HP), fixed, mechanical surface aerators suitable for operation in the Carrousel System basins shown on the Drawings. Each aerator shall consist of a drive motor, gear reducer, coupling, shaft, an open-type vaned surface impeller and a submerged, radial pumping impeller as covered under US Patent No. 4,869,818. Two of the mechanical surface aerators shall be installed in the existing aeration basins. The existing partition walls require modification as detailed on the plans to accommodate the new aerators.

1.2 QUALITY ASSURANCE

A. The CONTRACTOR shall provide aerators which have been tested by and approved by DHV Raadgevend Ingenieursbureau BV, and of a design approved by DHV for use in the Carrousel System shown on the Drawings. The aerator supplier shall provide prior to bid time, a certified letter from DHV Raadgevend Ingenieursbureau BV, declaring that it has approved the aerator for use in this application. The CONTRACTOR shall not propose aerators from a manufacturer which does not supply DHV approved aerators.

B. The CONTRACTOR, Licensor, and DHV must provide a review of aeration equipment submittals to insure that proper Carrousel performance is achieved and velocity guarantees can be maintained. All costs relative to this review, including basin and structure redesign, shall be borne by the CONTRACTOR. The CONTRACTOR shall not begin construction of the basin until final aerator approval has been obtained.

C. Consideration will be given only to the aerators of well established and reliable manufacturers who are regularly engaged in such work and thoroughly experienced in the design and manufacture of aerators of the size and type specified, and who have not less than 5 United States Carrousel installations of comparable size that have been in successful and continuous operation for not less than three years.

D. Performance Bond: A Performance Bond shall be provided to the OWNER by the supplier of the aeration equipment. The Performance Bond shall be for an amount equal to 150 percent of the bid price of the aeration equipment and shall remain in effect for two years from final acceptance of the installation by the ENGINEER and OWNER.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to the following:

1. EIMCO PMD, Salt Lake City, Utah (with Hubert impeller).

F. The CONTRACTOR shall obtain from the Licenser, EIMCO Process Equipment Co., a License entitling the OWNER to a non-exclusive, non-assignable sublicense to use EIMCO proprietary technology and know-how to design, construct, own and operate a Carrousel® sewage treatment installation.

G. The Licenser specifically agrees to defend all suits or claims for infringement of any letters, patent rights or use of any proprietary technology with respect to the Carrousel® and Bardenpho Systems, and to save the OWNER and ENGINEER harmless from any and all losses related thereto.

H. In addition to having provided assistance in the process engineering design of the system, the Licenser further agrees to provide various services related to the start-up and operation of the system as separately described below.

I. Start-up and Operations Services: The following services shall be provided by the Licenser at no additional cost to the CONTRACTOR or the OWNER:

1. At the same time that Carrousel® equipment is delivered to the project, the Licenser shall prepare and submit for approval, three copies of a written manual (specific to this installation) which will provide a detailed description of the process and its intended methods of start-up, operation and control.

2. At the time of process start-up, or within a maximum of 60 days thereafter, the Licenser shall provide a total of three working days at the site for the purposes of providing initial training of the staff. In this case, such training may be provided in conjunction with instruction on the start-up, operation and maintenance of the aeration and mixing equipment provided by EIMCO and specified elsewhere.

3. The Licenser also agrees to consult with and render supervisory assistance to the ENGINEER and/or OWNER, as requested by the OWNER, for a period of twelve months after the date on which the installation is completed. Such assistance shall be limited to six man-days at the site provided during no more than two trips. Telephone assistance (for these telephone communications made during the Licenser's regular business hours, or at any other reasonable lengths of time) shall be provided by the Licenser at no charge to the OWNER. All other assistance shall be provided at the Licenser's hourly rate then in effect for all its customers including its most valued customers, (including personnel travel time to and from the installation site, and including those reimbursable expenses agreed to by the parties).

J. Indemnification: The Licenser and the OWNER have executed or will execute an agreement under which the Licenser shall grant the CONTRACTOR, the OWNER and the ENGINEER an indemnification against any and all claims, damages, suits, or losses for infringement of patent rights with respect to the use of the Carrousel® Nutrient Removal Process, at the Manatee County Southeast Regional Wastewater Treatment Facility.

1.3 SUBMITTALS

A. Shop Drawing Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction dimensions, anchor bolt locations, and field connections.
2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the dry well and gear reducer lubrication points.
3. Installation, operation, and start-up procedures including lubrication requirements.
4. Complete motor data.
5. Total weight of the equipment including the weight of the single largest item.
6. A complete bill of materials for all equipment with the O&M manual. No samples will be required.
7. A list of spare parts that are supplied with the project.
8. A certified installation list and start-up date of the MANUFACTURER's aeration equipment of the same or similar size as that specified herein currently operating in the United States in an oxidation ditch basin geometry as shown on the Plans.
9. Certified oxygen and horsepower data from a minimum of two separate installations demonstrating that the mechanical aerators are capable of providing 3.5 lb 02/HP-hr based on the motor output power at standard transfer conditions. Oxygen transfer data shall be provided from a full scale aeration basin operating as an oxidation ditch. Tests from basins that are not operating as an oxidation ditch shall not be acceptable.
10. Written certification from EIMCO Process Equipment Company/DHV Water BV that the proposed aerators are approved for use on this Project, and are guaranteed to meet the specified velocity requirements. Shop drawings will not be reviewed without this certification.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Submit six (6) copies of operation and maintenance manual for the equipment in compliance with the Contract documents, 30 days prior to shipment. Manuals shall include:

1. Name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance and trouble shooting information.
4. Complete maintenance parts list.
5. Complete connection, interconnecting and assembly diagrams.
6. Approved shop drawings.

1.5 STORAGE AND HANDLING OF EQUIPMENT

A. The CONTRACTOR shall store and temporarily support equipment prior to installation in strict accordance with the MANUFACTURER's recommendations

and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The CONTRACTOR shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

B. Store gear reducers and motors in buildings or trailers which have a concrete or wooden floor, a roof and fully closed walls on all sides. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

C. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the MANUFACTURER's field ENGINEER.

1.6 PERFORMANCE REQUIREMENTS

A. The aeration equipment shall provide sufficient pumping to maintain an average channel velocity of no less than 1.0 fps with two aerators operating at their high speed, full nameplate horsepower (125 HP) condition. An average velocity of at least 0.8 fps must be maintained with two aerators operating at their low speed (93 HP) condition, each drawing no greater than 60% of full nameplate horsepower. Channel velocity shall be measured in the presence of the ENGINEER as specified under Paragraph 3.1.

B. The aeration equipment shall be capable of operating at the specified liquid levels of mixed liquor in the Carrousel basin so that oxygenation and power draw will vary as desired to respond to load variations to the plant.

C. The overall sound level shall be measured in accordance with ANSI/AGMA 6025-C90. The sound pressure level shall not exceed 85 dBA when measured at 5 feet from the aerator.

D. The aeration equipment shall be capable of delivering an oxygen transfer efficiency of no less than 3.5 lb. O2/HP-hr based on motor output power at standard transfer conditions.

E. In lieu of the certified oxygen and horsepower data under Paragraph 1.3, the aeration equipment supplier shall provide a separate performance bond in an amount of 100% of the aeration equipment contract value, and shall employ the services of an independent laboratory to perform full-scale tests of oxygen transfer efficiency, in the presence of the ENGINEER/OWNER. The cost of these tests will be paid by the CONTRACTOR. If the results do not meet the required performance, the CONTRACTOR shall have twenty (20) days to propose changes that meet the approval of the ENGINEER, and sixty (60) days to make these changes at no cost to the OWNER. The system shall then be retested at the CONTRACTOR's expense. If the system again fails to meet the required performance, the CONTRACTOR shall replace the aeration equipment with that of another manufacturer that will perform at no cost to OWNER.

PART 2 - MATERIALS AND EQUIPMENT

2.1 AERATORS

A. The mechanical surface aerators shall be mounted on fixed platforms and specifically designed for application in the Carrousel System shown on the Drawings to both oxygenate and mix the basin contents.

B. The Licensor and DHV must provide a review of aeration equipment submittals and guarantee that proper Carrousel System performance and velocity is maintained. Construction of the Carrousel basins shall not begin until aerator approval has been obtained.

2.2 MOTORS

A. Each aerator shall be driven by a two-speed 125/93 HP, totally enclosed fan-cooled, constant torque, premium efficiency motor wired for 460 volt, 60 cycle, 3 phase current. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The motor shall have a service factor of 1.15 and shall comply with the applicable provision of the Standards of NEMA. The minimum AFBMA B10 bearing life shall be 200,000 hours. The nominal motor speeds shall be 1200/900 rpm.

B. The motors shall be cast iron construction, Mill & Chemical or Corro- duty, and shall have a LP-base for flange mounting to the gear reducer. They shall be mounted in a vertical position to the gear reducer and furnished with a canopy cap (drip cover) and suitable lifting lugs. The motor to gear reducer connection shall be accomplished by the use of a flexible coupling.

C. Motors shall be suitable for operation in a moisture-laden atmosphere. The conduit boxes shall be gasketed with neoprene or equivalent material, so as to prevent moisture from entering the stator through the conduit box. Stainless steel condensation drains shall be suitably positioned in the lower external surface, so that any accumulation of moisture can drain from the complete motor housing. Ball bearings shall be supplied and shall be grease-lubricated. Grease reservoirs shall be ample and provisions shall be made for re-greasing with a lubrication system where grease is flushed through the bearings. The winding end turns shall be dipped and baked with a non-hygroscopic varnish, the stator bores and rotor cores shall be coated with epoxy paint. The entire enclosure shall be finish painted by the motor manufacturer at the factory with a corrosion-resistant paint to provide additional protection against moisture and contaminants. The nameplates shall be stainless steel.

D. Each motor shall be equipped with a suitably-sized space heater to keep condensation from forming when the motor is not running.

E. Each motor shall be equipped with a normally closed thermostatic heat protection device to protect the motor from overheating during operation. The unit shall immediately stop the aerator drive motor in the event of excessive heat build-up.

2.3 GEAR REDUCERS

A. Each gear reducer shall be of the helical gear type and shall be sized with a minimum service factor of 2.5 times the motor nameplate horsepower rating in accordance with applicable American Gear Manufacturers' Association (AGMA) standards 2001-C95 errata June 28, 1990, when each unit is operating at full load motor horsepower, 24 hours a day continuous running under moderate shock loads. The minimum AFBMA B10 bearing design life shall be 100,000 hours of the input shaft. The efficiency shall not be less than 94 percent based on the gear reducer input horsepower.

B. The gear reducers shall be designed for vertical input and output shaft operation and the housing shall be cast iron construction with provisions for the attachment of suitable lifting devices. Each reduction unit shall have gearing of the helical gear type. Worm gearing will not be acceptable. The units shall be designed to AGMA Service Classification III. Pinion and gear materials shall be left to the discretion of the manufacturer provided they are rated according to appropriate AGMA durability and strength requirements. The helical gear teeth shall be machined and then surface-hardened; pinion teeth shall be machined, case-carburized and then ground. All shafts shall be supported on tapered roller or double spherical roller bearings. The gear reducer housing shall be sealed with a corrosion resistant paint to provide maximum protection against moisture and contaminants. The speed reducer shall be designed in accordance with AGMA 6010-E88, and related AGMA standards referenced herein, except as modified or supplemented by this specification.

C. Gears and pinions shall be made of alloy steels. Shafting shall be made out of medium carbon steel. The gear teeth shall be through-hardened or carburized. Flame hardened gears will not be acceptable. All gears shall be made from alloy steels with sufficient hardenability to obtain case and core properties meeting the requirements for grade 2 material in accordance with ANSI/AGMA 2001-C95. The steel alloy shall be selected, and the heat treatment shall be controlled, to obtain a microstructure that meets all the requirements for grade 2 material in accordance with ANSI/AGMA 2001-C95.

D. All gears shall meet the accuracy requirements for AGMA quality No. Q11 in accordance with ANSI/AGMA 2000-A88. Pitting resistance and bending fatigue resistance shall be rated in accordance with ANSI/AGMA 2001-C95. The gear lives shall be calculated using full load motor horsepower. Gear life calculations shall be based on a reliability of 99% and the lower curves for life factor from Figure 17 or 18 of ANSI/AGMA 2001-C95. As an independent calculation, the gear pitting and bending fatigue lives shall be a minimum of 175,200 hours. Scuffing resistance shall be rated in accordance with Appendix A of ANSI/AGMA 2001-C95. The risk of scuffing shall be less than 5%.

E. All bearings incorporated within the gear reduction unit shall have a rating-life expectancy (B10) of 100,000 hours, except those bearings attached directly to the output shaft which shall have a rating-life expectancy (B10) of 250,000 hours. All bearings shall be of the anti-friction type. Bearing life shall be rated in accordance with ANSI/AFBMA Std. 11-1990 based on operating continuously at the rated full load horsepower and speed.

F. The lubrication of the speed reducer shall conform to AGMA 250.04. A reliable lubrication system, externally accessible, shall be provided for the gears and bearings. Lubrication systems which rely wholly or in part upon an oil circulating pump or internal splash lubrication shall incorporate a proven reliable pressure or level switch device which will immediately stop the driving motor and transmit an alarm signal to the motor control center in the event of insufficient lubrication. Pressure indicating devices influenced by changes in oil viscosity will not be acceptable. Each electrical switch shall be wired to its respective aerator motor control center. Also, each unit incorporating an oil pump shall have an external oil-pressure gauge so that gradual decreases in oil pressure can be observed. External oil cooling will not be permitted. The unit shall be provided with a dipstick or sightglass to observe oil levels. An oil fill and drain lines shall be sufficient size to permit efficient functioning and shall be located on the gear unit in a position which is easily accessible from the bridge platform. The oil drain piping shall be installed so that a container may be placed under the drain discharge. The CONTRACTOR shall supply the first charge of run in oil for the reducers, and if necessary due to run time, the change of oil. The CONTRACTOR shall purchase the oil from a local firm selected by the OWNER, in accordance with the information in the Operation & Maintenance manual, to assure lubricant compatibility.

G. All grease lubricated bearings shall have seals to retain the grease. The low-speed shaft shall have grease lubricated bearings and shall have a dry well to prevent oil leakage. The dry well shall fully enclose the output shaft and extend into a groove on the underside of the output gear. The well shall be sealed to prevent oil intrusion by both a v-ring and an oil seal. Additionally, the output end of the well shall include the upper and lower bearing seals and a separate oil seal. All grease lubrication pressure lines shall be fed from fittings accessibly located above the platform supporting the mechanism.

H. The housing shall be constructed of high tensile strength gray cast-iron conforming to ASTM A48 class 30 minimum with integral dry well construction to eliminate oil leakage at the output shaft and prevent loss of lubrication in the event of a seal failure. The housing for vertical installation shall be of two (2) piece construction with ground matching surfaces or liquid gasket for oil retention. Housing components shall be of adequate strength and rigidity to withstand all loads imposed on it from the operation of the equipment. The housing shall be designed and constructed to prevent harmful distortions resulting from thermal deformation, mechanical deformation or both. Housing shall be stressed relieved prior to machining. The housing bores shall be machined to an accuracy that ensures that all gearsets and all bearings contact correctly. The housing shall be tested to preclude casting porosity or weld defects that could result in oil leakage. Lifting lugs shall be provided on the housing suitably located to enable safe removal of the combined electric motor and gear unit from the supporting platform. Removable inspection cover(s) or inspection port(s) shall be provided.

I. Each gear reducer shall be mounted on a steel baseplate with hot dipped galvanized steel bolts. The baseplate shall be mounted on four (4) zinc plated jack studs inserted in the platform structure and designed to withstand all normal operating loads. The jack studs shall have the capability to provide a total vertical adjustment of six (6) inches.

J. The motor and gear reducer assembly shall be trial fit at the factory and the reducer shall be run under no load conditions for four hours. The test shall be monitored for heat buildup, excess noise, vibration, and overall assembly/fit. The coupling halves shall be factory mounted and aligned, and matchmarked for ease of on site installation. The CONTRACTOR shall be responsible for assuring proper alignment and gap tolerance as set forth in the installation instructions.

2.4 SHOP TESTS

A. Prior to assembly, all gear teeth shall be coated with hard, blue lacquer (DYKEM) and the speed reducer shall be assembled and prepared for testing. The speed reducer shall be run at full speed with no load for a minimum of two hours after the oil temperature has stabilized. The overall sound pressure level, housing vibration level and lubricant temperature shall be recorded during steady-state operation. The following requirements shall be met for all speed reducers:

1. The speed reducer housing and shaft seals shall be checked for leakage of lubricant. Any leaks shall be corrected.
2. The overall sound level shall be recorded in accordance with ANSI/AGMA 6025-C90. The sound level shall not exceed 85 dBA when measured at 5 feet from the speed reducer.
3. The temperature rise of the oil lubricant in the oil sump of the speed reducer shall not exceed 100° F above ambient. After successful completion of the shop tests and while the speed reducer is at operating temperature, the lubricant shall be drained and the speed reducer shall be flushed with filtered SAE 10 straight mineral oil containing no additives. The flushing oil shall be drained and the speed reducer shall be prepared for shipment.

2.5 IMPELLERS, SHAFTS AND COUPLINGS

A. The impeller assembly shall consist of a surface and submerged impeller connected to each aerator shaft. The surface impeller shall provide oxygenation and propulsion of the mixed liquor in the Carrousel basin. The submerged radial impeller shall provide additional propulsion of the mixed liquor at the bottom portion of the Carrousel basin. The impeller assembly shall operate at a maximum speed of 31 rpm and a maximum tip speed of 20 fps. The impeller shall present a minimum amount of edge perpendicular to the flow to prevent any attachment of solid materials.

B. Each surface impeller shall be an open-vane type with eight (8) equally spaced blades and constructed of 1/4" minimum steel plate. Each submerged radial impeller shall consist of a minimum of four (4) equally spaced radial pumping blades constructed of 1/4" minimum steel plate. The impellers shall be an integral, shop-welded unit requiring no field welding.

C. The outside diameter of the submerged radial impeller shall be at least 0.33 times the outside diameter of the surface impeller. The submerged impeller power draw at maximum speed shall be approximately 7%, but no greater than 10% of the motor nameplate power rating. An adjustable wall extension adapter plate shall be

fastened to the concrete partition wall to provide the clearance between the submerged impeller blades to the edge of the adapter plate as shown on the Plans. The adapter plate shall be constructed of 316 stainless steel plate and shall be rigidly secured to the concrete partition wall with stainless steel fasteners. The existing basin partition walls shall be modified to accept the adapter plate for the submerged radial impellers as shown on the plans.

D. The two impellers shall be connected to each aerator shaft. The aerator shaft shall be a hollow pipe sufficient size and thickness to safely withstand the torque and hydraulic side forces imposed by surface and submerged radial impeller.

E. The aerator shaft shall be attached to the gear reducer by a rigid, cast iron, split flange-type coupling. A retainer plate shall be provided for mounting to the end of the gear reducer output shaft to provide protection against disengagement of the coupling from the gear reducer output shaft. The split coupling shall be assembled with grade 5 galvanized bolts. The flange connections shall be assembled with hot dipped galvanized A325 high strength bolts only. Stainless steel fasteners are not acceptable.

F. All structural steel used in the fabrication of the aerator shall conform to the requirements of "Standard Specifications for Structural Steel" ASTM Specification A-36. All shop welding shall conform to the latest standards of the American Welding Society (AWS). Fabricated assemblies shall be shipped in convenient sections as permitted by carrier installations.

2.6 WARRANTY

A. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship; and that it will replace or repair, F.O.B. its factory, any part or parts returned to it which examination shall show to have failed under normal use and service by the user within thirty (30) months following initial shipment or twenty-four (24) months following operation start-up, whichever occurs first.

2.7 PAINTING

A. Unless otherwise noted, all ungalvanized fabricated iron and steel surfaces shall receive a shop-cleaned surface preparation equivalent to SSPC-SP-10 immediately prior to shop-priming. Shop-priming shall consist of one (1) coat of Tnemec 161-1211 Epoxoline primer or equal to 3.0 - 5.0 mils DFT. Touch-up and finish painting shall not be the responsibility of the equipment manufacturer.

B. The motors and gear reducers shall receive a minimum shop-cleaned surface preparation equivalent to SSPC-SP-1 immediately prior to shop-priming and finish coating. Shop-priming and finish painting shall consist of a coating that is compatible with a high quality epoxy finish coating that is specifically resistant to chemical, solvent, salt water, and acid environmental conditions. Touch-up painting shall not be the responsibility of the equipment manufacturer.

2.8 SPARE PARTS

A. One (1) oil sensing cut-out switch.

B. One (1) flexible motor coupling.

C. One (1) two -speed 125/93 HP electric motor.

D. Lubricants recommended by the Manufacturer (1 year supply).

PART 3 - EXECUTION

3.1 INSPECTION AND TESTING

A. The MANUFACTURER of the mechanical surface aerators shall furnish the services of a factory representative who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment.

B. The test runs on the mechanical aerators shall be undertaken with water in the aeration tanks filled up to the high water elevation shown on the Drawings. The CONTRACTOR shall be responsible for providing sufficient water, treated wastewater, or reclaimed water for filling the tanks for the test runs on the aerators.

C. In the event of improper installation, the CONTRACTOR and the manufacturer shall be responsible for supervising the correction of the work and subsequent test runs until the defects are corrected.

D. Oxygen transfer efficiency testing (if required) shall be performed using procedures acceptable to the ENGINEER. Such procedures shall be submitted to the ENGINEER for approval no less than two weeks prior to the scheduled testing.

E. Average channel liquid velocity shall be measured for each test condition. A velocity meter shall be used to measure velocity at 16 points in a cross-section of the channel that is unaffected by flow disturbance from the aerators or turning sections. The 16 points shall be developed from a matrix of 4 points equally spaced across the channel width and 4 points equally spaced from one foot below the liquid surface to one foot above the basin floor. The 16 points shall be averaged. When operating in clean water, velocity readings specified in paragraph 1.6(A) are an indication that the aerators can provide the necessary mixing capacity to maintain the mixed liquor solids in suspension.

F. If the required velocity or oxygen transfer efficiency levels are not produced, the CONTRACTOR shall repair the equipment or replace the equipment with units of another MANUFACTURER and the above test procedure shall be repeated until satisfactory results are obtained.

G. The following data and test specimens for items tested shall be available at the gear reducer MANUFACTURER's factory for up to 24 months after shipment, for examination by the ENGINEER:

1. Purchase specifications for all materials and components.
2. Certifications and test reports.
3. Results of all quality assurance tests.
4. Results of all performance tests.
5. All test specimens and heat treat coupons generated.

H. Certified inspection documents generated for all gears and shafts shall be available at the gear reducer MANUFACTURER's factory, upon request, for two (2) years after shipment. These documents shall include:

1. Available records of test reports and certifications for raw material.
2. Chemical and physical data from specimens made and heat treated with the components that are heat treated.
3. Records of heat treatment components, including any charts or reports.
4. Test reports of hardness measurements on the sample coupon.
5. Vendor's in-house quality assurance inspection reports.
6. Records certifying that all gears conform to the requirements for grade 2 gears in accordance with ANSI/AGMA 2001-C95.
7. Records certifying that all gears conform to the requirements for AGMA quality No. Q11 in accordance with ANSI/AGMA 2000-C95.
8. Vendor's statement of compliance that the gearbox meets the requirements contained within this specification.

I. After the speed reducer has been installed and aligned, and the manufacturers recommendations for initial start up have been implemented, the speed reducer shall be run at full speed and full load for a minimum of two hours after the oil temperature has stabilized. The overall sound level and lubricant temperature shall be recorded during steady-state operation. The following requirements shall be met for all speed reducers:

1. The speed reducer housing and shaft seals shall be checked for leakage of lubricant. Any leaks shall be corrected.
2. The overall sound level shall be measured in accordance with ANSI/AGMA 6025-C90. The sound pressure level shall not exceed 85 dBA when measured at 5 feet from the speed reducer.
3. The temperature rise of the lubricant in the oil sump of the speed reducer shall not exceed 100° F above ambient.

J. Refer to Section 01660 - Testing, Adjusting and Balancing for additional requirements.

END OF SECTION

SECTION 11382 - FINE BUBBLE/DRAFT TUBE AERATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing a fine bubble aeration/mixing system including, but not limited to, the air header and lateral piping, the fine bubble diffusers, draft lift tubes and associated valves, orifice plates, flange(s) and fittings necessary to provide a complete and functional system. Location of the diffusers shall be as shown on the Drawings and as specified.

B. This equipment described in this Section shall be furnished by one supplier to form an integrated system.

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Envirex, Inc., Waukasha, WI
2. Wilfley Weber, Inc., Denver, CO
3. Or Equal

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and installation. After verifying details and dimensions, provide three sets of final drawings and installation instructions to Engineer for use in observing installation and for record purposes.

B. Submit certified copies of reports of factory tests specified in this Section and required by referenced standards.

C. Submit manufacturer's parts list, operation and maintenance literature and instructions.

1.4 EXPERIENCE

A. The supplier shall have at least five years experience in the U.S. in the design and manufacture of the diffusers and piping system offered. The supplier shall have operating systems of the same type in Florida. In lieu of experience, the supplier may furnish a five year material bond.

B. Experience is defined as having equipment in full scale, operating, wastewater treatment plants, not pilot or demonstration plants. A reference list for the installations above, shall be supplied with equipment submittals. This list shall include the names and telephone numbers of contacts.

C. All diffusers and piping assemblies shall be manufactured in the United States.

1.5 PERFORMANCE

A. The diffuser assembly shall have an oxygen transfer efficiency of 31% at an air flow rate of 5 SCFM per diffuser, at a diffuser submergence of 20 ft. The maximum header spacing shall be 10 feet and the concentration rate shall be 65 sq. ft./diffuser (maximum).

B. The headloss through the diffuser assembly shall not exceed 12-inches of water at an air flow rate of 5 SCFM per diffuser.

1.6 FACTORY CLEAN WATER TEST

A. The stated transfer efficiency shall be demonstrated by the unsteady state method in clean tap water per "Measurement of Oxygen Transfer in Clean Water", ASCE, July 1984. Testing shall be performed at the specified airflow rates, and diffuser submergence. Diffuser layout shall be similar to the full scale system. Should alternate diffused aeration equipment be proposed, the Engineer reserves the right to require a full scale field test to verify performance. The Contractor will be responsible for any and all associated costs of this testing.

PART 2 - MATERIALS AND EQUIPMENT

2.1 FINE BUBBLE DISC DIFFUSERS AND DRAFT TUBE AIR LIFT SYSTEM

A. Diffuser Material. Air diffuser assemblies shall be of the round, non-clog, fine bubble type with a flexible perforated air release membrane. The perforations shall be die cut I-shaped slits. Tube shaped diffusers are not acceptable.

1. The diffuser shall have a minimum diameter of 10 inches.

B. Membrane. The diffuser membrane shall be constructed from injection molded EPDM rubber and be suitable for continuous or intermittent aeration. The membrane shall include UV inhibitor and compounds designed for resistance to chemical attack, weathering and aging. The membrane shall be molded in a tapered thickness, becoming thicker in the center, in order to prevent ballooning and non-uniform bubble size. The maximum deflection of the center of the membrane under normal operating conditions shall be less than two (2) inches.

C. Frame. The diffuser frame shall be one piece molded construction including a 3/4-inch MPT inlet. Thread quality shall be such that the diffuser can be installed without pipe sealants. Frame material shall be glass reinforced nylon or equivalent.

D. Backflow Check Valve. The diffuser assemblies shall have double backflow prevention to prevent liquid from passing into the aeration header.

E. Stratamix Air Lift Tubes. Lift tubes shall be manufactured of PVC containing 2 percent by weight titanium dioxide ultraviolet light inhibitor. Lift tube supports shall be 304 stainless steel with stainless steel hardware.

F. Mounting Saddle. The diffuser connection to the pipe shall be on the crown of the pipe to limit stresses and shall be a shock absorbent type that is unaffected by system vibration. The diffuser connector shall be capable of withstanding a horizontal or vertical moment of 1,000 inch-pounds, as well as an air pressure of 50 psi, without permanent deformation.

2.2 DIFFUSER

A. The diffuser shall be shipped totally assembled by the manufacturer, ready for installation by the Contractor.

B. Each diffuser shall consist of: EPDM membrane, diffuser baseplate, retaining ring, EPDM diffuser mounting saddle.

2.3 DIFFUSED AIR PIPING

A. The diffuser supplier shall furnish drop pipes, submerged manifolds and diffuser headers in the aeration basin. Piping shall be fabricated in conformance with this Section and as shown on the drawings.

B. All air supply piping into the basin, including supports, stands, valves, and similar items shall be provided by others. A butterfly type or similar valve shall be provided on each drop to allow adjustment of the air supply.

C. Dropleg shall be fabricated from 304L stainless steel pipe conforming to ASTM A312 and AISI 304L. Other non-welded parts and pieces such as nuts, bolts, washers, supports, follower flanges and anchor bolts shall be made from 304 stainless steel.

D. Gasket shall be 45 to 55 durometer (Shore A) neoprene.

E. All 304L material shall conform to the chemical requirements of ASTM 240-72A and AISI 304L except that the maximum carbon content shall be limited to .30%.

F. Dimensions shall be as shown on the Drawings with dimensional tolerances uniform to ASTM 554-72 and ASTM A530-72.

G. Welding shall be completed in the factory. Field welding shall not be permitted. All welding shall be by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross-section and weld metal equal to or greater than the parent metal. Butt welds shall have full penetration to the interior surface and gas shielding shall be provided to the interior and exterior of the joint.

H. Interior weld basics shall be smooth, evenly distributed with an interior projection not exceeding 1/16-inch beyond the ID of the air header or fittings.

I. The outside welds shall be wire brushed. Brushes shall be stainless steel and used only on stainless steel.

J. After fabrication, all stainless steel piping shall be passivated by immersion in a pickling solution of nitric and hydrofluoric acid. Parts shall be free of iron particles or other foreign materials. A final neutralizing rinse will complete the cleaning.

K. Manifolds and Headers. Manifolds and headers shall be Type 1, Grade 1 PVC with T102 ultraviolet light inhibitor conforming to ASTM D-1784 rated for 150 psi @ a water temperature of 23°C.

L. PVC pipe and fittings shall be Schedule 80 for DIP 8" and larger and Class 160 for pipe 6" and smaller.

M. Piping shall be sized to minimize headloss at the design air rate.

N. Piping assemblies shall be fabricated for field installation using standard 125 lb. flanges and compression type couplings where shown on the Drawings. No field solvent welding will be allowed. Where couplings are used, a method of restraint shall be provided to prevent pipe blowouts.

O. Removable and caps shall be supplied at the ends of all headers to allow purging of debris before operation.

P. Piping assemblies shall be designed to withstand expansion and contraction from the specified field operating conditions.

Q. Supports. Adjustable pipe supports shall be provided which allow movement of pipe and to compensate for variation in tank floor height, ± 1-1/2-inches total variation. Support system shall be designed for installation on flat concrete floors with a safety margin of 10 against calculated buoyant forces. Space supports on maximum nine-foot centers.

R. Stands shall be fabricated of 304 stainless steel. All nuts, bolts, washers and expansion fasteners shall be of 18-8 stainless steel.

S. Pipe support brackets will have minimum thickness of 3/16-inch x 1-1/2-inches for flat stock and 1/2-inch for rod.

2.4 SPARE PARTS

A. Ten (10) fine bubble disc diffusers.

B. Ten (10) Air Lift Tubes and associated supports, hardware, and fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The supplier shall furnish six (6) sets of installation and operation manuals including arrangement drawings for layout/installation of the piping and diffusers, and operation and maintenance instructions.

B. Install aeration equipment level, plumb and at uniform space in accordance with the manufacturer's instructions.

3.2 TESTING AND ACCEPTANCE

A. Notify the Owner and Engineer in writing when the installation is ready for inspection. Perform the inspections in the presence of the Engineer's representative.

B. Inspection of Piping. Visually inspect all piping, joints and supports for proper installation and conformance to the plans.

C. Level Inspection. Inspect piping with leveling instrument to insure that all headers are level and diffuser outlets are within a maximum of ± 1/4-inch of same elevation in accordance with Subparagraph "Manifolds and Header".

D. Uniformity and Leakage Test. Fill the tanks to a depth of one foot above the diffusers. With the blowers operating, check for leakage and visually check that air is evenly distributed throughout the tank.

END OF SECTION

SECTION 11385 - SUBMERGED TURBINE MIXERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing mechanical, submerged, turbine mixers suitable for installation in the anoxic basins. Each mixer shall include a pumping turbine, shaft, coupling, gear reducer and drive motor, all supported on a fixed platform. The unit shall be of adequate size to achieve the required solids suspending requirements, as shown on the Drawings.

B. The mixing provided, shall be sufficient to insure that the MLSS concentration shall not vary more than ± 10 percent of the average value from top to bottom at representative points in the basin.

1.2 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. EIMCO PMD, Salt Lake City, Utah
2. Chemineer
3. Lightnin

1.3 SUBMITTALS

A. Mixer manufacturers desiring to be considered as an equivalent for the mixing equipment specified in this Section must submit, no less than fourteen days prior to bid date, sufficient information for a complete review of the proposed equipment. This submittal shall include:

1. Catalog Data and Manufacturers' specifications.
2. General Arrangement drawings.
3. Materials Specifications.
4. Certified horsepower data demonstrating that the mechanical aerators are capable of meeting the required operating conditions based on full scale basin testing conducted by an independent laboratory.
5. A certified installation list and start-up date of the manufacturer's mixing equipment and currently operating in U.S. installations.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. All structural steel used in the fabrication of the mixer shall conform to the requirements of "Standard Specifications for Structural Steel" A.S.T.M. Specification A-36. Shop welding shall conform to the latest standards of the American Welding Society. Fabricated assemblies shall be shipped in convenient sections as permitted by carrier regulations.

2.2 MOTORS

A. The mixers shall be driven by 15 Hp, totally enclosed, fan-cooled motor wired for 277/480 volt, 60 cycle, 3 phase current. The motors shall be rated at 40°C ambient with Class F insulation, shall have a service factor of 1.15, and shall comply with the applicable provisions of NEMA Standards. The minimum B-10 bearing life shall be 100,000 hours. The nominal motor speed shall be 1800 rpm.

B. The motor shall be of cast iron construction and shall have a LP frame for flange mounting to the gear reducer. They shall be mounted in a vertical position to the gearbox and furnished with a canopy cap (drip cover) and suitable lifting lugs. The motor to gear reducer connection shall be accomplished by the use of a flexible coupling.

C. Motors shall be suitably sealed for operation in a moisture laden atmosphere. The conduit boxes shall be gasketed with neoprene or equivalent material, so as to prevent moisture from entering the stator through the conduit box. Drain holes shall be suitably positioned in the lower external surface, so that any accumulation of moisture can drain from the complete motor housing. Ball or roller bearings shall be supplied and shall be grease-lubricated. Grease reservoirs shall be ample and provisions shall be made for regreasing with a lubrication system where grease is flushed through the bearings. The nameplates shall be stainless steel. The winding end turns shall be dipped and brushed with a non-hygroscopic coating, the stator bores and rotor cores shall be coated with epoxy paint, and the entire closure shall be sealed with an epoxy-polyamide semi-gloss coating to provide additional protection against moisture and contaminants.

2.3 GEAR REDUCER

A. The gear reducer shall be of the helical or spiral bevel helical gear type and shall be sized with a minimum service factor of 3.5 times the motor nameplate horsepower rating in accordance with applicable American Gear Manufacturers' Association standards. The minimum B-10 bearing design life shall be 100,000 hours with output bearings at 250,000. The efficiency shall not be less than 92 percent based on the reducer input horsepower.

B. Gear reducers shall be designed for vertical output shaft operation and the housing shall be all cast iron construction with provisions for attachment of suitable lifting devices. Helical or spiral bevel meshes, or combinations thereof, are acceptable. Worm gearing shall not be used. Pinion and gear materials shall be left to the discretion of the manufacturer provided they are rated according to appropriate AGMA durability and strength requirements. The helical gear teeth shall be machined and then surface-hardened; pinion teeth shafts shall be supported on tapered roller or double spherical roller bearings. Shaft mounted gear reducers will not be acceptable. The gearbox housing shall be sealed with an epoxy polyamide semi-gloss coating to provide maximum protection against moisture and contaminants.

C. The gear reducers shall be mounted to the platforms either with a set of zinc plated jack studs inserted in the platform structure and adequately designed to withstand all normal operating loads or alternately with a baseplate and zinc plated anchor bolts with the baseplate grouted to the platform.

D. The applicable speed reducer components shall be designed in accordance with AGMA 6010-E-88, and related AGMA standards referenced herein, except as modified or supplemented by this specification. Gear and pinions shall be made of alloy steels. Shafting shall be made out of medium carbon steel. The gear teeth shall be through-hardened nitrided or carbonized. Flame hardened gears will not be acceptable. All gears shall be made from alloy steels with sufficient hardenability to obtain case and core properties meeting the requirements for grade 2 material in accordance with ANSI/AGMA 2001-C95. The steel alloy shall be selected, and the heat treatment shall be controlled, t0 obtain in microstructure that meets all the requirements for grade 2 material in accordance with ASNI/AGMA 2001-C95. All applicable gears shall meet the accuracy requirements for AGMA quality no Q9/10 in accordance with ANSI/AGMA 2000-A88. The gear lives shall be calculated using full load motor horsepower. Gear life calculations shall be based on a reliability of 99% and the lower curves for life factor from figure 17 or 18 of ANSI/AGMA 2001-C95. Scuffing resistance shall be rated in accordance with appendix a of ANSI/AGMA 2001-C95. The risk of scuffing shall be less than 5%. All bearings incorporated within the gear reduction unit shall have a rating-life expectancy (B_{10}) of 250,000 hours. All bearings shall be of the anti-friction type. Bearing life shall be rated in accordance with ANSI/AFBMA std 11-1990 based on operating continuously at the rated full load horsepower and speed.

E. The housing shall be constructed of high tensile strength gray cast-iron conforming to ASTM A48 class 30 minimum with integral dry well construction to eliminate oil leakage at the output shaft and prevent loss of lubrication in the event of a seal failure. The housings for vertical installation shall be of (1) piece construction. Housing components shall be of adequate strength and rigidity to withstand all loads imposed from the operation of the equipment. The housings shall be designed and constructed to prevent harmful distortions resulting from thermal deformation, mechanical deformation or both. Housings shall be stressed relieved prior to machining. The housings shall be line bored to ensure that all gearsets and all bearing contact correctly. The housing shall be tested to preclude casting porosity or weld defects that could result in oil leakage. Lifting lugs shall be provided on the housing suitability located to enable safe removal of the combined electric motor and gear unit from the supporting platform. The gear reducer shall have a hollow low speed shaft with a keyed fit to the mixer impeller shaft. The gear reducer shaft and the impeller shaft shall be locked together with a lock-nut at the top of the gear reducer housing. Units that do not form a one piece shaft or require coupling connections between the reducer and the impeller will not be accepted.

2.4 GEAR REDUCER LUBRICATION

A. Each gear reducer shall employ a lubrication system utilizing an integral mechanical driven oil pump or shall employ a splash-type lubrication. All gear meshes shall be oil lubricated and all bearings can be oil or grease lubricated

except for the lower take-off shaft bearing which shall be grease lubricated. A dry well or dry shaft incorporating double seals, shall prevent oil from escaping around the output shaft and lip-type oil seal shall be used to prevent lubricant leakage down the output shaft. Special moisture resistant breathers shall be installed. The housing shall be provided with an oil level sight glass or dipstick. An accessible oil drain shall also be provided.

B. Reducers employing oil pump lubrication shall be provided with a low oil flow or oil pressure cut-out switch externally accessible and available for connection to the motor control center to allow the control to stop the mixer drive motor in the event of a loss of lubrication.

C. ***Oil Level Protection Devices:*** For reducers employing splash-type lubrication, a low oil level cutoff switch shall be provided to allow the control to stop the aerator drive motor in the event of loss of lubrication. The switch shall be externally accessible and available for connection to the motor control center.

2.5 IMPELLERS AND STABILIZER MECHANISMS

A. Each impeller shall consist of a minimum of four equally spaced downward pumping blades. Sufficient mass shall be provided to stabilize the operation of the entire mechanism. The impellers shall operate at a maximum speed of approximately 72 rpm, shall be designed as a low shear pump to reduce adverse floc shear effects, and shall be designed to pump water with minimal air entrainment. Underwater bearings to provide the required operating stability shall not be acceptable.

2.6 MOTOR ACCESSORIES

A. Heat Protection Devices: Each motor shall be equipped with a heat protection device to protect the motor from overheating during operation. The units shall immediately stop the aerator drive motor in the event of excessive heat build-up.

B. Motor Space Heaters: Each motor shall be equipped with a suitably sized space heater to keep condensation from forming when the motor is not running. The space heater will operate on control voltage and may be turned off at the operator's discretion.

2.7 ANTI-VORTEX BAFFLE

A. One anti-vortex baffle fabricated of 1/4-inch steel plate shall be provided for each aerator to be positioned at the water surface as close to the turbine shaft as possible. Assembly bolts shall be stainless steel.

2.8 PAINTING

A. Unless otherwise noted all surfaces shall be prepared and painted in compliance with Section 09900.

2.9 CONTROLS

A. The supplier of the mixers shall coordinate the details of the controls and protective devices with the Contractor.

B. Low oil pressure shutdown and zero speed alarm shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions.

3.2 SPARE PARTS

A. Spare parts for each mixer shall include one set of motor and gear reducer bearings, one low-level or oil pressure cutout switch, and one flexible motor coupling.

B. Provide one spare electric motor and one spare gear reducer.

C. Provide one year supply of lubricants recommended by the Manufacturer.

3.3 SERVICES OF MANUFACTURER

A. The manufacturer of the mixer equipment shall provide the services of a trained, qualified representative for at least two days for the purpose of inspecting the installation. Each mixer shall be checked for lubrication, alignment, rotation, vibration and the representative shall notify the Contractor and the Engineer of anything in the installation which might render the manufacturer's guarantee null and void. See Section 01660 - Testing, Adjusting and Balancing for additional information.

END OF SECTION

SECTION 11387 - CENTRIFUGAL AIR BLOWER

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all labor, materials, tools, and equipment to furnish multi-stage centrifugal blowers as shown on the Drawings and specified herein. The blower equipment shall be used for the equalization and sludge holding tanks. The equipment and controls specified in this Section shall be provided by a single supplier as a complete package to ensure adequate coordination and system compatibility.

1.2 WORK INCLUDED

A. Six (6) blowers and respective constant speed electric motor drivers.

B. All appurtenances as described herein which are required for proper operation of the centrifugal blower.

C. Manufacturers' or manufacturers' authorized representative field services.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications - Manufacturers proposing to furnish equipment for this Section shall have demonstrated long standing experience and ability in the design, manufacture and installation of similar units conforming to the Specifications.

B. Available Manufacturers - Subject to compliance with the requirements, provide the following:

1. Hoffman Air and Filtration Systems, Syracuse, N.Y. (Basis of Design)

    a) (2) - Model No. 74109 Equalization Tanks
    b) (3) - Model No. 75107 Sludge Holding Tanks
    c) (1) - Model No. 75103 Air Scour Blower

2. Roots
3. Sutorbilt
4. Tuthill
5. Or Equal

1.4 SPECIAL DEFINITIONS

A. SCFM: *Standard cubic feet per minute* is understood to be air at 68 degrees F, 14.7 psia, and 36 percent relative humidity flowing at a rate of 1 cubic foot per minute.

B. ICFM: The volume of air *in cubic feet per minute* (cfm) actually entering the blower or filter inlet at the atmospheric condition specified.

C. Discharge Pressure: The pressure in *pounds per square inch gauge* (psig) at the blower discharge flange.

D. Overall Efficiency: The total efficiency for the motor, drive, and blower from the motor terminals to the pumped air.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PERFORMANCE REQUIREMENTS

A. Each blower shall be installed indoors and shall be shielded from weather. All components of the systems as specified herein shall be suitable for permanent installation and continuous operation. The blower equipment has been designed around the listed manufacturer's system.

B. Each blower shall be capable of providing the following air volumes measured at 68 degrees F, 14.7 PSIA, and 36 percent relative humidity when operated at an elevation of 0-feet, inlet pressure of 14.7 PSIA, inlet air temperature of 100 degrees F, 36 percent relative humidity:

Location	Equalization Tank	Sludge Holding Tanks	Sand Filters
Quantity	2	3	1
Model No.	74109	75107	75103
Air Flow - SCFM	1,280	4,010	4,800
Discharge Pressure - PSIG	10	10	3
Blower Horsepower (Not to Exceed)	98	222	81
ICFM	700	2,206	2,000
Drive Motor Horsepower	125	250	100

C. In addition, at a winter temperature of 10 degrees F, the blower horsepower shall not exceed the motor horsepower rating (excluding service factor) at the design flow measured in SCFM.

D. When the volumetric capacity is reduced by at least 45 percent, the blower under the specified inlet conditions shall:

1. develop at least 1.6, 0.95 and 0.95 PSI pressure, respectively, above the specified discharge pressure.
2. not be in surge.

E. The blower shall be selected based upon data previously established by tests in accordance with the ASME power test code for centrifugal compressors, PTC-10.

F. No exceptions to the Performance Requirements stated above shall be allowed.

2.2 EQUIPMENT DESCRIPTION

A. The blower shall be of the multi-stage centrifugal type with outboard mounted bearing construction in which impellers are keyed to a ground steel shaft supported by antifriction type ball bearings. The blower shall be of the type in which the diaphragm is integrally cast with the casing. Where the blower shaft passes through both the inlet and outlet heads, carbon ring seals shall be provided to prevent leakage and to assure noncontamination of bearing lubricant. Seals and bearings shall be replaceable without having to disconnect the inlet or discharge piping. The blower shall include stainless steel intake baffles.

B. Inlet and outlet connections shall be ANSI 125-pound drilled and tapped flange pattern, and shall be an integral part of the heads. Inlet and outlet flange size shall be as shown on the drawings.

C. The complete assembly (motor, coupling, and blower) shall be dynamically balanced to ensure that mechanical vibration does not exceed 1.5 mils (peak to peak) amplitude, when measured on the bearing housing in either the horizontal, vertical, or axial direction at the design operating speed of approximately 3600 RPM. The blower manufacturer shall submit a certified test report attesting to the date and place of dynamic balance, and the results achieved. Tip speed of the rotating assembly shall not exceed 372 feet per second, and the first critical speed shall be 20 percent removed from the blower operating speed.

D. The blower shaft shall be supported by two antifriction ball bearings that can be lubricated, inspected or replaced without disassembling the rotating element of the blower.

E. Oil shall be provided for lubrication when the blower is in operation.

F. The blower unit shall be mounted on a common fabricated structural steel baseplate, and shall be furnished with a disk-type flexible coupling, and OSHA approved coupling guard. Manufacturer's standard resilient foundation mounting pads shall be furnished. Cast bases shall not be allowed.

G. The blower casing shall be rated per its standard published data sheets for at least a 25 psig maximum casing pressure.

H. Blower Components:

1. Safety Devices: Include per OSHA Standards.
2. Casing: ASTM A48 Class 30 semisteel.
3. Impellers: Cast or fabricated aluminum No. 356 alloy T-6 hubs, with fabricated No. 6061, T-4 aluminum front shrouds, No. 6061 T-6 aluminum rear shrouds, No. 6061 T-651 aluminum backup plate and No. 6061 T-6 aluminum vanes.
4. Impeller Shaft: AISI 1045 carbon steel.
5. Bearings: Antifriction type designed for an AFBMA minimum expected life of 10 years, at the speeds and loads imposed by this application in

accordance with AFBMA Standards for Ball and Roller Bearings, Section 9. The blower manufacturer shall submit calculations to substantiate bearing life.

6. Coupling: Rexnord Omega flexible coupling, with OSHA approved coupling guard. The service factor of the coupling shall be at least 1.5 greater than the motor nameplate rating.

I. Drive Motor:

1. Each blower shall be furnished with a 3 phase, 60 hertz, 460 volt, 3600 rpm, TEFC enclosure, squirrel-cage induction motor with a 1.15 service factor, factory mounted with the blower. The service factor of the motor shall not be used in establishing the nameplate rating. Motors shall be suitable for starting on reduced voltage.
2. Provide motors with a full load efficiency of 95 percent (plus or minus 1 percent) and a full load power factor of 89 percent (plus or minus 1 percent).
3. Motors shall be premium efficiency conforming to all requirements of Section 16150.

2.3 ACCESSORIES

A. The inlet air filter/silencer shall be rated for 120 percent of the blower design ICFM. Filter elements shall be cleanable and replaceable. The inlet air filter/silencer shall be manufactured by JAWS, Inc.

B. Provide a flexible connection on the blower outlet connection. Flexible connection shall be of the single arch, reinforced flanged rubber expansion joint type with a minimum 8-inch laying length. Flexible connection shall be designed to mate with ANSI 125-pound flanges. Blower flexible connection shall have a working pressure of at least 15 psig to 15 inches Hg vacuum and a working temperature of at least 250 degrees F. The connection shall be furnished with stainless steel split rings and the necessary bolts, nuts, and washers. The discharge flexible connection shall be equipped with a control unit (control rods), suitable for mating to the blower outlet connection, to restrict axial pipe movement. Flexible connection shall be Proco, or equivalent.

C. Double disc check valve shall be wafer style, spring loaded with cast or ductile iron body, aluminum, bronze, or ductile iron doors; resilient seats shall be EPDM or Viton and shall be suitable for 250 degree F service; and stainless steel hinge pin and stop pin spring. Valve shall be Duo-Check II, or equivalent.

D. Wafer butterfly valves shall have semisteel bodies with 316 stainless steel disc, Type 316 stainless steel stem, and reinforced TFE or TFE coated packing material and EPDM resilient seat shall be suitable for 250 degree F service. Valves shall be suitable for mounting between ANSI 125-and 150-pound flanges. Valves shall be hand lever actuated.

E. Discharge pressure gauge: Pressure gauge shall have a nominal 2-inch dial and accuracy of 2 percent (plus or minus) of span. Unit shall have a 1/4-inch NPT connection through the bottom. Units shall be Ashcroft, or equivalent.

F. Equipment Identification Plates: A 16-gauge stainless steel identification plate shall be securely mounted on the equipment and panels in a readily visible location. The plate shall bear the 1/4-inch die-stamped identification indicated in this Specification.

2.4 FACTORY PAINTING

A. All ferrous metal surfaces, except aluminum and stainless steel, shall be shop cleaned by sandblasting to bare metal in accordance with the *Steel Structures Painting Council* specifications prior to coating (painting). Shop painting (prime and finish) shall be carefully done by the manufacturer and all coatings applied in a workman-like manner in strict accordance with the paint manufacturer's published recommendation.

2.5 SPARE PARTS

A. The following spare parts shall be furnished. All parts shall be suitably marked and boxed for shipment.

Quantity	Item
12 each	Spare air filter elements
6	Shaft Seals

2.6 OPERATION, MAINTENANCE, AND INSTALLATION MANUALS

A. Six (6) Operation, Maintenance, and Installation manuals shall be provided by the equipment manufacturer at least two weeks prior to the shipment of all major equipment components. Each manual shall be a hard bound, indexed binder conforming to EPA standards for O&M manuals and shall be for the specific equipment provided, rather than general equipment instructions.

B. As a minimum each manual shall contain:

C. A complete bill of materials for the equipment including the weights of major components.

D. Installation and Maintenance instructions for the specific equipment including the erection sequence, maintenance and trouble-shooting check points, and complete lubrication procedures.

E. A list of the manufacturer's recommended spare parts. The list shall include: Wear items, long delivery items and all items convenient for stocking as optional replacement items.

2.7 CONTROL PANELS (SIX [6] REQUIRED)

A. The electrical components shall include all necessary tests, reset buttons, selector switches, relays, and transformers required for proper operation. The operation of this device shall be based on the current draw of the blower motor.

The device shall be designed and calibrated such that a given amount or current shall correspond to the volume of air being handled by the blower. When blower motor current drops to a pre-determined level, the alarm devices shall be actuated.

B. All components shall be mounted and factory wired in a NEMA 4X deadfront panel fabricated as specified in Division 13. The control panel shall be suitable for channel mounting. The blower control panels shall be installed in the locations as shown on the Drawings.

C. An ammeter calibrated in both SCFM and AMPS shall be supplied for each compressor and located in the control panel and current transformer located in the MCC.

D. There shall be furnished for each compressor control panel an electrically operated surge protection device. This device shall be so designed that, when volumetric demand of the compressor is reduced to the surge volume, the compressor motor will be de-energized and a visual and audible alarm will be produced. Contacts shall be provided for a remote alarm, which shall consist of a dry contact and an amber pilot light marked, "surge" and an audible alarm, consisting of a horn mounted at the location as shown on the drawings.

E. The electrical components shall include all necessary test, reset buttons, selector switches, relays, pushbutton starter contacts to start and stop blowers, timer, surge control, vibration shutdown, filter pressure switch, and accessories required for proper operation. The operation of this device shall be based on the current draw of the compressor motor. The device shall be designed and calibrated such that a given amount of current shall correspond to the volume of air being handled by the compressor. When the compressor motor current drops to a pre-determined level, the alarm devices shall be actuated and shall be provided in the MCC located in the electrical room. A current transformer shall be provided for each blower to be mounted in the MCC.

F. A standard NEMA 4 vibration switch mounted at the center of each blower shall have a 30-second startup delay and a 5-second monitoring delay designed to sort out false signals. The set point shall be adjustable by a screw for trip out in accordance with a predetermined vibration level. Any continuous vibration limit which exceeds a set point of the vibration switch will cause alarm and shutdown. The panel shall be provided with a relay, terminal strip and warning light.

G. Pushbutton switches shall be maintained contacts. The stop switch shall have a lock button to hold switch off.

H. Provide a start signal for a motor starter located in a remote motor control center.

I. Auxiliary dry contacts rated 10 at 120 VAC shall be supplied for remote sensing of ON, OFF, and FAILURE status, and per division 13.

J. Six (6) NEMA 4X No. 316 stainless steel panels are required, one for each blower provided."

PART 3 - EXECUTION

3.1 MANUFACTURER'S RESPONSIBILITIES AND SERVICES

A. Equipment Installation: The Contractor shall be solely responsible for assuring a complete facility in accordance with the provisions of the Project Manual. The equipment manufacturer's representative shall provide installation assistance to the Contractor to ensure that the equipment specified herein is installed in conformance with the manufacturer's recommended methods, as approved and as further specified hereunder.

B. Manufacturer's Services: Furnish manufacturer's representative for the following services at the job-site or classroom as designated by the Owner, for the minimum person-days listed below, travel time excluded:

1. One-person-day for installation assistance, inspection, and certification of installation.
2. One-person-day for functional testing, training, and system startup.

3.2 INSTALLATION

A. Install all filter equipment in accordance with the Drawings, these Specifications and approved manufacturer shop drawings and instruction.

B. Field painting shall be as specified in Section 09900 Painting and Coatings.

3.3 TESTING

A. Field Tests

1. Functional Test: Prior to equipment startup, all equipment described in this Specification shall be inspected for proper alignment, quiet operation, proper connection, and satisfactory performance by means of a functional test.

2. Vibration Test: The complete assembly, consisting of the driving unit and blower, connected and in normal operation shall not develop amplitudes of vibration on exceeding the limits specified herein.

3. Performance Test: The complete assembly, consisting of the driving unit and blower, connected and in normal operation, shall be tested to demonstrate their conformance to the Specifications and to the satisfaction of the Owner. A test log shall be presented to the Owner upon completion of each test that records the following:

a) Blower inlet and discharge pressure.
b) Driving motor voltage and amperage for each phase.
c) Blower SCFM based on ammeter.

END OF SECTION

SECTION 11500 - WET SCRUBBER ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish all labor, materials, equipment and incidentals required to provide the odor control system, complete with controls as shown on the Drawings and as specified herein.

B. The odor control system shall be a complete coordinated system consisting of but necessarily limited to: One fan, one scrubber tower, ductwork, recirculating pumps, two chemical solution feed pumps , two chemical storage tanks , prewired NEMA 4X control panel, equipment pad, secondary containment, reclaimed water supply, wastewater drains, electrical work, and all other appurtenances.

1.2 QUALIFICATIONS

A. All the equipment specified under this Section shall be furnished by a single Manufacturer who is fully experienced, reputable, and qualified in the design, construction, and operation of gas odor control systems. The absorption/reaction columns, chemical control system, recirculation pumps and blower shall be supplied by a single Manufacturer. The manufacturer shall provide evidence of successful operation of odor control systems in commercial applications for a period of at least five years. The equipment specified herein shall be as supplied by the Jacobs Group, manufactured by Duall Division of Met-Pro Corporation; R.J. Environmental, or approved equal.

1.3 SUBMITTALS

A. Shop drawings and schedules shall be submitted in accordance with the General Conditions and Division 1. Shop drawings literature describing the equipment and showing dimensions and all important details of construction shall be submitted to the Engineer for evaluation and approval. Complete master power and control wiring diagrams, elementary or control schematics, and suitable outline drawings of the control panel shall be furnished as part of the shop drawing submittal.

B. All details on shop drawings submitted for approval shall show clearly the relation of the various parts of the main members and lines of the structure, and where correct fabrication of the work depends upon field measurements, such measurements hall be made and noted on the Drawings before being submitted for approval.

1.4 SHIPPING INSTRUCTIONS

A. All parts shall be properly protected so that no damages or deterioration will occur during the prolonged delay from the time of shipment until installation is completed and the unit is ready for operation.

B. All equipment and parts shall be protected against damage during a prolonged period at the site.

C. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.5 SUBSTITUTE EQUIPMENT

A. If the equipment the Contractor proposes to furnish differs from that indicated on the plans or herein specified, or requires a different arrangement, the Contractor shall prepare and submit for review detailed structural, mechanical and electrical drawings and equipment lists showing all such changes. If accepted by the Engineer, any additional costs involved, including those for shop drawing review, project drawing changes, and changes in interfacing work, shall be the responsibility of the Contractor at no additional cost to the Owner. In addition, the Contractor shall compensate the Engineer for any additional work necessary for the engineering review and redesign.

PART 2 - MATERIALS AND EQUIPMENT

2.1 DESCRIPTION OF THE SYSTEM

A. The odor control system shall treat and effectively eliminate odors from the headworks and the flow splitter box. The system shall have a rated air flow capacity of 3,000 cfm and be capable of continuously oxidizing compounds having an average oxidation demand equivalent to 50 ppm of hydrogen sulfide. The system shall be capable of continuously providing a treated exhaust air stream having a hydrogen sulfide concentration not greater than 1 ppm at the rated capacity and/or guaranteed H_2S removal efficiently of greater than 98 percent based on the design capacity of the unit.

B. Evaporation and other water loss makeup shall be accomplished by an automatic level control system in the bottom of the scrubber towers in conjunction with a continuous water makeup. The system shall be capable of operating in either mode, automatic or continuous water makeup.

C. In order to provide maximum absorbent effectiveness, the equipment supplier shall furnish all necessary chemicals, chemical feed pumps, automatic monitors and controls to maintain sufficient pH and ORP to effectively remove odorous gases.

D. The control system shall be provided with a common alarm function indicating system malfunction. The alarm shall be local at the control panel and activate a light, as well as a remote alarm at the central control panel.

E. The odor control unit shall be supplied as a "package," i.e. all components of the system shall be assembled on a common mounting base. To facilitate relocating the equipment in the existing treatment facility in the future, the system shall permit easy dismantling and reassembly with no adverse effects on the system operation.

F. The complete system shall be designed for outdoor service.

2.2 TANKS AND CONTACT TOWERS (VESSELS)

A. The vessels shall be manufactured entirely of PVC overlayed with FRP material.

B. The Serpentine scrubber shall consist of a side entry, top discharge, Serpentine packed bed with integral recirculation sump. All gas inlet/outlet connections shall be connected by means of flexible sleeves. Access doors shall be provided to facilitate easy removal. All nozzles shall be accessible from access doors. All chemical feed fittings, pump suction, overflow, drain, fresh water makeup, liquid level control, site gauge and any other necessary fittings shall be included.

C. Packing material shall be P/P random dumped packing equivalent to Jaeger Tri-Packs, or approved equal. All packing support grids and mist eliminator support grids shall be designed to withstand the operating load with a minimum of 300% safety factor. Support design calculations shall be submitted to the Engineer.

D. The sump capacity shall provide for a minimum of three times the recirculation rate.

E. The maximum and nominal dimensions of the scrubbing column system footprint shall be 74" x 68". Total packing depth shall be a minimum of 12 ft. The manufacturer shall submit calculations showing the design basis, number of transfer units, L/G etc., with the test results from similar systems in operation demonstrating H_2S removal efficiency.

F. The scrubber vessel shall be one piece fabricated with three separate packing sections.

2.3 RECIRCULATION PUMPS

A. The two recirculating pumps shall pump the scrubbing solution from the reservoirs in the bottom of the scrubber to the spray nozzles at the top. The pumps shall be capable of pumping 130 gpm against the total dynamic head required. Each pump shall be a vertical sealess design complete with a 12" x 18" mounting plate and 5 HP TEFC motor. Pumps shall be manufactured by Sethco, Dean or Serfilco.

B. Each of the pump motors shall be TEFC, severe duty, 460 volt, 3 phase, 60 Hertz and 1.15 service factor. Motors shall be premium efficiency conforming to all requirements of Section 16150. The pump motor starter shall be furnished by the odor control system Manufacturer and located in the Odor Control Panel/Motor Control Center enclosure.

2.4 CHEMICAL METERING PUMPS

A. Chemical metering pumps shall be the positive displacement type. The metering pumps shall have a capacity that is at least 150% of the capacity required at max. inlet air loadings. Discharge pressure shall be at least 60 psi. Operating range shall be 200 to 1 and shall be achieved by means of independently variable stroke length and stroke frequency. Feed rate shall be adjustable from 0 to 100%. Stroke frequency shall be adjustable from 3.75 to 75 strokes per minute. Stroke frequency shall be automatically controlled by a dry contact from the odor control panel. Output from this panel shall be proportional to the input signal.

B. Each pump shall use 115 volt, single phase. 60 Hertz electrical power, and shall be provided with a 6 foot power cord with grounded 3 prong plug.

C. Each pump drive shall be totally enclosed with splash-proof enclosure and shall have no exposed moving parts. The Pulser shall be solid state and shall be fully encapsulated. Electronics shall be housed in a chemical-resistant enclosure.

D. Each pump housing shall be of chemical-resistant glass fiber reinforced thermoplastic. All exposed fasteners shall be corrosion resistant. Valves shall be ball type with ceramic balls seating on a combination valve seat and seat ring. Valve seat and seat rings shall be replaceable and shall be of hypalon or teflon elastomer.

E. Each head shall be of PVC material capable of resisting the pumped chemical. Fittings and connections at the pump head shall be PVC.

F. Each pump shall be provided with a diaphragm type anti-syphon-pressure release valve on its pump head, a splash guard, and a wall mounted bracket assembly.

G. Sufficient polyethylene pump discharge tubing shall be provided to connect to the fittings on the scrubber sump, complete with connectors, and an injection/anti-syphon check valve with ½" NPT male connection for the injection point. A foot valve with a one piece strainer and 10' of polyethylene tubing on the suction line shall be provided for each pump.

H. One pump shall be capable of pumping a 20 to 50% sodium hydroxide solution. The other pump shall be capable of pumping a 5 to 15% sodium hypochlorite solution.

I. The system shall be capable of receiving a 4-20 mA signal and changing speed proportionally.

J. Chemical feed pumps shall be Pulsatron by Pulsafeeder or approved equal.

2.5 EXHAUST FAN DUCTWORK

A. One centrifugal fan of PVC construction shall be located downstream from the scrubber. The fan capacity shall be 3000 SCFM at 6" SP. The fan and motor shall be designed to allow speed-up and increase of 1-inch w.g. static pressure, if required. The fan shall be a 12-blade, backwardly inclined, non-overloading style wheel, with fully encapsulated steel hub. The housing shall be manufactured of high impact PVC and shall have been tested and rated according to AMCA Standard 210-74 and ASHRAE Standard 51-75. The fan shall be furnished with a flanged inlet, flanged outlet, drain , drives, and belt guards, and shall be dynamically balanced prior to delivery.

B. The exhaust fan motor starter shall be furnished by the system manufacturer and located in the odor control panel/motor control center enclosure with the following performance requirements:

1. Fan shall be 7.5 HP, TEFC, severe duty, 460 volts, 3 phase, 60 Hertz, and have a 1.15 service factor.

C. Ductwork shall be of PVC construction as a standard material from the system supplier.

2.6 AUTOMATIC CHEMICAL CONTROLLERS

A. The odor control system manufacturer shall furnish the automatic chemical feed controller. This automatic controller shall provide automatic adjustment of the chemical composition of the scrubbing solution to minimize the possibility of odor breakthrough because of gas flow fluctuation.

B. The controls shall include pH and ORP analyzers mounted in the NEMA 3R enclosure.

C. The controller shall have a digital display with a 1-14 range for pH and a 0-1000 mv range for ORP with a 4-20 Ma output with range expand. The controller shall have a dual alarm relay with two individual adjustable controls to establish low and high alarm points so that the alarm relay is energized whenever the process solution is outside of those points.

D. The pH and ORP analyzers shall be Great Lakes Model 672 or approved equal.

E. The pH or ORP probes shall be located in the sump area wired to individual NEMA 3R junction boxes mounted on the scrubber vessel.

F. Each probe shall be a fully encapsulated flow-thorough type with wetted materials consisting of vinylester body, ceramic salt budget, glass process electrode, titanium palladium ground electrode, viton and RTV sealant.

2.7 ODOR CONTROL PANEL/MOTOR CONTROL CENTER

A. The odor control system manufacturer shall provide the odor control panel/motor control center in a NEMA 4X enclosure prewired complete with the following:

1. 7.5 fan motor starters, 460 V, 3 Phase, 60 HZ.
2. (2) 5 HP circulation pump motor starters, 460 V, 3 Phase, 60 HZ.
3. Lockable 100 amp fused disconnect switch.
4. 120 V control voltage transformer (30 amps).
5. (2) chemical feed pump contacts, 120 V, 1 Phase, 60 HZ.
6. Illuminated start buttons for each fan and pump.
7. Acknowledge silence and alarm reset buttons.
8. (1) adjustable alarm horn.
9. Interlock between circulation pump and chemical feed pumps so that when the circulation pump is off, chemical feed pumps cannot operate.
10. Dry contact for remote alarm indication at the central control panel.
11. pH out of range alarm lights for the scrubber.
12. pH controller.
13. ORP out of range alarm lights for the scrubber.
14. ORP controller.

2.8 CHEMICAL STORAGE TANKS

A. Sodium Hydroxide (NaOH) tank shall be 500 gallon capacity.

B. Sodium Hypochlorite (NaOCl) tank shall be 2000 gallon capacity.

C. The chemical storage tank configuration shall be as indicated in drawings.

D. The vessel containing the NaOH shall be insulated and heat traced so that the NaOH does not freeze. Means of control shall be automatic including, Thermostat, probe, NEMA 4 control box, paneling, relays, and miscellaneous controls. The heat traced tank shall be a standard of the supplier.

E. An eye wash-shower shall be supplied and located on the odor control pad.

2.9 OPERATING INSTRUCTIONS AND MANUFACTURERS' REPRESENTATIVES

A. The bid price for the equipment furnished shall include the cost of a competent representative of the manufacturer to instruct the Owner's operating personnel on operation and maintenance. A minimum of one (1) man-day shall be provided. This instruction may not be combined with the services specified in Part 3.

B. The representative provided for the various instructional sequences shall have complete knowledge of proper operation and maintenance of the equipment.

C. Operation and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The owner shall receive six (6) copies.

2.10 TOOLS AND SPARE PARTS

A. All special tools required for normal operation and maintenance of the equipment shall be furnished with the equipment by the Manufacturer, including chemicals and kits to monitor residual chlorine and probe calibration kits.

B. Spare Parts: Spare parts shall be furnished to assure normal operation and maintenance for a period of one year as recommended by the Manufacturer of equipment under this Section. As a minimum the following list shall be provided:

1. 1 set of fan belts
2. 1 set of spray nozzles
3. 1 spare chemical pump for each chemical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the odor control equipment in accordance with the construction drawings , specifications and approved manufacturer's shop drawings and instructions.

B. Provide all piping and service connections, including exhaust air ducts, reclaimed water, wastewater drain, electric power, and instrumentation wiring.

3.2 INSPECTION AND TESTING

A. The system manufacturer shall furnish the services of a factory representative who has complete knowledge of proper operation and maintenance of the equipment for a minimum of three (3) days to inspect the final installion and supervise the test runs.

B. The scrubber shall be tested with 50 ppm of hydrogen sulfide in the exhaust air supplied by the manufacturer. The equipment supplier shall furnish utilities, labor, hydrogen sulfide generator, flowmeter for air flow measuring and a portable hydrogen sulfide analyzer. Tests shall be conducted using an Interscan electro/chemical gas sampling system. The test shall be supervised by the equipment supplier and witnessed by representatives of the Engineer and Owner. The system shall provide a minimum of 98 percent removal of hydrogen sulfide from the influent air stream at design conditions.

C. If the system if any component thereof fails to operate properly and to remove odors at the existing hydrogen sulfide concentration, the necessary revisions shall be made or components shall be replaced until the system operates to the satisfaction of the Engineer.

3.3 CERTIFICATES

A. Certificates from the manufacturer stating that the installation of the equipment is satisfactory, the unit has been satisfactorily tested, is ready for operation and the operating personnel have been suitable instructed in the operation, lubrication, and care of the unit shall be submitted.

END OF SECTION

SECTION 13300 - CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION of WORK

A. The CONTRACTOR shall provide an approved professional SYSTEMS INTEGRATOR to have total system responsibility for all instrumentation, controls, services, and systems as indicated in the contract drawings and described herein.

B. These sections of specifications shall be considered as a single unit and shall be included in the single source responsibility from the SYSTEMS INTEGRATOR.

C. The SYSTEMS INTEGRATOR, working together with the CONTRACTOR, shall provide and install the total instrumentation requirements for all System Controls and Instrumentation as described herein and shown in the contract drawings.

D. This project provides an "In-Plant SCADA" system, as described herein, for the Manatee County Southeast Subregional Wastewater Treatment Plant (SERWTP).

E. The SCADA system will utilize standard industrial Programmable Logic Controllers (PLCs), which shall be installed at five key locations scattered throughout the plant.

F. These PLCs shall be connected to every major instrument and piece of equipment, both existing and proposed, to provide complete monitoring of all equipment and process measurements and provide local sequencing logic and distributed control for each unit process.

G. Programming logic and operator interface screens shall be designed to provide reliable, comprehensive and versatile control of effluent disposal, including special protocols and sequencing logic. All automatic controls shall be designed with appropriate fail-safe logic and means for manual backup.

H. The PLCs shall be linked in an Industrial Data Highway, using fiber-optic communications, configured in a self healing "redundant ring" topology, to provide a secure and reliable communications backbone.

I. The PLCs shall utilize the communications backbone to provide peer communications between all PLCs and all related SCADA components. These communications shall be configured to provide automatic remote monitoring and control across the plant site.

J. An industrial "Operator Interface" (OPI) shall be provided at each SCADA panel to provide distributed and redundant operator access to all current analog and discrete process information, as well as providing access to timers, counters, control selections and setpoints for supervisory control.

K. The existing main Process Instrumentation Console (PIC) shall be removed and replaced with a new PIC.

L. This panel shall also designed to accommodate a future computer system to be provided by others.

M. The System Integrator shall provide various levels of training, and spare parts, as described in these specifications. Training on the operator's level shall provide a comprehensive understanding of the control algorithms, including all control scenarios, options and backup systems. Training shall also be included on the operation, maintenance and programming of all equipment, including PLC and OPI equipment, and shall provide training in the programming and troubleshooting of all components and systems.

N. FUTURE: This project does not include a SCADA computer, or related hardware, software or implementation. A future County-Wide SCADA project is planned for the near future, and the new SCADA computer will be provided and installed as part of that project. Therefore, the limits of responsibility for this project will include the complete implementation of the PLC and OPI, as described in these documents, but does not include the SCADA computer and software.

O. The specifications for "Controls and Instrumentation" are provided in the following sections:

1. 13300 - Controls and Instrumentation
2. 13310 - Control Panels and Equipment Tabulation
3. 13320 - In-Plant SCADA System
4. 13330 - Fiber Optic Communications System

1.2 INSTRUMENTATION SYSTEM RESPONSIBILITY

A. The Contractor's attention is directed to the fact that each part of the instrumentation work specified forms part of an integral system, and as such shall be supplied by one supplier, who shall provide all of the equipment and appurtenances regardless of manufacture, and shall be responsible to the contractor for satisfactory operation of the entire system.

B. The new instrumentation system shall interface with the existing chlorination system. The SYSTEM INTEGRATOR shall be responsible to oversee the coordination between the proposed instrumentation and the existing chlorination controls, and providing system start-up and calibration services so that the entire system operates as intended.

C. The INSTRUMENTATION SYSTEM shall be provided by a professional SYSTEM INTEGRATOR, who shall take responsibility for the work provided under this SECTION and for other related instrumentation sections referenced herein.

D. Work shall include but not be limited to the following: Provide all instruments regardless of manufacturer, and apply total SYSTEMS INTEGRATION ENGINEERING to assure that each component is appropriate for the service intended, and that it is applied and utilized in keeping with the recommended standards of practice designated by the manufacturer.

E. The SYSTEMS INTEGRATOR shall also oversee the installation, start-up and calibration of every system component to verify that all details of the system are properly executed.

F. The SYSTEMS INTEGRATOR shall provide technical services including interface design, coordination with related equipment and systems provided by others, equipment installation, system calibration and operator training.

1.3 QUALITY ASSURANCE

A. AVAILABLE SYSTEM INTEGRATORS: A single sub-contractor shall be designated as the SYSTEMS INTEGRATOR. This supplier shall be responsible for all of the specialized controls and instrumentation for the project. The instrumentation SYSTEMS INTEGRATOR shall provide all engineering, equipment, materials, and hardware as well as assuring proper installation, adjustment, calibration, and startup of all systems, regardless of manufacture.

B. The SYSTEMS INTEGRATOR shall be a company which is regularly engaged in the business of instrumentation systems integration, in the state of Florida, in the water and wastewater industry.

C. If additional hardware is required to achieve proper interface, or systems operation, (i.e. signal converters, signal re-transmitters, interposing relays and similar items) these shall be provided and installed by the SYSTEMS INTEGRATOR as part of the total systems responsibility at no additional cost to the County, to form a total system which is well ordered and complete.

D. The Contractor, with the Owner's concurrence, shall select the SYSTEMS INTEGRATOR from one of the names listed below, or an approved equal:

1. Diversified Engineering, Richmond, Virginia
2. GE Team, Charlotte, North Carolina
3. C_2I, Atlanta, Georgia
4. Lord & Company, Rock Hill, South Carolina
5. Revere Controls, Birmingham, Alabama

1.4 SHOP DRAWING SUBMITTALS

A.. The shop drawing submittals shall provide detailed information specific to the project requirements as outlined below:

B.. Catalog cuts and Component Data Sheets shall be provided for each individual component, device, system or subsystem supplied as a component of this project. Catalog cuts shall include catalog information, descriptive literature, application information, operating ranges, accuracy statements, wiring diagrams, power sources, options and accessories.

C. All options or accessories shall be marked with dark arrows so that the exact model, configuration and accessories are clearly delineated. Each catalog cut shall be accompanied with an appropriate component data sheet which shall summarize the job-specific data which describes each component supplied, with specific data including manufacturer, model number, scale, range, set-points, options included, materials of construction, mounting hardware, power requirements and accessories.

D. A Bill of Materials shall be provided, which shall list all of the instruments, equipment, panels and devices supplied in this project, grouped by remote location designations, and identified by code numbers consistently and systematically. The tabulation shall include as a minimum the instrument name and model, the code number, a description, options and accessories provided and the quantities.

E. Panel Drawings shall be provided for each enclosure, control panel, or system schematic provided. Drawings shall include front panel elevation and layout of the internal panel components, drawn to scale. Panel drawings shall be fully detailed showing hinges, doors, latches, subpanels, component cut-outs, panel face mounted devices, nameplates and service legends.

F. Also, complete control diagrams shall be provided, in ladder and loop schematic form, showing all wiring details, including all devices, electrical connections, wire numbering, terminal strip numbering, wire color code and termination designations at each device.

G. The LOOP DIAGRAMS shall meet the minimum requirements of ISA S5.4. The physical location of each component shall be clearly designated, both in the panel and in the field.

H. Field Wiring Diagrams shall be provided showing all wiring interconnections between equipment, panels, junction boxes, field mounted devices. The diagram shall identify each cable and conductor by size and type (i.e. gage, THHN, twisted, shielded, coaxial, etc.), as well as color code and numbering. Termination details shall be included at the panel, at the field device termination point, as well as any intermediate connections required.

I. Installation Details shall be provided for each field mounted device, which shall include mounting details, piping, tubing, wiring connections, pilot tube routing, materials and accessories and other necessary details required for proper equipment installation.

1.5 DOCUMENTATION

A. The CONTRACTOR/SYSTEMS INTEGRATOR shall provide full documentation for all hardware, instrumentation, and equipment, including complete manuals for installation, operation, calibration, troubleshooting. All documentation shall be neatly organized, readable and complete.

B. Complete hardware installation, operation, maintenance and troubleshooting manuals shall be provided. Six sets required.

C. At the completion of the project, the instrumentation CONTRACTOR shall provide complete as-built drawings, describing all instrumentation systems and all instrumentation-related wiring interface details accurately and completely. Wiring diagrams shall include complete, detailed, as-built wiring diagrams for all locations. These shall include all components as described under SHOP DRAWING SUBMITTALS above, but shall be corrected to include all information reflected by AS-BUILT conditions. These shall be provided also in electronic format as AUTOCAD files. Six sets required.

D. LOOP DIAGRAMS: Currently, the loop diagrams are in single binder which was prepared by Hi-Ran systems, as part of the 1986 expansion. A copy of that binder will be provided to the SYSTEMS INTEGRATOR. Much of the EXISTING instrumentation is being modified or replaced by this project. Many of the loops have been removed. Therefore, at the completion of this project, the system integrator shall provide a complete new documentation of LOOP diagrams to completely replace the previous documentation, to provide the MASTER documentation for the instrumentation system. This documentation shall be provided in 8.5 x 11 inch format. These drawings shall also be provided as electronic files in AUTOCAD format.

E. NOTE: Documentation above which is required as AUTOCAD files shall be provided on a writable compact disc, which shall be organized to provide easy access to all files.

1.6 SYSTEM SCHEMATICS IN THE CONTRACT DRAWINGS

A. In some cases, wiring schematics have been included in the contract drawings to clarify the intended control function and to explain typical interactions of system components.

B. These schematics are "SIMPLIFIED" versions of the required systems. These schematics provide recommended details for various aspects of the system design. They do not purport to include all of the details and components of the total system design. It shall be the responsibility of the system supplier to design the entire control system in compliance with the purposes intended, and the functions described herein.

C. In some cases, fairly detailed schematics are provided. In some cases partial schematics are included for specific functions. For some of the proposed control panels, schematics are not shown at all. It is the responsibility of the system supplier to design the control systems and furnish the completed schematics and system designs subject to the review and approval of the engineer.

PART 2 - PRODUCTS

2.1 ULTRASONIC LEVEL TRANSMITTERS

A. Ultrasonic transmitters shall be provided to measure various tank levels or to characterize flow by measuring level over a weir or flume. Equipment shall be provided with features and accessories as described herein, suitable for the application. The System Integrator shall provide all mounting hardware and coordinate the details of the installation, so that the instruments are installed in keeping with the best standard and recommended practices of the manufacturer, and conforming to the requirements set forth by the Engineer.

B. Level transmitters shall be fully programmable and configurable using a key pad. The final AS-BUILT documentation shall be provided with a tabulation of the Programming Setpoints used in EACH level transmitter, so that the initial calibration can be re-produced when a spare transmitter is installed.

C. Level transmitters shall be provided with optional integral analog signal isolators, as part of the transmitter assembly. Even though the CASE is NEMA 4X, each level transmitter shall be installed in an additional NEMA 4X enclosure. The outer enclosure shall be provided with a clear front, polycarbonate or equal. The enclosure shall also be used to house the power and signal surge protection. All conduit connections shall be sealed to prevent damage or corrosion due to vapors or wetness.

D. Ultrasonic Level Transmitters shall be Badger, Series 2100 or 2500 as appropriate for the application, to match the existing County equipment inventory and spare parts. There shall be no approved equals. Transmitters shall be installed using the appropriate level transducer, suitable for the range of the installation. The CABLE provided with the transducer shall be ordered with sufficient length to provide installation without splicing the cable at any point.

E. The System Integrator shall provide a mounting design and appropriate mounting hardware, to install and secure the transducers in a manner in keeping with the recommendations of the manufacturer of the equipment. All hardware shall be fabricated from corrosion resistant materials, and shall utilize stainless steel hardware. The mounting system shall be secure, and permanent, and shall allow easy access to the probes for servicing. All cables shall be installed in suitable rigid conduit, with only short lengths of flexible conduit allowed to complete the installation.

F. SPARE PARTS: Provide one spare Ultrasonic Level Transmitter of each type used, and one spare transducer of each type used(supplied with the longest cable utilized in the project).

2.2 ULTRASONIC FLOW TRANSMITTERS

A. Strap-on ultrasonic flow transmitters shall be provided to monitor the flow, and to provide a 4-20 ma signal proportional to flow over the appropriate range. Sonic transducers shall be mounted to the pipe, using stainless steel mounting bands. The flow transmitter shall be fully programmable to the ranges and conditions in the field. The instrument shall be housed in a NEMA 4X enclosure. The microprocessor based transmitter shall provide an interface with the local keypad, and digital display to provide programming configuration, rate indication, and totalization on a 24 character alphanumeric display. Meter shall provide a linearity of 0.5%, repeatability of 0.25% and an accuracy of 1 to 3 % above 1 foot per second. Meter shall be complete with all components, cables, accessories, and manuals. A representative of the manufacturer shall provide start-up and training. Ultrasonic flow transmitters shall be Badger model 4500. There shall be no approved equals.

2.3 PRESSURE TRANSMITTERS

A. Pressure transmitters shall be provided, to provide accurate analog measurement of line pressure. Typical range shall be 0-100 PSIG. The transmitter shall provide a 4-20 ma signal in proportion to the measured pressure. Accuracy shall be 0.25 % of calibrated span. Transmitter shall be equipped with a local LCD scale, providing percent output proportional to pressure as a scale.

B. The SYSTEM INTEGRATOR shall provide all labor and materials for appropriate installation, mounting, start-up and calibration of the transmitters. Pilot piping shall be stainless steel. A Stainless Steel ball valve shall be installed for isolation. All components shall be Swagelok for tubing and connectors and Whitey for ball valves.

C. Mounting brackets shall be provided for 2-inch pipe stands, and shall utilize 316 SST u-bolts and bracket material. Construction components such as isolating diaphragms, drain/vent valves, process flanges and adapters shall be 316 SST. All options and components of construction shall be selected for best use in a wastewater plant environment. Transmitters shall be Rosemount Alphaline 1151 AP. There shall be no approved equals.

2.4 OPEN NOZZLE FLOW TRANSMITTER

A. Open nozzle flow transmitters shall be provided for the dirty backwash water discharge. Each transmitter shall consist of a open discharge "Halmi" nozzle, a diaphragm seal with 5 feet of armored stainless steel capillary tubing and a pressure transmitter. The transmitter shall be characterized to provide a 4-20 ma signal proportional to flow. The backwash trough is a 12-inch trough with a hexagonal bottom. The nozzle shall be installed at the end wall discharge of the backwash trough. Flow range shall be 0-800 gpm The transmitter shall be mounted on the handrail above the channel. Pressure transmitter shall be Rosemount. Nozzle shall be as manufactured by Primary Flow Signal or approved equal. The manufacturer of the nozzle shall provide a complete system, including the nozzle, diaphragm seals, capillary system and transmitter, and shall provide a standard 5-year warrantee.

2.5 CURRENT TRANSMITTER (CT)

A. Current transmitter shall utilize a current transformer ring mounted around one leg of the motor power conductor, and convert the 0-5 amp output to a 4-20 ma signal. The Current transmitter shall be mounted within a suitable enclosure near the motor control equipment. The transmitter shall output a signal proportional to the motor current to the PLC, where it shall be monitored in the SCADA system.

2.6 SLUDGE BLANKET TRANSMITTER (SBT)

A. An interface level transmitter shall be provided to monitor the level of the solids blanket in each clarifier. The transmitter shall consist of a microprocessor based control panel and a separate ultrasonic transducer. The control panel shall include an LCD display which shall provide a full graphical profile of the tank.

The control panel shall produce a 4-20 ma signal proportional to the sludge blanket level. The enclosure shall be NEMA 4X. The entire instrument shall be housed in a stainless steel NEMA 4X enclosure.

B. The transducer shall be provided with a complete swing-out mounting system, which shall include all mounting brackets, hinges, connectors and accessories. The Contractor shall install the sensor according to the instructions from the manufacturer. The Contractor shall provide the services of a factory qualified technician, to provide the final programming, calibration and start-up of the equipment. The technician shall also provide four (4) hours of training to the Owner's instrumentation/electrical staff in the proper operation and maintenance of the equipment.

C. The sludge blanket transmitter shall be Royce Model 2511A to match the existing equipment. The supplier shall provide two training courses of four hours each, for training the plant staff and the instrumentation/electrical maintenance staff on every facet of operation, calibration and maintenance of the instrumentation.

2.7 DISSOLVED OXYGEN TRANSMITTERS (DOT)

A. A dissolved oxygen transmitter shall be provided to monitor the level of dissolved oxygen in each aeration basin. The transmitter shall consist of a microprocessor based control panel and a separate submersible sensor. The analyzer shall include menu directing setup and trend graphing on the display. The transmitter shall provide simultaneous DO and temperature readout on the display. Transmitter shall utilize automatic sensor membrane self-cleaning. Instrument shall be microprocessor based and feature one-touch calibration.

B. The transducer shall be provided with a complete swing-out mounting system, which shall include all mounting brackets, hinges, connectors and accessories. The Contractor shall install the sensor according to the instructions from the manufacturer. The Contractor shall provide the services of a factory qualified technician, to provide the final programming, calibration and start-up of the equipment. The technician shall also provide four (4) hours of training to the Owner's instrumentation/electrical staff in the proper operation and maintenance of the equipment.

C. The dissolved oxygen transmitter shall be Royce Model 9200, and shall utilize the model 94 DO sensor. The supplier shall provide two training courses of four hours each, for training the plant staff and the instrumentation/electrical maintenance staff on every facet of operation, calibration and maintenance of the instrumentation.

2.8 SIGNAL SELECTORS AND SIGNAL ISOLATOR

A. Provision shall be made for the selection and or signal isolation of analog signals as described herein. Signal selectors shall be designed to switch 1-5 VDC signals, by the use of precision 250 ohm resistors on a resistor-block terminal strip. Switching shall be designed so that neither loop is broken when the switch is changed. The selected 1-5 VDC signal shall be provided as an input to the Signal Isolator.

B. Signal Isolators shall accept a 1-5 VDC signal and create a proportional 4-20 MA signal. The Signal Isolator shall provide a regulated power source as well as signal isolation and protection to the analog measurements. Signal Isolators shall be adjustable and fully configurable. Signal Isolators shall be guaranteed by the manufacturer for a minimum of 3 years. Signal isolators shall be as manufactured by AGM. There shall be no approved equals.

2.9 PANEL DESIGN & FABRICATION

A. All control panels shall be NEMA 4X, corrosion resistant constructed of stainless steel, or as otherwise shown in the contract drawings. Panels shall have stainless steel hinges and hardware, and shall be provided with quick release luggage type latches, and a lock hasp suitable for a standard sized external pad-lock.

B. All panels shall be slightly over-sized to provide uncrowded mounting of all devices for ease of troubleshooting and maintenance. All devices shall be mounted and wired in a neat and workmanlike manner. Each component shall be prominently identified with the use of permanent engraved legend plates.

C. All wiring shall be color coded and numbered in a manner which promotes ease of system understanding. Each panel shall be provided with a fully detailed wiring schematic and component schematic, which shall be laminated and permanently installed in the inside door of the enclosure, and additional copies shall be provided in the as-built documentation.

D. Wiring which enters or leaves the enclosure shall be terminated to large lug type terminal strips, designed to accommodate minimum 16 ga wiring, and permanently numbered consistent with the component schematic. These wiring termination strips shall be located with ample room to allow field wiring to terminated in a neat and workmanlike manner.

E. Appropriate panel mounting hardware shall be provided and installed in order to assure that the panel is rigidly installed.

F. Panel locations shall be individually selected for best operational and aesthetic considerations. Wherever practical, panels shall be mounted inside a building, using heavy duty wall anchors.

G. Outdoor enclosures shall utilize wall mounted or stanchion mounting rack support systems using stainless steel mounting hardware and stainless steel Unistrut.

H. Indoor SCADA panel shall utilize two-door, floor mounted enclosures. Enclosures shall be designed for ease of troubleshooting and maintenance.

I. Each SCADA panel shall be designed to anticipate a minimum of 100% expansion and future Input-output requirements (double the initial installation). Incoming wiring terminal strips shall be provided to accommodate 100% spare terminals. All surge arrestors, control relays and related devices shall be din-rail mounted. Din rails shall be installed with sufficient room to double the initial installed component list. PLCs shall be installed using the initial rack configuration shown. Space shall be provided on the backplane for an I/O expansion rack.

J. Each SCADA panel shall be designed with an appropriate fiber-cable management systems and patch panels to provide optimum protection for fiber cables. The heavy jacketed multiconductor cable shall enter the enclosure, and encircle the perimeter twice, to provide spare cable for future splices. The cable shall be clamped using a suitable strain relief bracket and fanned out to a fiber-optic patch panel. Each cable strand shall be tested and terminated to the patch panel, which shall provide protection from physical damage. A pre-made fiber jumper shall be utilized to make the final connection from the patch panel to the Fiber Optic modem.

K. There shall be generally three types of conductors used on this project: power conductors, communications conductors and signal conductors. Each shall be installed in separate conduits, and separated from the others, to minimize the effect of noise.

L. All panel mounted controls shall be corrosion resistant NEMA 4X. Selector switches, push buttons, pilot lights, and other pilot devices, shall be heavy duty oil-tight units, Allen Bradley Bulletin 800H, or approved equal.

M. Other controls shall be provided as required to accomplish the required operation and controls. All devices shall be heavy duty industrial quality appropriate for the service intended and designed to provide many years of service under the conditions and usage of this application.

N. Each panel shall contain appropriate surge protection for both the power line system feeding the instruments and the signal lines to and from various locations.

O. All enclosures shall be Hoffman or Stahlin. There shall be no approved equals.

2.10 CONTROL CONSOLE

A. The PIC (Process Instrumentation Console) in the control room shall be removed and replaced with a modular console designed to accommodate the controls and instrumentation component requirements of this project. The console shall consist five(5) sections, 24-inches wide, and each shall be equipped with modular accessories as shown in the contract drawings and as described herein.

B. The console system shall ship in individual fully assembled units to be leveled in position and bolted together at the end user's site.

C. The console shall be ergonomically designed for operator comfort and suitable for housing and mounting personal computers, 21" CRT's, 19 inch rack mount equipment, video monitors, PLC's, Distributed Control Systems, and other items required in a control room environment.

D. The console system shall have the ability to house panel mounted components such as panel meters, chart recorders, push buttons, pilot lights, and other components required by the system. Internal solid aluminum sub-panels shall be installed for mounting panel components. Sub-panels shall be two-sided to allow mounting of equipment from either side. Two-sided sub-panels shall be provided as two separate panel with appropriate spacing between them.

E. The console system shall utilize gaskets which shall minimize the amount of dust and contaminates entering into the modular console system.

F. The base frame shall be constructed out of fully arc welded, multiformed 14-gage steel. Various means shall be employed to mount equipment, including ball bearing pullout CPU trays, solid floor panels with conduit entries, side mounted sub-panels, movable equipment shelves, and EIA rails for rack mounting equipment.

G. To assure alignment of the complete system, levelers shall be provided at each corner. The rigidity of the frame shall not rely on contact with the floor for support. To insure that the console does not tip, the base frame shall be lag bolted to the floor.

H. All end and rear panels shall be lift-off and constructed out of 16-gage steel. These panels shall feature smoothly dressed beveled corners to both enhance appearance and avoid square corners that could cause injury.

I. Front hinged doors shall be welded 16-gauge steel with stiffeners and smooth radius edges for strength and rigidity.

J. The base module shall constitute a desk structure for supporting the work surface and the upper tier modules. The standard base unit shall consist of front hinged doors and rear lift-off panels. The work surface height shall be 29" from the bottom of the console frame to the top of the work surface to insure maximum operator comfort while using a standard computer keyboard.

K. Pull out equipment trays with full extension 100 lbs. rated slides with clearance for standard tower. Sub-panels shall be provided for the mounting of electrical panel components on the front, rear, or either side.

L. The monitor tiers shall be constructed from 14-gauge steel with retractable front monitor doors.

M. A separate (removable) task light module shall be mounted to the top of the 1st tier. The task light shall illuminate the work surface for the operator and also act as a shelf for keyboards. The overall height of the console with the task light shall not exceed 54 inches.

N. The front shall slope back at a 10-degree angle and include 0.15-inch thick glass with an anti-glare coating to minimize screen glare for the operator.

O. The lower monitor tier shall accommodate a monitor size of 21 inches and allow easy removal of the monitor from the rear without the use of special tools. The housing shall employ an adjustable monitor tray to allow the monitor to be properly positioned within the housing.

P. The front retractable door can be replaced with fixed panels shall have the option to accommodate EIA mounting rails or a full width panel to mount control components.

Q. Work surface shall be rated to withstand a distributed load of 500-lbs. Work surfaces shall utilize a bull nose 2" thick design on the front edge, with a Nevermar Charcoal Matrix (or equivalent) post forming laminate on the top, sides, and a portion of the underside. The console manufacturer shall offer other laminates at the request of the end user. The work surfaces are also available in full depth desk style for consoles without monitor tiers. Once assembled the work surfaces shall appear to be continuous utilizing draw bolts and plates to tie each individual work surface together.

R. A printer console shall be provided as shown, which shall match the console construction, and provide convenient management of printer and paper. The printer shall be a dot matrix design and shall utilize fan fold paper from a box. The printer console shall include hidden storage of a full box of paper, and shall incorporate paper supply and paper receiver for ease of access and reliable operation.

S. All metal shall be thoroughly cleaned and iron phosphated prior to the application of the paint. The console manufacturer shall provide custom paint colors for selection of the paint color by the Owner.

T. Each unit in the console system shall be shipped fully assembled with the work surfaces removed. The individual units will be located within the control room, leveled, and bolted together.

U. The console system shall be shipped via air ride van to minimize the risk of damage during shipment.

V. Each Console section shall have Surge Protected power strips with EMI/RFI protection.

W. Consoles shall be as manufactured by Grace Engineered Products, Davenport, Iowa or approved equal.

2.11 ANALOG LOOP SUPPLY AND SIGNAL TRANSMISSION

A. Each analog instrument and system shall be provide with an appropriate modular, regulated power supply with sufficient power to drive all loop components, conductors and accessories. Analog signals shall be communicated using shielded stranded signal cable with braided shield and water proof jacket, suitable for the service intended. The Instrumentation System Integrator shall coordinate the installation of the signal wiring, and provide appropriate installation procedures.

B. All signal wiring shall be installed in metallic conduit which is physically separated from power conduits. Shields shall be wired to drain only at one end, and terminated to a proper ground connection. Signal loops shall be provided with signal line surge protection at every panel, or at any instrument or device which is separated from the panel by more than 20 feet. Signal isolation shall be as described below.

2.12 SURGE PROTECTION - POWER, ANALOG SIGNAL

A. All electronic systems, equipment and devices provided in this contract shall be protected from surges.

B. These protective devices shall be external to and installed in addition to the protective devices built into the equipment. Power and signal protection shall be installed in either in a NEMA 4X enclosure or in the enclosure which houses the equipment to be protected.

C. Power line surge protection shall be Ditek Inc., Largo, FL.

D. Analog signal wiring protection shall be Joslyn signal line surge protectors.

2.13 LATCHING RELAYS

A. The motor controls for motors which are controlled by a PLC shall be designed to operate using a latching relay. The PLC shall be provided with two separate discrete outputs to control each motor: one to start the motor and the other to stop the motor. The outputs shall be designed to latch or unlatch a mechanical latching relay, so that the motor will continue to operate in it's last state, even when the PLC is shut down.

B. The latching relay shall be installed in the appropriate SCADA panel, and a contact of the relay shall be wired to the Hand-Off-Auto selector switch of the motor controls.

C. The latching relay shall be Square-D type KL or approved equal.

2.14 FLANGED TUBE METER

A. Flanged TUBE Meters shall be propellor flow transmitters fabricated into a flanged steel pipe spool. Flange ends shall be 150 pound class D flat face steel flanges. Fabricated steel meter tubes shall be equipped with straightening vanes and shall be protected inside and out with twelve (12) to fifteen (15) mils of fusion epoxy resin. Propellor shall be magnetically coupled with a drive mechanism through a sealed, oil-filled gearbox. Meters shall meet or exceed AWWA standard C704. Meters shall be equipped with a local totalizing register with protective cap. Meters shall also be equipped with an analog transmitter which shall be configured as an extender below the register. Meters shall be Water Specialties model ML-03-5G, equipped with transmitting totalizer TR-15.

2.15 PROGRESSIVE CAVITY PUMP CONTROLS

A. The SYSTEMS INTEGRATOR shall coordinate the integration of protective devices supplied by the pump manufacturer. Control features shall be provided as described herein. A temperature switch imbedded in the motor shall be wired to the starter, to stop the motor from running if the motor overheats. The temperature sensor shall be wired to stop the pump and to provide an alarm to SCADA.

B. A pressure switch, provided by the pump manufacturer, shall be wired as a protective feature. If the outlet pressure of the pump exceeds the pressure setting, the motor shall be stopped, and an alarm shall be generated. The pressure switch shall be wired as an input to the PLC. The PLC logic shall be programmed to shut down the pump if the pressure switch exceeds the setpoint with a programmable time-delay of 3 seconds. The alarm and shutdown shall be displayed through SCADA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall provide all labor, materials, equipment, and expertise required to carry out the installation, calibration, testing and start-up of all equipment, in a manner in keeping with the best standard practices available, and in accordance with the manufacturer's recommendations for each piece of equipment supplied.

B. All work shall be scheduled accordance with the County's staff, to minimize down time of any system. All modifications to existing and proposed wiring systems shall be carefully documented and included in the as-built documentation to be delivered at the end of the project.

C. Careful attention should be paid to provide installations at each location which are both functional and attractive.

D. All conduits used in conjunction with control panels, or instrumentation of any kind shall be sealed using a suitable duct-sealing compound to minimize the possible damage caused by vapors or wetness. It shall be the responsibility of the SYSTEM INTEGRATOR to verify that this is accomplished early in the project, so that corrosion damage does not occur during the time of construction.

E. All analog wiring shall be installed using shielded multiconductor cables appropriate for the service intended. Cables shall have heavy protective PVC jackets and full braided shield. Conductors shall be multi-stranded, minimum 16-gauge. Cables shall be installed in a separate conduit and junction box system from any other conductor type. Cables shall be wire numbered to a unique and consistent numbering system, and referenced on the as-built documentation. Cables shall extend the entire length, with no intermediate splicing permitted. Cables shall be Belden or Alpha. There shall be no approved equals.

3.2 EQUIPMENT CALIBRATION

A. Every analog instrument, limit switch, control or related device shall be properly calibrated, tuned, adjusted and commissioned so that the accuracy and operation of the device equals the highest level of performance which that device can achieve.

B. Accurate and appropriate test equipment and industry standard test procedures shall be used to demonstrate that the equipment operates within it's expected tolerance of accuracy at various points throughout it's operating range.

C. Whenever calibration adjustments are being made, the SYSTEM INTEGRATOR supplied technician(s) shall notify the members of the plant electrical/instrumentation staff, so that they may witness the procedure as an educational process. The technicians shall assist the operator in any way possible in becoming well-versed in the start-up, operation, maintenance and calibration of the equipment provided.

D. The technician(s) shall be fully familiar, trained and qualified to service and support the items which are being serviced.

3.3 CALIBRATION & SERVICE REPORTS

A. A written, dated report shall be prepared by the SYSTEM INTEGRATOR technician for each start-up, calibration, troubleshooting or maintenance event. This report shall identify the instrument serviced, define the procedures, and provide conclusions. This shall include every instrument or system provided in this project, and shall also apply to every visit by equipment suppliers and system subcontractors. The reports shall also document every wiring modifications, warrantee repair and problem analysis.

B. All reports shall be distributed to the Engineer, the Contractor and copied to the plant staff, and a copy shall be kept in a permanent file on site for future reference.

3.4 REMOVAL OF EXISTING HARDWARE

A. The contractor shall remove all equipment and systems which have become obsolete as part of this work. This includes, but is not limited to the following:

B. Some of the existing under-ground multi-conductor communications cables. The SYSTEM INTEGRATOR shall work with the Engineer and the Owner to identify conductors, to determine which conductors shall remain.

C. The existing Control Panel shall be removed and replaced with a new control panel, as shown in the contract drawings. Most of the existing control wiring, annunciator wiring, and related components are being removed and being replaced with the new in-plant SCADA system. The existing mosaic graphic and the existing Ronan Annunciator are being removed. Most of the existing signals which were terminated to this annunciator are being removed and reterminated in the remote PLCs. These shall be removed when the main control console is removed.

D. Some of the existing wiring within the console will remain. This wiring includes radio and intercom interfaces and various instrument and signal wires which need to be identified in the field at the time of construction. These shall be temporarily bypassed when the old console is removed, and re-installed when the new control console is installed.

E. All components shall be completely removed in a neat and workman-like manner acceptable to the Owner.

F. The Contractor shall provide restoration of components to remain. Holes in walls or poles shall be patched and suitable touch-up paint applied as appropriate. Holes in panels shall be repaired using an appropriate blank of a compatible material and finish.

G. All existing components as indicated above shall be neatly removed and shall become the property of the Owner. In every case, the Owner shall be given the option of retaining the component. This applies in particular to existing termination panels.

H. If the Owner wishes to retain the component, it shall be carefully salvaged by the contractor and delivered to the plant staff. If the Owner chooses not to retain the component, it becomes the property of the Contractor, and must be removed from the site.

END OF SECTION

SECTION 13310 - CONTROL PANELS AND EQUIPMENT TABULATION

PART 1 - GENERAL

1.1 DESCRIPTION of WORK

A. The CONTRACTOR shall provide an approved professional SYSTEMS INTEGRATOR to have total system responsibility for all instrumentation, controls, services, and systems as indicated in the contract drawings and described herein.

B. These sections of specifications shall be considered as a single unit and shall be included in the single source responsibility from the SYSTEMS INTEGRATOR.

C. The specifications for "Controls and Instrumentation" are provided in the following sections:

1. 13300 - Controls and Instrumentation
2. 13310 - Control Panels and Equipment Tabulation
3. 13320 - In-Plant SCADA System
4. 13330 - Fiber Optic Communications System

PART 2 - EQUIPMENT

2.1 EQUIPMENT TABULATION

LEGEND: AAA-Nxx
AAA: represents the instrument abbreviation
N: represents the SCADA PANEL Number (1-4)
N: = 0 for PIC
xx: unit numbering

Abbreviations:
VFD: Variable Frequency Drive
LT: Level Transmitter
FM or FT: Flow Meter or Flow Transmitter
CV: Control Valve
AI: Analog Input
CT: Current Transmitter
VT: Voltage Transmitter
PT: Pressure Transmitter
CL: Chlorine Residual
pH: pH Transmitter
Tur: Turbidity Transmitter
SBT: Sludge Blanket Transmitter
PIC: Process Instrumentation Console
CL: Chlorine Residual Analyzer
DOT: Dissolved Oxygen Transmitter

A. The following provide a summary of Analog Instrumentation and Controls to be provided and/or interfaced as part of this project:

PIC - PROCESS INSTRUMENTATION CONSOLE (Main Control Console)

FM-901: Schroeder Manatee Finished Flow Meter

Proposed 24-inch flanged tube meter. Meter shall be installed above ground at the location shown. Meter shall be equipped with a local mechanical register and totalizer. Meter shall also be provided with an analog output transmitter for connection to future telemetry RTU. Meter is remote from the plant site. Analog output capability to be provided but not used at this time.

FM-001: CCC Flow #1

Existing Badger ultrasonic flow transmitter, mounted on the wall behind the main control console. Currently used for pacing of chlorine. Currently interfaced with chart recorders. Modify the wiring interface to integrate with the PLC.

FM-002: CCC Flow #2

Existing Badger ultrasonic flow transmitter, mounted on the wall behind the main control console. Currently used for pacing of chlorine. Currently interfaced with chart recorders. Modify the wiring interface to integrate with the PLC.

FM-003: CCC Flow #3

Existing ultrasonic flow transmitter, mounted near the CCC tank. Currently used for pacing of chlorine. Currently interfaced with chart recorders. Modify the wiring interface to integrate with the PLC.

FM-004: CCC Flow #4

Existing ultrasonic flow transmitter, mounted near the CCC tank. Currently used for pacing of chlorine. Currently interfaced with chart recorders. Modify the wiring interface to integrate with the PLC.

CL-005: Chlorine Residual Analyzer - CCC #1 & #2

Existing Chlorine residual analyzer. Currently used for pacing of chlorine. Currently interfaced to chart recorders. Modify the wiring interface to integrate with the PLC.

CL-006: Chlorine Residual Analyzer - CCC #3 & #4

Existing Chlorine residual analyzer. Currently used for pacing of chlorine. Currently interfaced to chart recorders. Modify the wiring interface to integrate with the PLC.

FM-007: Filter Backwash rate of Flow. Filter #3

Proposed open nozzle flow transmitter. Mounted at discharge of backwash trough. Specification 13300 - 2.4

FM-008: Filter Backwash rate of Flow. Filter #4

Proposed open nozzle flow transmitter. Mounted at discharge of backwash trough. Specification 13300 - 2.4

FM-009: Reuse Flow Meter

Existing Flow transmitter. Interface to PLC

FM-010: Irrigation Flow Meter

Existing Flow transmitter. Interface to PLC

pH-011: Effluent pH Transmitter

Existing pH transmitter. Interface to PLC

SCADA PANEL #1 - MAIN ELECTRICAL BUILDING

VFD-101: RAS Pump #1

Provide PLC interface with VFD, provide automatic control based on RAS wetwell level. See Specification 13320-1.7.H.

VFD-102: RAS Pump #2

Provide PLC interface with VFD, provide automatic control based on RAS wetwell level. See Specification 13320-1.7.H.

VFD-103: RAS Pump #3

Provide PLC interface with VFD, provide automatic control based on RAS wetwell level. See Specification 13320-1.7.H.

VFD-104: WAS Pump #1

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.J.

VFD-105: WAS Pump #2

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.J.

VFD-106: WAS Pump #3

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.J.

VFD-107: WAS Pump #4

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.J.

VFD-108: Reuse Pump #1

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-109: Reuse Pump #2

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-110: Reuse Pump #3

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-111: Reuse Pump #4

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-112: Reuse Pump #5

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-113: Reuse Pump #6

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-114: Reuse Pump #7

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VFD-115: Reuse Pump #8

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.N.

VT-116: Switchboard #1: M1 Voltage

Interface to voltage monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

VT-117: Switchboard #1: M2 Voltage

Interface to voltage monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

VT-118: Switchboard #2: M3 Voltage

Interface to voltage monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

VT-119: Switchboard #2: M3 Voltage

Interface to voltage monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

CT-120: Switchboard #1: M1 Current

Interface to current monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor current and provide SCADA screens and alarms.

CT-121: Switchboard #1: M2 Current

Interface to current monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor current and provide SCADA screens and alarms.

CT-122: Switchboard #2: M3 Current

Interface to current monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor current and provide SCADA screens and alarms.

CT-123: Switchboard #2: M4 Current

Interface to current monitoring equipment in switchboard. Input 4-20 ma signal to PLC. Monitor current and provide SCADA screens and alarms.

VT-124: Generator #1: Voltage

Interface to voltage monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

VT-125: Generator #2: Voltage

Interface to voltage monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

VT-126: Generator #3: Voltage

Interface to voltage monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

CT-127: Generator #1: Current

Interface to current monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

CT-128: Generator #2: Current

Interface to current monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

CT-129: Generator #3: Current

Interface to current monitoring equipment at Generator. Input 4-20 ma signal to PLC. Monitor voltage and provide SCADA screens and alarms.

FM-130: FLOW TRANSMITTER - RAS

Existing Badger clamp-on flow transmitter. Interface with proposed PLC
See specification 13320 - 1.7.H

FM-131: FLOW TRANSMITTER - WAS

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.
See specification 13320 - 1.7.J

LT-132: LEVEL TRANSMITTER - RAS Wetwell

Proposed level transmitter. Monitor the level in the RAS WETWELL.
Specification 13300 - 2.1 See specification 13320 - 1.7.H

SBT-133: Sludge Blanket Transmitter- Clarifier #1

Existing Sludge Blanket interface transmitter. Interface to proposed PLC.

SBT-134: Sludge Blanket Transmitter- Clarifier #2

Existing Sludge Blanket interface transmitter. Interface to proposed PLC.

SBT-135: Sludge Blanket Transmitter- Clarifier #3

Proposed Sludge Blanket interface transmitter. Installed complete with transmitter, special enclosure, probe and probe mounting system. Specification 13300 - 2.6 Interface to proposed PLC.

SBT-136: Sludge Blanket Transmitter- Clarifier #4

Proposed Sludge Blanket interface transmitter. Installed complete with transmitter, special enclosure, probe and probe mounting system. Specification 13300 - 2.6 Interface to proposed PLC.

ANALOG INPUTS 137-140 are spares.

LT-141: Level in Clearwell, CCC #1 & #2

Existing Badger Ultrasonic Level Transmitter. Existing transmitter is used in conjunction with reuse pumping sequence. Connect existing instrument to PLC. See Specification 13320-1.7.N.

LT-142: Level in Clearwell, CCC #3 & #4

Proposed Badger ultrasonic level transmitter. Install to monitor level in Clearwell. Specification 13300 - 2.1 Connect to PLC. Utilized in automatic sequence. See Specification 13320-1.7.N.

FM-143: Flow Meter to Schroeder Manatee

Existing Flow transmitter. Integrate into proposed PLC. See Specification 13320-1.7.N.

PT-144: Pressure to Schroeder Manatee

Existing Pressure transmitter. Integrate into proposed PLC. See Specification 13320-1.7.N.

SCADA PANEL #2 - BLOWER ELECTRICAL BUILDING NEAR HEADWORKS

FM-201: Raw Sewage Flow Meter

Existing Fisher & Porter Magnetic Flow meter. Integrate to proposed PLC.

SAM-201: Raw Sewage Sampler

Existing Automatic flow proportional sampler. Currently receives pacing signal from FM-201. Maintain current operation after modifications to FM-201

FM-202: Leachate Flow Meter

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.

FM-203: Leachate Flow Meter to Equalization Tank

Existing flow transmitter. Integrate to proposed PLC

CV-208: Control Valve - RAS to Equalization

Proposed Motor Operated Plug Valve. Controlled by PLC. See specification 13320-1.7.I

FM-209: Flow Transmitter - RAS to Equalization

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.
See specification 13320 - 1.7.9

FM-210: Flow Meter: Overflow to Equalization

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.
See specification 13320 - 1.7.9

FM-211: Flow Meter - Bypass to Equalization

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.
See specification 13320 - 1.7.9

CV-212: Control Valve - Bypass to Equalization

Proposed Motor Operated Plug Valve. Controlled by PLC. See specification 13320-1.7.P

LT-213: Level in Equalization Basin

Proposed level transmitter. Monitor the level in the equalization basin.
Specification 13300 - 2.1

FM-214: Flow from Equalization Basin

Proposed Badger Clamp-on flow transmitter. Specification 13300-2.2.
See specification 13320 - 1.7.P

LT-215: Wastewater Weir Level/Flow

Proposed Badger ultrasonic level transmitters. Characterized to measure FLOW over the splitter box weirs. Integrated into the PLC where the flow is divided among the available openings. Specification 13300 - 2.1. See also Specification 13300 - 1.7.P

LT-216: RAS Splitter Box weir level/flow

Proposed Badger ultrasonic level transmitters. Characterized to measure FLOW over the splitter box weirs. Integrated into the PLC where the flow is divided among the available openings. Specification 13300 - 2.1. See also Specification 13300 - 1.7.P

CV-217: REUSE CONTROL VALVE - Reuse/reject protocol control

Proposed Motor operated butterfly valve. Controlled by PLC in conjunction with REUSE/REJECT protocol. Refer to Specification 13320 - 1.7.N

CV-218: REJECT CONTROL VALVE - Reuse/reject protocol control

Proposed Motor operated butterfly valve. Controlled by PLC in conjunction with REUSE/REJECT protocol. Refer to Specification 13320 - 1.7.N

LT-219: LEVEL TRANSMITTER - Reject Pond

Proposed level transmitter. Monitor the level in the reject pond.
Specification 13300 - 2.1

DOT-220: Dissolved Oxygen Transmitter - Aeration Basin #1

Proposed Dissolved Oxygen transmitter. Installed complete with transmitter, special enclosure, probe and probe mounting system. Specification 13300 - 2.7 Interface to proposed PLC.

DOT-221: Dissolved Oxygen Transmitter - Aeration Basin #2

Proposed Dissolved Oxygen transmitter. Installed complete with transmitter, special enclosure, probe and probe mounting system. Specification 13300 - 2.7 Interface to proposed PLC.

DOT-222: Dissolved Oxygen Transmitter - Aeration Basin #3

Proposed Dissolved Oxygen transmitter. Installed complete with transmitter, special enclosure, probe and probe mounting system. Specification 13300 - 2.7 Interface to proposed PLC.

PH-223: pH Signal from Odor Control Panel

Provide interface between odor control system and instrumentation. pH transmitter is being provided by the manufacturer of the odor control system. Provide signal isolation and surge arrestor. Transmit analog signal to PLC for monitoring and display.

ORP-224: ORP Signal from Odor Control Panel

Provide interface between odor control system and instrumentation. ORP transmitter is being provided by the manufacturer of the odor control system. Provide signal isolation and surge arrestor. Transmit analog signal to PLC for monitoring and display.

SCADA PANEL #3 - BLOWER BUILDING NEAR SLUDGE HOLDING TANKS

VFD-301: Thickened Sludge Pump #1

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

VFD-302: Thickened Sludge Pump #2

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

VFD-303: Thickened Sludge Pump #3

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

VFD-304: Thickened Sludge Pump #4

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

VFD-305: Thickened Sludge Pump #5

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

VFD-306: Thickened Sludge Pump #6

Provide PLC interface with VFD, provide automatic control based on control sequence. See Specification 13320-1.7.4 & 13320 - 1.7.M

CT-307: AMPS - Blower #1

Provide current transmitters to monitor the motor amps of the three blowers. Current transmitters shall monitor motor current and produce a 4-20 ma signal proportional to current. Transmitter shall be installed in a suitable enclosure near the motor controls.

CT-308: AMPS - Blower #2

Provide current transmitters to monitor the motor amps of the three blowers. Current transmitters shall monitor motor current and produce a 4-20 ma signal proportional to current. Transmitter shall be installed in a suitable enclosure near the motor controls.

CT-309: AMPS - Blower #3

Provide current transmitters to monitor the motor amps of the three blowers. Current transmitters shall monitor motor current and produce a 4-20 ma signal proportional to current. Transmitter shall be installed in a suitable enclosure near the motor controls.

LT-310: Level Transmitter - Sludge Holding Tank #1

Proposed Badger ultrasonic level transmitter. Install to monitor level in Sludge Holding Tank. Specification 13300 - 2.1 Connect to PLC.

LT-311: Level Transmitter - Sludge Holding Tank #2

Proposed Badger ultrasonic level transmitter. Install to monitor level in Sludge Holding Tank. Specification 13300 - 2.1. Connect to PLC.

SCADA PANEL #4 - SLUDGE DEWATERING BUILDING

CL-403: Chlorine Flow Pacing Signal

Existing termination point for analog signal.

FM-406: BFP #1 - Feed Flow

Existing Polysonics flow transmitter. Modify to interface with proposed PLC.

FM-407: BFP #2 - Feed Flow

Existing Polysonics flow transmitter. Modify to interface with proposed PLC.

POL-408: Polymer Signal - BFP #1 - Monitor

Existing Polymer feed signal from Belt Filter Press. Modify to monitor from PLC.

POL-409: Polymer Signal - BFP #2 - Monitor

Existing Polymer feed signal from Belt Filter Press. Modify to monitor from PLC.

CL-410: Effluent Chlorine Residual

Existing termination point for analog signal.

pH-411: Effluent pH

Existing HF Scientific pH transmitter. Modify to interface with PLC

TUR-412: EFFLUENT TURBIDITY

Existing HACH Surface Scatter 6 Turbidimeter. Modify to interface with PLC

END OF SECTION

SECTION 13320 - IN PLANT SCADA SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The CONTRACTOR shall provide an approved professional SYSTEMS INTEGRATOR to have total system responsibility for all instrumentation, controls, services, and systems as indicated in the contract drawings and described herein.

B. These sections of specifications shall be considered as a single unit and shall be included in the single source responsibility from the SYSTEMS INTEGRATOR..

C. The specifications for "Controls and Instrumentation" are provided in the following sections:

1. 13300 - Controls and Instrumentation
2. 13310 - Control Panels and Equipment Tabulation
3. 13320 - In-Plant SCADA System
4. 13330 - Fiber Optic Communications System

1.2 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all hardware, software, labor and materials required to provide a complete and operational system for communications, interface and control of the five (5) SCADA Panels, and the five (5) Operator Interfaces as described herein.

B. Each SCADA Panel shall be equipped with a local PLC which shall provide analog and discrete inputs and outputs. All of the signals generated in the plant will be continuously and automatically communicated back to the PLC, and the controls produced at any Operator Interface will be communicated and executed at the appropriate PLC to form a complete In-plant SCADA system.

C. The SCADA Panels shall be linked with all of the others, in a "peer-to-peer" industrial data highway, using fiber-optic communications. The Fiber Communications network shall simulate the native mode of communications protocol (DH-plus) between various SCADA panels so that the communications medium, optical modems and the entire communications back-bone is "transparent" to the PLC or I/O hardware.

D. Each SCADA Panel shall be provided with an "Operator Interface" OPI which shall provide the operator with real-time read-outs of each analog signal, equipment status and alarms, and provide the ability to enter supervisory control commands and setpoints.

E. The OPI units in each SCADA panel shall be linked directly to the data-highway as shown, so that each OPI may gather data from any PLC on the network. Each OPI shall be programmed identically to the rest (except for a few additional

features at the console) , so that the capabilities for monitoring and control are available at any one of the SCADA Panels.

1.3 FUTURE SCADA COMPUTER

A. The County has plans for a future County-wide SCADA computer system. For the current project, the SCADA features will be implemented using the PLC network and the OPI interfaces, in conjunction with the available recorders. In the future, the proposed SCADA computer will utilize DH+ and the PLCs being provided in the current project as the local I/O server. A space has been allocated in the proposed control console for a future SCADA computer.

B. The OPI will operate an a "minimal" HMI (Human Machine Interface) SCADA interface, to serve the necessary purposes until the future SCADA computer is installed.

1.4 ALARM ANNUNCIATOR

A. The existing console uses a RONAN lighted-panel annunciator. The RONAN annunciator will be removed as part of this project, and the function of the old annunciator will be replaced and expanded using the proposed in-plant SCADA equipment as follows:

B. All of the equipment status and alarm contacts, and alarms for various analog signals will be monitored by the appropriate PLC. Upon triggering of any alarm, the PLC will activate the audible alarm horn and the OPI on the PIC will display the appropriate message.

C. Suitable "acknowledge" and "reset" push buttons shall be installed on the control console and wired as inputs to the PLC. The PLC shall be programmed to simulate the annunciator and provide appropriate logic.

D. Provisions shall be made to adjust the various alarm setpoints and to enable/disable the various alarms from the OPI.

E. Special logic and alarms shall be provided for various process control and equipment status changes. For example, certain aerators or mixers should never stop. Therefore, an alarm shall be generated if they ever stop. Alarms shall be subject to appropriate time delays, and shall be user definable or user inhibited. Details shall be established at the sequence development meetings as described below.

F. The OPI shall be linked to the ALARM PRINTER and shall be programmed to print alarms as they occur. This applies only to the OPI at the PIC.

1.5 GRAPHIC DISPLAY

A. The existing mosaic graphic display provides a pictorial depiction of the plant, and shows colored lights to show equipment status or alarm conditions. The graphic display is being removed as part of this project, and will be replaced by the proposed in-plant SCADA system as follows:

B. All of the major equipment in the plant shall be monitored by one or other of the PLCs. The OPIs shall be programmed to provide the status of each piece of equipment as well as providing current analog readouts from every analog measurement or process value.

C. The OPI shall be programmed using a simple touch screen menu structure to allow the operator to review the equipment status and analog measurements at every part of the plant.

D. The programming of the OPI will not be expected to display detailed process graphics. This feature will be included in the SCADA computer & HMI software to be furnished under a separate project.

E. The OPI shall provide displays which contain all of the control setpoints, alarm setpoints, sequence selectors, progress timers and other user interfaces pertinent to the operation and control of the treatment plant.

1.6 ANALOG AND DIGITAL INPUTS AND OUTPUTS

A. The Instrumentation drawings provide a summary of the inputs and outputs, both discrete and analog, which shall be included in the PLC design and the SCADA implementation. Each analog or discrete point included in the drawings shall be properly designed, integrated, wired, terminated and to provide the intended function. Some of the criteria for the design of these various points are described herein.

B. Motors and other moving equipment shall be monitored for running status utilizing the status of the contactors in the motor starter. Other status and alarm features are also to be included as applicable to each piece of equipment. The SYSTEMS INTEGRATOR shall coordinate the detailed wiring requirements with the electrical contractor and the suppliers of the various control panels to assure that the interface is well ordered and complete.

C. All analog and digital inputs and outputs noted in the drawings shall be integrated into the PLC programming and SCADA interface to provide a complete and working feature. Automatic controls shall be designed to provide fail-safe operation by using appropriate control logic, time delays and recovery algorithms. Manual controls shall be provided to achieve a clear and unmistakable feedback of the operators actions.

D. All analog flow measurements shall be monitored and totalized by the local PLC. These totalizer readings will be displayed on the OPI on the appropriate screens. The PLC shall also maintain run time statistics (Elapsed Time) and number of starts for major pumps and equipment. These shall also be displayed on the appropriate screens.

1.7 AUTOMATIC CONTROL SEQUENCING

A. The PLCs shall be programmed with custom ladder logic and sequencing to provide appropriate automatic control of various process systems as described herein. In each case the appropriate local PLC shall provide the sequence logic.

The control logic will be structured to provide monitoring and supervisory control of timers, setpoints, sequences, current conditions and alarms using the OPI screens.

B. Sequence Development Meetings: The SYSTEM INTEGRATOR shall provide the services of a PLC programmer with extensive experience in process control, to provide programming for the various plant process control systems. The programmer shall meet with the Owner and the Engineer throughout the project to define the exact sequencing requirements, configuration and algorithms to be used to control each unit process. As part of each sequence development meeting, the system integrator will provide a synopsis of the PLC logic algorithms, and the details of the implementation. These documents will be included in the final documentation to describe the sequence logic of the PLC programming and to define how the system should operate.

C. The paragraphs below provide a simplified description of the sequencing logic required for each unit process. These shall be used as the starting point in the sequence development meetings. They shall be refined, to provide the finalized algorithms for process control.

D. Each control algorithm shall be designed to operate appropriately in case of equipment failures of various types. Upon failure of various analog measurements or communications, the control will revert to a "safe" operation as defined in the sequence development meeting.

E. Sequences shall be versatile and shall respond appropriately to equipment which fails to start, or units which are out of service. Suitable time delays shall be included in all sequences so that rapid sequencing of pumps or motors is not possible.

F. In several cases, the equipment at one PLC are being controlled by process variables located at a different PLC. In those cases, the PLCs shall be programmed to provide automatic PEER-to-PEER transfer between these sites. These transfers shall be timed in a reasonable cycle so that the communications channel is not overloaded. On failure of any communication, the PLC shall be programmed to maintain a fail-safe operating condition.

G. Abbreviations:

1. **SP1**: SCADA PANEL #1 (,2,3 etc.)
2. **RAS**: Return Activated Sludge
3. **WAS**: Waste Activated Sludge
4. **PLC**: Programmable Logic Controller
5. **VFD:** Variable Frequency Drive
6. **EQT**: Equalization Tank
7. **TSP**: Thickened Sludge Pumps (At Sludge Holding tanks)
8. **RST**: Rotary Sludge Thickener
9. **CCC:** Chlorine Contact Chamber

H. ***CONTROL*: RETURN ACTIVATED SLUDGE (RAS)**

1. Sludge from the four clarifiers will flow into a common wetwell. The flow from each clarifier is controlled by "slip tubes", which are manually set. All of the RAS is pumped to the head of the plant.

2. There are three variable speed pumps for RAS. These shall be started and stopped manually by the operator, from the OPI. Normally the selected pump(s) will run continuously. The PLC **(SP1)** shall control the speed of the pump to match the incoming flow, by maintaining a desired level in the wetwell **(SP1)**. There is no need for automatic start/stop sequencing.

3. The normal mode of pump speed control will be *proportional*. The operator will choose a desired minimum wetwell level (ft) and a desired maximum wetwell level (ft). The PLC shall control the pump speed so that it is 0 speed at the minimum operating level, and 100% speed at the maximum operating level, and directly proportional in between.

4. The OPI shall be provided with a manual override, to allow the operator to input any desired pump speed temporarily for testing and calibration.

5. The OPI will be provided with an adjustable "fail-safe speed". Upon failure of the level transmitter, the VFD shall revert to the fail-safe speed.

6. The PLC shall monitor the RAS flow rate, in comparison to the maximum and minimum desired rate, and provide an alarm if the limits are exceeded.

I. ***CONTROL*: RAS to EQUALIZATION (EQT)**

1. A control valve and flow meter have been provided to allow a desired rate of flow of RAS to be diverted to equalization. There shall be two possible modes of control as follows:

   a) Mode 1: The operator will input a desired flow rate at the OPI. The PLC **(SP2)** will automatically modulate the control valve to maintain the desired flow rate.
   b) Mode 2: The operator will input a desired valve position for the Control Valve.

J. ***CONTROL*: WASTE ACTIVATED SLUDGE (WAS)**

1. A total of four variable speed pumps are available for wasting sludge. These take their suction from the individual clarifiers, or alternately from the common RAS wetwell. These pumps can pump to the two rotary sludge thickeners, or alternately they can pump directly to the sludge holding tanks.

2. The variable speed drives are controlled from SP1. The waste sludge flow meter is wired to SP1. The sludge thickeners and sludge holding tanks are located at SP3.

3. There are several variations in the possible desired mode of operation which shall be programmed into the PLC operating sequence.

4. The wasting cycle will be enabled by one of these options: either manually initiated from OPI, or time of day, adjustable from OPI, or remote control from rotary thickeners

5. The operator may choose to automatically alternate between any available combination of the four WAS pumps. Time setpoints shall be assigned to each pump from the OPI to allow the operator to set the desired time for each pump. Typically, each pump runs 20 minutes, and then sequences to the next. Normally, only one pump will operate. Provision shall also be made for two pumps to run simultaneously.

6. The control of the pump speed will normally be based on WAS flow. The desired flow will be manually set from the OPI or remotely set from the rotary thickener. The PLC shall control the pump speed to maintain the desired rate of flow. The speed correction algorithm shall be encoded in ladder logic (not using the PID block) so that the speed corrections can be gradually inched up or down, on a user-defined time cycle, based on a flow signal derived from the meter.

7. Provision shall be made for setting a desired pump speed. Also, in case of failure of the WAS flow meter, the speed shall revert to the fail-safe setpoint.

K. *CONTROL*: ROTARY SLUDGE THICKENERS - SLUDGE HOLDING TANK

1. Two rotary sludge thickeners are provided. These can receive their sludge feed from two different sources.

2. The WAS pumps can be piped to pump directly to one or both of the ROTARY SLUDGE THICKENERS (RST).

3. The six pumps at the Sludge Holding Tank are known as Thickened Sludge Pumps (TSP). Three of these pumps (TSP1, TSP2 & TSP3) can be used to feed RST #1 and the other three (TSP4, TSP5 & TSP6) can be used to feed RST #2. The Operator shall designate which pump is being used to feed the thickener using the OPI.

4. The Control Panel on the Rotary Thickeners shall send an enabling signal to the PLC for sludge feed. When the PLC receives this signal, it shall run the appropriate pump.

5. The speed of each TSP shall be adjustable from the OPI. The OPI shall be mounted between the two ROTARY SLUDGE THICKENERS.

6. A variable speed polymer feeder is provided for each Rotary Sludge Thickener. The speed of the POLYMER system shall also be controlled from the PLC. The pacing signal shall be either manually set from the OPI or automatically set from the PLC in proportion to sludge flow.

7. The operator shall select the desired mode of operation and set the manually positioned valve to achieve that mode of operation. The PLC shall provide the interposing logic matrix so that automatic control of pump starting and stopping and pump speed control are properly sequenced.

8. CAUTION: Each of the six Thickened Sludge Pumps can be used to pump to a Rotary Thickener OR to a selected Belt Filter Press. However, the valves need to be positioned manually to accomplish the selection. Therefore, the operator must use caution when changing the selection. A cautionary note should appear on the OPI when the operator changes a selection: "CAUTION: BE SURE TO POSITION THE VALVES CORRECTLY WHEN MAKING A CHANGE IN THE SLUDGE FEED SOURCE."

L. ***CONTROL*: (NOT USED)**

M. *CONTROL*: BELT FILTER PRESS FEED

1. There are currently two belt filter presses. Eventually there will be four (4) belt filter presses. These belt filter presses are fed from the six (6) Thickened Sludge Pumps (TSP) which are also capable of feeding the rotary thickeners. The PLC shall be programmed to provide a logical matrix interface so that the OPERATOR can select which TSP (sludge pump) will feed which Belt Filter Press.

2. The PLC shall be programmed to accept control signals from the BFPs and to operate the correct Sludge pump start/stop and speed control either manually from the OPI or automatically/remotely from the BFP.

3. CAUTION: Each of the six Thickened Sludge Pumps can be used to pump to a Rotary Thickener or to a selected Belt Filter Press. However, the valves need to be positioned manually to accomplish the selection. Therefore, the operator must use caution when changing the selection. A cautionary note should appear on the OPI when the operator changes a selection: "CAUTION: BE SURE TO POSITION THE VALVES CORRECTLY WHEN MAKING A CHANGE IN THE SLUDGE FEED SOURCE."

N. *CONTROL*: EFFLUENT REUSE PROTOCOL

1. The filtered effluent from the SERWTP is split into two sets of CCCs (Chlorine Contact Chambers) each of which has an outlet clearwell. Each of these two clearwells operate as the source of water for four large variable speed effluent pumps (for a total of eight pumps). The clearwells are linked to each other and to a sidestream storage pond so that they can sometimes operate in unison. A level transmitter is provided in each clearwell. Pressure and flow transmitters are provided to monitor the reuse flow. Chlorine residual and turbidity are monitored by the PLC as part of the reuse/reject protocol. Also, motorized valves are installed in the effluent line to control the reject/reuse protocol.

2. The PLC programming shall be designed to properly address the following control variations:

3. Normally the total effluent flow is pumped to Schroeder Manatee for irrigation. The agreement with the reuse customers requires that the County maintain an operating pressure in the range of 60 PSI. The PLC shall control the sequencing of the high service pumps and control the speed of the high service pumps so that the desired pressure is maintained.

4. Normally, the flow from both clearwells will be pumped to the same destination. However, in the future, the flows may be split so that all of the effluent from the second CCC is pumped to an alternate destination. Under that scenario, the flow from the second CCC will programmed to maintain the desired clearwell level.

5. The Effluent Reuse Protocol requires a continuous evaluation of water quality. The PLC shall monitor the turbidity and the chlorine residual. If the either parameter goes outside of the setpoint limits, for a pre-determined amount of time, the controls will revert to the REJECT mode. After the conditions of reject have been restored, after a predetermined time limit, the controls will return to the REUSE mode.

6. In REUSE mode, the reuse valve is opened and the reject valve is closed. The pumps are maintaining flow and pressure to the reuse customers.

7. In REJECT mode, the reject valve is opened and the eject valve is closed. The pumps are maintaining flow to the reject pond in proportion to the level in the clearwell.

O. *CONTROL*: REJECT PUMP STATION

1. The reject pump station provides a means of returning flow from the reject pond back to the plant. The Reject pumps shall be operated based from the PLC in the following instances:

2. Manually controlled from the OPI.

3. Automatically, by time clock control from the OPI.

4. The reject pumps will stop if the level gets too low or if the REJECT mode is set.

P. *CONTROL*: SPLITTER BOX AND EQUALIZATION TANK

1. The Equalization tank, used in conjunction with the splitter box, provides a hydraulic control structure, an aerated storage tank, control weirs, pumps, control valves, level transmitters, and flow transmitters which shall be provided with control logic to operate as described below:

2. The plant flow enters the "wastewater" zone of the splitter box. The level transmitter monitors the level in the wastewater zone, and calculates the wastewater flow to each of the aeration basins in service. The operator shall select the number of tanks in service, so that the flow can be divided among the available basins. The PLC generates a calculated flow rate for each basin.

3. The Return Activated sludge enters the RAS zone of the splitter box. The level transmitter monitors the level in the RAS zone, and calculates the RAS flow to each of the aeration basins in service. The operator shall select the number of tanks in service, so that the flow can be divided among the available basins. The PLC generates a calculated flow rate for each basin.

4. If the level rises above the overflow weir, a portion of the incoming wastewater is bypassed to equalization.

5. A BYPASS is installed, which allows the operator to bypass a portion of the wastewater flow to the equalization basin. The operator shall select either the desired flow rate, or the desired valve position for bypass, and the PLC shall modulate the valve to achieve the desired setpoint.

6. Five pumps are located in the splitter box. Three of these pumps are used to return flow from the equalization basin to the wastewater zone of the splitter box. The other two pumps provide aeration and mixing of the equalization basin. The OPI shall be programmed to allow the operator to start and stop these pumps remotely.

PART 2 - PRODUCTS

2.1 PLC HARDWARE

A. The programmable controller at each SCADA PANEL shall be an Allen Bradley SLC-5/04, with remote and local racks, and with analog and discrete inputs and outputs as required to fulfill the SCADA requirements of this project. The SLC memory shall be backed by an EEPROM.

B. Each Rack POWER SUPPLY shall be over-sized so that it can operate any combination of equipment which may be installed if the I/O rack were fully loaded. Calculations shall be provided in the shop drawings to support the selected power supply.

C. Analog input modules shall be equipped with four 16-bit differential current analog inputs, configured for operation as 4-20 ma inputs.

D. Analog output modules shall be equipped with four 16-bit differential current analog outputs, configured for operation as 4-20 ma inputs.

E. Discrete inputs and discrete outputs shall be equipped with 16-points per card.

F. Each SLC shall be equipped with a Fiber Optic Modem, as described below, which is designed to mount directly in the PLC rack, and to communicated directly to the PLC as a standard product.

2.2 FIBER OPTIC MODEMS

A. The Fiber Optic Modems (FOM) shall be provided as an integrated system, based on a standard product line. The Fiber Optic Modems shall be as provided by Phoenix Digital Industrial Automation, Scottsdale, AZ.

B. The Fiber Optic Modem shall be a standard product of the manufacturer, which was developed in partnership with the PLC manufacturer, to provide seamless integration with the native communications architecture of the PLC.

C. The FOM shall be designed to be installed directly in the PLC I/O rack. The FOM shall connect to the Data Highway Plus communications port of the SLC, using a suitable cable supplied with the FOM, and shall provide a DH+ link between all SCADA panels, which is "transparent" to the processor. FOM shall be designed to operate in the 850 nanometer range.

D. The FOM hardware shall be provided as a complete communications solution, compatible with the fiber-optic medium, providing the most current and appropriate hardware, firmware, products, components, and accessories to match the PLC hardware and communications topology of the application.

E. The FOM shall be designed to implement redundant-ring topology, by providing automatic failover in case of signal fault, in a counter-rotating topology. The FOM shall also be equipped with build-in diagnostics, which shall provide on-board measurement of optical power levels and provide adjustable thresholds for pending fault alarms.

F. Optical modems shall be capable of operating at distances of up to 6,000 feet between nodes. The configuration, and optical budget, including all in-line termination losses, shall be designed and calculated to provide dependable communications based on the configuration of this project, as shown in the contract drawings, with ample spare power levels for reasonable future splices.

G. Fiber cable type shall be multimode, with standard connectors of either ST or SMA style. Transmitter launch power shall be -15 dbm, with a receiver sensitivity shall be -32 dbm. Equipment shall be ruggedized for temperature and humidity, and suitable for installation in an outdoor enclosure.

2.3 OPERATOR INTERFACE (OPI)

A. An Operator Interface Panel shall be provided at each SCADA panel and other locations as shown in the drawings, to provide analog and status information, alarms, operator setpoints and process graphics.

B. The OPI at the Main Control Panel shall be a 12.1 inch TFT color touch screen industrial operator interface designed to operate directly on Data Highway PLUS, and able to provide real time updates from all PLC linked to that data highway. The OPI shall provide sufficient memory for more than 50 pages of process graphics and 500 real and discrete data points. The OPI shall be configured to provide process graphics, alarms and controls as required in these specifications. The OPI shall also be configured to print alarms to an alarm printer. The OPI shall simulate push buttons, pilot lights, digital indicators, and shall provide direct control of timers, counters and data table information, in both read and write modes, to the PLCs in the network.

C. The OPI at each of the other SCADA PANELS shall be a 6-inch STN color touch screen industrial operator interface designed to operate directly on Data Highway PLUS, and able to provide real time updates from all PLCs linked to that data highway. The OPI shall provide sufficient memory for more than 50 pages of process graphics and 500 real and discrete data points. The OPI shall be configured to provide process graphics, alarms and controls as required in these specifications. The OPI shall simulate push buttons, pilot lights, digital indicators, and shall provide direct control of timers, counters and data table information, in both read and write modes, to the PLCs in the network.

D. The OPI shall be industrially hardened, for usage 24 hours per day, and shall be rated NEMA 12/4. The OPI shall have a renewable surface membrane and backlight which is easily replaced.

E. The OPI shall be provided with all hardware, software, power supplies and accessories require to form a complete system. The Programming configuration shall be assembled in a computer, and downloaded to the OPI using a cable supplied with the project. The computer software, cables and documentation shall be provided with the project and installed in the Portable Programming Terminal provided with the project. All documentation shall be provided.

F. Operator Interface shall be Quick Panel for the larger OPI and QUICK PANEL Jr., for the smaller OPIs. These shall be as manufactured by TOTAL CONTROL PRODUCTS, Inc., CTC POWER STATION or PANELMATE.

2.4 PORTABLE PROGRAMMING TERMINAL & SOFTWARE

A. A portable computer suitable for use in programming the PLC equipment and the OPI equipment shall be provided as part of this project. The computer shall be a

Gateway 2500 XL or current similar model, or approved equal. Computer shall be equipped at minimum as follows:

1. inch XGA active matrix color display
2. Intel 300 Mhz Pentium II Processor w/512 cache
3. MB SDRAM
4. 2MB graphics accelerator
5. MB floppy
6. 15X CDROM
7. PCMCIA 56K fax modem
8. Two deep socket PCMCIA slots
9. EZ Pad Pointing device
10. Carrying Case
11. Power supply
12. Windows 98
13. McAfee Anti Virus

B. The Computer shall be provided with a PCMK card, which shall provide direct communications to the PLC equipment over the Data Highway plus. The computer shall be equipped with RS LOGIX 500 software, for on-line and off-line programming of the PLCs provided with this project. The Computer shall be loaded with the OPI software provided with the project. The Computer shall be fully configured, and loaded with the software provided with the project.

C. The finalized versions of PLC programming and OPI programming for Manatee County shall be installed in the computer.

2.5 PRINTERS

A. Two printers shall be provided as part of this project.

B. ALARM PRINTER: A wide carriage dot matrix printer shall be provided as the alarm printer. This printer shall utilize fan-fold paper and shall be suitable for printing alarms one-line at a time. Printer shall be suitable for use with the OPI and for installation on the console. as shown. Printer shall be EPSON, current suitable model, or approved equal.

C. DOCUMENTATION PRINTER: A desk-top color ink-jet printer shall be provided, for use with the portable computer in documenting the PLC and OPI systems. The printer shall be Hewlett Packard Deskjet, the current model.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall provide all labor, materials, equipment, and expertise required to carry out the installation, calibration, testing and start-up of all equipment, in a manner in keeping with the best standard practices available and in accordance with the manufacturer's recommendations for each piece of equipment supplied.

B. All work shall be scheduled in accordance with the City's staff, to minimize down time of any system. All modifications to existing and proposed wiring systems shall be carefully documented and included in the as-built documentation to be delivered at the end of the project.

C. Careful attention should be paid to provide installations at each location which are both functional and attractive.

3.2 EQUIPMENT CALIBRATION

A. Every communications instrument, control or related device shall be properly calibrated, tuned, adjusted and commissioned so that the accuracy and operation of the device equals the highest level of performance which that device can achieve.

B. Accurate and appropriate test equipment and industry standard test procedures shall be used to demonstrate that the equipment operates within it's expected tolerance of accuracy at various points throughout it's operating range.

C. Whenever calibration adjustments are being made, the technician shall notify the members of the plant staff, so that they may witness the procedure as an educational process. The technicians shall assist the operator in any way possible in becoming well-versed in the start-up, operation, calibration, maintenance and calibration of the equipment provided.

D. The technician shall be fully familiar, trained and qualified to service and support the items which are being serviced.

3.3 CALIBRATION & SERVICE REPORTS

A. A written, dated report shall be prepared by the systems integrator technician for each start-up, calibration, troubleshooting or maintenance event which identifies the instrument serviced, defines procedures, describes the results of the testing, identifies witnesses, and provides conclusions. This shall include every instrument or system provided in this project, and shall also apply to every visit by equipment suppliers and system subcontractors. The reports shall also document every wiring modification, warrantee repair and problem analysis.

B. All reports shall be distributed to the engineer, the contractor and copied to the plant staff, and a copy shall be kept in a permanent file on site for future reference.

3.4 REMOVAL OF EXISTING HARDWARE

A. The contractor shall remove all equipment and systems which have become obsolete as part of this work. This includes but is not limited to following. Pneumatic controls, instruments, tubing, cables, controls, brackets, conduits, mounting hardware, and related items. All components shall be completely removed, in a neat and workman-like manner acceptable to the owner.

B. The contractor shall provide restoration of components to remain. Holes in walls shall be patched and suitable touch-up paint applied. Holes in panels shall be repaired using an appropriate blank of a compatible material and finish.

C. All existing components as indicated above shall be neatly removed and shall become the property of the owner. In every case, the owner shall be given the option of retaining the component. If the owner wishes to retain the component, it shall be carefully salvaged by the contractor and delivered to the plant staff. If the owner chooses not to retain the component, it becomes the property of the contractor, and must be removed from the site.

3.5 TRAINING AND SPARE PARTS

A. Spare parts shall be provided as follows: Provide a SPARE of all of the components comprising the entire hardware system provided at each well (excluding only the enclosure, terminal strips, fuse blocks, mounting hardware and the fiber-optic patch panel). This shall include but not be limited to the following: a spare SLC, complete with all power supplies, I/O modules, communications modules and accessories, a spare FOM, and two (2) spare relays of each type used.

B. TRAINING:

1. The system integrator shall provide TRAINING in the use of the SLC controllers, the APS system and the programming of the SLC systems. Training shall include complete classes on troubleshooting, SLC programming, DH-plus communications, FOM interface, PLC programming in relation to the SLC communications and all related topics implemented as part of this project.

2. Minimum requirement - 5 eight-hour days. Training topics, outlines and schedules shall be submitted, scheduled and approved by the Engineer and the Owner, and shall address various groups and technical forums in a "hands-on" approach.

END OF SECTION

SECTION 13330 - FIBER OPTIC COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The CONTRACTOR shall provide an approved professional SYSTEMS INTEGRATOR to have total system responsibility for all instrumentation, controls, services, and systems as indicated in the contract drawings and described herein.

B. These sections of specifications shall be considered as a single unit and shall be included in the single source responsibility from the SYSTEMS INTEGRATOR.

C. The specifications for "Controls and Instrumentation" are provided in the following sections:

1. 13300 - Controls and Instrumentation
2. 13310 - Control Panels And Equipment Tabulation
3. 13320 - In-Plant Scada System
4. 13330 - Fiber Optic Communications System

1.2 DESCRIPTION OF WORK

A. The CONTRACTOR shall provide all equipment, materials, labor, installation, troubleshooting, testing and training required to provide a complete fiber-optic communications network between the SERWTP control room (PIC) and the four (4) remote SCADA panels, as shown in the contract drawings and as described herein.

B. The fiber optic cable shall be installed in conduit, between the various locations, within the property of the plant site. Much of the existing conduit is existing 4-inch rigid conduit. These conduits contain from one to 3 multiconductor cables. The existing cables are either 12 pair shielded of 37 conductor control wiring. In most cases, the existing cable is being removed. In each case, there is ample room in the conduit for the proposed fiber cables. Some additional new conduit must also be provided as part of this project. Refer to the drawings for further details.

1.3 QUALITY ASSURANCE

A. The Contractor, with concurrence of the owner, shall select and oversee the services of an appropriate, well established, contracting firm which is local to west central Florida and is experienced in all facets of fiber-optic cable installation.

B. This sub-contractor, designated herein as the Fiber-Optic Installer, shall provide installation technicians who are trained, experienced and qualified and who shall provide all of the appropriate installation, termination, testing and maintenance of the fiber-optic communications medium. These technicians shall install the cable

in accordance with the best recommended standards and practices of the manufacturer and the fiber-optic cable industry.

C. The Fiber-Optic Installer shall have a Registered Communications Distribution Designer on staff, who is currently registered with BICSI, (Building Industry Consulting Services International). The designer shall oversee the project installation.

D. The Fiber-Optic Installer shall be one of the following or approved equal with the concurrence of the owner:

1. Florida Industrial Electric, Longwood, Fl
2. Security Engineers, Oldsmar, Fl
3. Shephard Communications, Tampa, Fl

PART 2 - PRODUCTS

2.1 FIBER OPTIC CABLES

A. Fiber optic cables shall be heavy-duty, multi-fiber breakout style cable, designed for high tensile strength and durability, and suitable for installation in aerial runs and for long pulls through conduit. Cables shall be specially designed for outdoor environments.

B. Cables shall be suitable for installation with a rated pull strength capability in excess of 340 lbs. The contractor shall use procedures, measurements and precautions so that no more than 50% of the maximum rated pull strength capability of the cable is ever applied during any point in the installation procedure.

C. Cables shall be suitable for installation with a minimum bend radius of 3 inches or less. The contractor shall use procedures, measurements and precautions so that the cable is never exposed to a bend radius of less than 6-inches during any point in the installation procedure.

D. Jacketing shall be polyethylene, with high abrasion and cut-through resistance. Outer jacket shall be UV stabilized for outdoor use and overall ruggedness. Jackets shall have low friction resistance and high strength so that long pulls in conduit will not cause damage.

E. Fibers shall have a 200 micron core, with a .37 numerical aperture. Multimode fiber core shall utilize low loss fiber, with a typical maximum attenuation of 6.0 dB/km.

F. Each sub-channel shall be tight buffered with a 2.5 mm PVC jacket, and internal strength fibers. Subchannels shall be breakout style, for ease of handling by inexperienced plant staff personnel.

G. Fibers shall be hard silica clad, with a thin hard polymer optical cladding, over a pure fused silica core.

H. Cables shall have Kevlar ripcord and all subchannels shall be color coded.

I. Fiber-optic system shall be Spectran Specialty Optics Company, Avon CT., model HCP-M0200T-A06EB-06, or approved equal. Each cable shall contain six fibers. At the present time, only two of the fibers shall be utilized. The other four shall be terminated as spares.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. The contractor shall provide all labor, materials, equipment, and expertise required to carry out the installation, calibration, termination, testing and start-up of all cables, connectors, patch panels and related equipment, in a manner in keeping with the best standard practices available and in accordance with the manufacturer's recommendations.

B. All work shall be timed in accordance with the County's staff, to minimize down time of any system. All modifications to existing and proposed wiring systems shall be carefully documented and included in the as-built documentation to be delivered at the end of the project.

C. Careful attention should be paid to provide installations at each location which are both functional and attractive.

3.2 CABLE ROUTE AND CONTINUITY

A. Fiber optic cable shall be installed un-broken and un-spliced for the entire distance from one designated termination point to the next. The designated termination points shall be as follows:

B. Each SCADA PANEL shall be provided with a fiber-optic patch panel. All of the fiber conductors of each cable entering or leaving that RTP shall be terminated on that Patch Panel. If the fiber cable is "passed through" any panel, the cable shall be provided with two coils of excess cable, neatly secured in the perimeter of the panel, and shall proceed to the destination un-broken.

3.3 FIBER AND TERMINATION TESTING

A. Terminations shall be made, utilizing the termination kit, in a manner in keeping with the recommended practices of the fiber-optic cable manufacturer.

B. All terminations shall be made neatly and properly made, tested and immediately booted or placed in their final termination, so that they are fully protected from damage. Each fiber, including those designated as spares, shall be terminated and tested.

C. Each termination shall be tested, in the presence of the construction engineer, using a microscope. And the finished cable shall be tested, under an actual connected loading condition, using a light source and a calibrated digital power meter. The Power Budget of the fiber with it's connectors shall be calculated and shall be compared with the Power Budget. Any significant visual defects or any power loss in excess of 2 dB shall be reason to fail the test.

D. Failed terminators shall be cut off and re-terminated. If any fiber of a cable fails, the entire cable shall be replaced in it's full length, to the next SCADA panel.

E. Accurate and appropriate test equipment and industry standard test procedures shall be used to demonstrate that the equipment operates within it's expected tolerance of accuracy at various points throughout it's operating range.

F. The technician shall be fully familiar, trained and qualified to service and support the items which are being serviced.

G. A written, dated report shall be prepared by the technician for each fiber test, troubleshooting or maintenance event which identifies the fiber serviced, defines procedures, describes the results of the testing, identifies witnesses, and provides conclusions.

H. All reports shall be distributed to the engineer, the contractor and copied to the plant staff, and a copy shall be kept in a permanent file on site for future reference.

3.4 TRAINING AND TEST EQUIPMENT

A. The fiber-optic Communications Distribution Designer shall provide training to the SERWTP plant staff, on the installation, operation, maintenance and troubleshooting of the Fiber-Optic system. The classes shall include but not be limited to the following:

1. Installing ST and SMA Connectors on Fibers
2. Calculation of Optical Budgets
3. Testing fibers using a Power Meter
4. Installation techniques
5. Maintenance and Troubleshooting
6. Field Splicing and Emergency Repairs

B. TRAINING: Training courses shall be formally prepared and scheduled and tailored to the appropriate plant personnel. Provide two sessions, 4 hour duration each.

C. TEST EQUIPMENT: The contractor shall provide an OPTICAL LIGHT SOURCE and a HAND-HELD FIBER OPTIC DIGITAL POWER METER to the County for use in testing and troubleshooting fiber-optic communications systems. The test equipment shall be suitable for use with the fiber-optic system provided. The equipment shall be portable, and shall be provided with rechargeable batteries, charger, carrying case, instruction manuals, adapters, and all related accessories. Photodyne 118XE or approved equal.

D. FIBER OPTIC TERMINATION KIT: The contractor shall provide one complete kit for fiber optic terminations. The Kit shall be capable of terminating 200 micron fibers, using ST or SMA connectors, using a crimp and cleave cable termination kit. The contractor shall be permitted to use this kit to terminate the installed fibers, but the kit must be turned over to the County is good working condition at the end of the project. Provide spare termination supplies sufficient to make 30 future terminations of each type used. (I.E. ST, SMA, etc.)

END OF SECTION

SECTION 14301 - MONORAIL AND HOIST

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing a 4,000 lb. capacity hoist system for the vertical non-clog centrifugal return activated sludge pumps in the clarifier area and a 2,000 lb. capacity hoist system for the submersible pumps in the flow splitter box. Each monorail hoist system which shall include: Track and suspension fittings, hoist carrier and hoist. All equipment shall be designed with a safety factor of 5, based on the ultimate strength of the material.

1.2 QUALITY ASSURANCE

A. The complete hoist system shall be furnished by one manufacturer.

B. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Cleveland Tramrail Co. (Basis of Design)
2. American Monorail
3. Or Equal.

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and installation. After verifying details and dimensions provide three sets of final drawings and installation instructions to Engineer for use in observing installation and for record purposes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 TRACK AND APPURTENANCES

A. Track shall be a composite section with a mild steel top flange and web, and high carbon lower rail with carbon content of .55 to .65 and manganese content of .60 to .90 on lower rail. Capacity of the track shall be determined by the crane manufacturer so deflection will not exceed 1/450 of the span. The lower rail shall have a raised tread riding surface. End stops shall be provided. Track shall be TARCA beam as manufactured by Cleveland Tramrail Company.

B. Switches shall be glide or sliding type and shall be manually operated. Transfer mechanisms and locking devices shall be capable of positioning the switch to maintain true vertical and horizontal alignment of the track and prevent switch operation when any part of the trolley is in the switch.

2.2 SUSPENSION

A. All necessary clamps, hanger rods and other fittings from which the runway is suspended shall be provided as part of the system. Rigid attachment of the runway to the building structure will not be permitted. The runway tracks shall be flexibly suspended by hanger rods from the building structure. Hanger rods shall be 3/4-inch diameter and made from high carbon cold rolled steel, annealed.

2.3 HOIST AND CARRIER

A. The electric hoist shall be of the capacity and headroom design shown, single-speed, motor-operated type with pendant pushbutton control and motor driven trolley. The hoist shall be designed for a 20 ft. lift, lifting speed of 10 fpm, and trolley speed of 5 fpm for the return activated sludge pumps in the clarifier area. The other hoist shall be designated for a 40 ft. lift, lifting speed of 10 fpm, and trolley speed of 5 fpm for the submersible pumps in the flow splitter box.

B. The hoist shall be spur or helical-gear driven with antifriction bearing, a positive acting mechanical load brake, and an entirely separate electric brake. Either brake shall be capable of supporting the full load and shall be capable of adjustment from the outside after removal of cover plates. The mechanical load brake and all gears shall run in oil. Shafts of the motors, drums, and drum pinions shall run in grease-lubricated ball bearings. All vital parts shall be fully protected from damage by dust and moisture. Motors, gears, and bearings shall be fully enclosed.

C. Each hoisting drum shall be machine grooved to take the full length of cable plus two extra turns without overlapping.

D. The hoisting cable shall be flexible high-strength plow steel wire rope having a load safety factor of at least 5 to 1.

E. The hook shall be of high-grade forged steel and shall have swivel, antifriction bearings.

F. The trolley shall be four-wheel design type fabricated from heavy steel or aluminum sections with sides beyond the wheel flanges to provide bumper protection. Trolley wheels shall have machined treads set at the proper angle to bear the load evenly on the beam flanges. Wheels shall be provided with lifetime lubricated ball or roller bearings. Trolley pinions shall be of machine-cut teeth. Safety stops shall be installed at end of rails to prevent trolleys from damaging building construction and piping and as shown on the Construction Drawings.

G. The capacity shall be permanently marked in a conspicuous manner on the hoist.

H. Operation of the hoist shall be from the floor by a six-button pendant magnetic disconnect pushbutton station. Each pushbutton shall be clearly marked to indicate its function. The cable shall be long enough to reach within 4 feet 6 inches above the operating level and shall be provided with an adjustable supporting chain for field height setting.

I. An upper limit switch of the automatic reset control circuit type shall be provided on the hoist to prevent overtravel.

J. The hoist and trolley motors shall be totally enclosed, horizontal, reversible motors with antifriction bearings and shall be suitable for the electrical characteristics shown.

K. Magnetic controls shall be furnished for the motors. The design of the controls shall permit "plugging" in both forward and reverse directions under full load and provide automatically regulated acceleration and rapid brake response.

L. Power for the motor of the hoist and powered trolley shall be fed through single, flexible, multiconductor power cable from a spring operated reel. The spring operated reel shall be dustproof with a roller outlet and swivel-type base. The cable shall have at least four No. 12 conductors. The junction box to connect the cable reel to the power supply circuit shall be furnished with the hoist.

M. Control equipment shall include a transformer for a 120-volt control circuit.

N. Electrical equipment including motors, controls, resistors, and brakes, plus all conduit, wiring, panels and enclosures shall comply with the applicable requirements for materials, workmanship, construction and installation of the latest NEMA and National Electrical Code and Standards and Division 16 Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendations and instructions and shall be supervised by a manufacturer's service engineer.

3.2 TESTING

A. Each electrical hoist shall be field tested to demonstrate its capacity and ability to operate without undue vibration. The Contractor shall make all necessary changes, adjustments or replacements required, at his own expense to ensure compliance with the specifications. Test loads shall be furnished by the Contractor.

END OF SECTION

SECTION 14440 - SCREW CONVEYOR

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing, installing, and placing into operation a screw conveyor on top of the headworks to serve two (2) mechanical screens. The work shall include all accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. The installation shall incorporate the highest standards for the type of service required.

1.2 QUALITY ASSURANCE

A. The equipment specified under this Section shall be furnished by a single manufacturer who is regularly engaged in this type of work, who is thoroughly experienced in the design and manufacture of screw conveyors of the size and type specified, and who has not less than 10 installations in the United States of comparable size that have been in successful, continuous operation for at least three years.

B. Available Manufacturers: Subject to compliance with requirements, provide from the following:

1. Keller Manufacturing, Dunedin, FL (Shaft Type Screw Conveyor)
2. American Bulk Conveying, Inc. (Buck-El), Murry Hill, NJ (Shaftless Screw Conveyor)
3. Or Equal

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Provide seven (7) shop drawings for fabrication and installation. After verifying details and dimensions, provide three sets of final Drawings and installations to the Engineer for use in observing installation for record purposes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

A. The Contractor may provide either a shaft type screw conveyor or a shaftless screw conveyor.

B. The conveyor will be used to convey screenings removed by an existing mechanical bar screen and a new mechanical bar screen to a discharge chute.

C. The conveyor shall be capable of transporting screenings with a minimum volume of 60 cubic yards per day.

D. The screw conveyor shall have three (3) inlet chutes, two for mechanical bar screens and one for a grit dewatering unit. The screw conveyor shall have one discharge chute discharging downward from its bottom at one end as shown on the drawings.

E. Controls and Accessories

1. A zero-speed switch with a time delayed detection device will be provided.
2. Emergency stop cables on both sides of the conveyor with one switch per 100 ft of conveyor length. Cable will be orange plastic coated safety cable mounted through eyebolts spaced no more than10 feet.
3. An electronic current control relay to protect the spiral and drive against a torque overload (Tsubaki TSB-50 or equal) shall be installed for each drive.
4. The conveyor shall be interfaced with the two mechanical screens such that the conveyor will begin to operate when either of the screens begins to operate, and the conveyor will stop 5 minutes after either of the two mechanical screens stops.

2.2 SHAFT-TYPE SCREW CONVEYOR

A. The screw conveyor shall be a one-piece screw 13 inches in diameter by 23± feet long. The screw shall be fabricated of 304 stainless steel material. The conveyor shall consist of a 12-gauge type 316 stainless steel double flanged trough. The screw flight shall be sectional and shall be mounted on 2-inch SCH 40 stainless steel pipe. The screw shall be full pitch, right-hand.

B. The end plates shall be 1/4" type 304 stainless steel.

C. The covers shall be bolted on, 14 gauge type 316 stainless steel. The covers shall be hinged on one side and no one piece shall be longer than 4'-0". The trough shall be covered except where the mechanical screens and grit dewatering unit drop into the screw.

D. Tail shaft shall be 1-1/2" diameter and shall run in an Arguto wooden bearing. The tail shaft and drive shaft shall be type 316 stainless steel. The screw shall be driven by a 1 HP washdown motor driving a SCXT 125 Dodge double reduction torque-arm reducer turning the screw about 10-15 RPM. There shall be a 2" stainless steel coupling welded in the bottom of the screw trough at the low end. The trough shall have an incline toward the discharge end to allow water to flow to the low end.

E. The screw trough shall be mounted on 1-1/2" x 1-1/2" type 316 stainless steel angle legs with adjustable feet. There shall be one hole in each foot for anchoring the conveyor to the floor.

F. The conveyor shall be delivered in one (1) piece.

G. A NEMA 4X Control Panel shall be provided.

2.3 SHAFTLESS SCRW CONVEYOR

A. The shaftless screw conveyor will consist of a shaftless screw complete with a min. Brinell 250 Micro-Alloy Carbon Steel cold-formed Spiral; Direct Drive; Inlet Chutes; UHMWPE liner with a color-coated wear warning; and Full Supports. The conveyor shall be controlled from a NEMA 4X Control Panel.

B. Design Criteria:

1. The conveyor shall be designed and manufactured to handle intermittent loading of screenings which will include rags, plastics, food wastes, organic material, lumber, rocks, and debris of domestic and commercial origin, 24 hours per day, seven days per week. The torque capacity of the drive unit shall be sufficient to start the Conveyor with 100% trough loading.
2. The "spring effect" (compression or elongation) of the spiral shall not exceed 0.08 in. per 1 foot (6.7 mm per 1 meter) of length at maximum load conditions.
3. Manufacturer shall demonstrate by submission of calculations for a Cylindrical Helical Spring of Rectangular Cross Section, as defined in Mark's Mechanical Engineering Handbook, latest edition, that at 100% trough loading, the stress in the auger does not exceed 30% of the yield strength value in the extreme outer fibers of the spiral.
4. There shall be no internal or external bearings other than those in the drive.

C. Materials:

1. The shaftless screw conveyor will be new and of at least 50% U.S. domestic content and of current manufacture; and will be designed to transfer, dewater and compact municipal screenings as shown and will be constructed in accordance with CEMA 350 dimensional standards.

a)	Trough, Chutes	Stainless Steel 1/8" min. (304)
b)	Covers	12 Ga. Min 304 SS
c)	Drive and End Plates	½" min. 304 S.S. Drive, 3/8" Non-drive
d)	Spiral Flighting	Min. 11" (280mm) dia., 2.4" (60mm) wide x 0.8"(20mm) thick Carbon Steel, Micro-Alloy, min. 250 Brinell
e)	Wear Liner	Plastimeric, (UHMWPE) ¼" thick min. with color-coded wear warning
f)	Hardware	Type 304 Stainless Steel
g)	Cover Fasteners	Type 304 Stainless Steel bolts
h)	Drive Shaft	AISI C1045

D. Spiral:

1. The spiral flighting shall be designed to convey material without a center shaft and shall be designed with the stability to prevent distortion and jumping in the trough. The supplier shall demonstrate that at 250% of the motor nameplate horsepower, the drive unit cannot produce more torque than the shear stress rating of the flight.

2. The spiral flighting shall be cold-formed in sections from continuous, flat, hot-rolled, high strength (85,000 psi min) corrosion-resistant Micro-Alloy steel bar with a minimum hardness of 250 Brinell and be concentric to within 1/16 inch. The "neckdown" at the outer diameter shall be less than 20%. Sectional flighting from A-36 plate or AR bar shall not be permitted.
3. The spiral flighting shall be connected to the drive shaft by welding the spirals to a ¾" min. circular torque plate properly reinforced with a curved gusset plate for 180 degree support. A separate connection plate shall be bored with a hole equal to the shaft and the drive shaft shall be concentrically welded to the plate to effectively transmit torque and shall be bolted to the torque plate.
4. Spiral connections shall be welded according to AISC B-U3-GF (double-V groove) specifications and be full penetration welds. Flights shall be welded in a jig to assure true alignment.

E. Trough and Liner:

1. Construction: Materials shall be 1/8" min. thick 304 stainless steel U-Trough with neoprene gasketing at each trough flange and 12 Ga. stainless steel cover. The trough shall have two cross braces every 10 ft. and shall be lined with a ¼" min. Plastimeric-type UHMWPE (ultra-high molecular weight) polyethene with color-coated wear warning and 304 S.S. retainer bars welded to the trough at 180 degrees along the trough. Fasteners that penetrate the trough shall not be used.
2. The portion of the trough not covered by a filling chute shall be covered by a bolted 304 S.S. cover in maximum 4 ft. sections. To prevent unsafe access to the conveyor, quick-opening clamps and covers shall not be allowed.
3. Conveyor shall have standard trough end plates with a split-gland seal at the drive end.
4. All components, including saddles and supports shall be type 304 stainless steel except the drive unit and spiral. All stainless steel welds shall be passivated.
5. The trough shall be equipped with 1/8" 304 S.S. filling chutes designed to direct all material into the trough at the loading areas.

F. Drive: The drive unit shall be a shaft-mounted gear motor rated min. AGMA Class II, single, double or triple reduction. Provide min. 1.0 HP 230/460, 60 Hz., 3 phase, TEFC, constant speed, motor at inlet end of conveyor, running at approx. 10 - 15 RPM. Provide NORD Gear Corporation Unicase, or equal, shaft -mounted drive, hollow shaft design. (V-belt driven speed reducer, or chain driven reducers shall not be permitted.) Shaft shall be 1-5/8" min. dia. welded to spiral and with sealed housing at tail and connected to the spiral to effectively transmit torque from the drive shaft to the spiral flighting.

G. Supports: Conveyor trough saddles shall be provided for support and shall include A-36 structural members to support or suspend the conveyor per the contract drawings. The structural members for support or suspension shall be designed such that the ratio of the unbraced length to the least radius of gyration (slenderness ratio) will not exceed 20 for compression and 240 for tension. Stresses shall not exceed AISC allowable stresses by more than 1/3 when subject to 2 times the running torque of the drive motor.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the location shown on the Drawings.

3.2 INSPECTION AND TESTING

A. The equipment manufacturer shall furnish the service of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the conveyor for start-up, inspection, testing and operation and maintenance classes. Refer to Section 01660 - Testing, Adjusting, and Balancing. The manufacturer's Representative shall be on-site a minimum of two (2) days not counting travel time, to provide the above services.

END OF SECTION

SECTION 15050 - PIPE AND PIPE FITTINGS - GENERAL STATEMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all pipe and pipe fittings as indicated in accordance with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
4. See Division 1 for General Requirements.

B. Related specification sections include but are not limited:

1. 15061 - Steel Pipe
2. 15062 - Ductile-Iron Pipe and Fittings
3. 15064 - Plastic Pipe
4. 15100 - Valves and Appurtenances
5. 15110 - Check Valves
6. 15111 - Telescopic Valves

1.2 SUBMITTALS

A. See Section 01300.

B. Verify on shop drawings, dimensions, schedule of pipe, linings, coatings, fittings, hangers, supports, and miscellaneous appurtenances. When special fittings are necessary, verify locations of items and include complete details.

C. Yard piping drawings. Submit scaled drawings showing locations and dimensions to and from fittings, valves, structures, gates, and related appurtenances. Provide scaled drawings to a minimum scale of 1/8-inch equals 1-foot. Provide details to minimum scale of 1/8-inch equals 1-foot. Information shall include but not necessarily be limited to:

1. Dimensions of piping lengths.
2. Invert or centerline elevations of piping crossings.
3. Acknowledgment of bury depth requirements.
4. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
5. Line slopes and vents.

D. Building piping diagrams. Submit sealed drawings showing locations and dimensions of all piping inside structures. Show all pipeline-mounted devices, connections to equipment, hangers and supports, anchors, and related appurtenances. Information shall include but not be limited to the following:

1. Dimensions of piping and end connections.
2. Invert of centerline dimensions.
3. Location and type of pipe supports and anchors.
4. Locations of valves and valve operator type.
5. Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
6. Acknowledge valve and equipment tag numbers and instrument tag numbers.
7. Show provisions for expansion and contraction.
8. Show line slopes and air release vents.

E. Include on fabrication drawings location of jointed sections to permit maintenance of connected equipment and to permit removal of connected equipment without disturbance of main piping system.

F. Copies of any manufacturer's written directions regarding material handling, delivery, storage and installation.

G. As work progresses and again when work is complete, submit "As-Recorded" drawings of piping systems in project including project items and pre-existing items. Identify complete location, elevations, description of piping systems. Relate piping systems to identified structures and appurtenances. Submit four (4) copies.

H. Submit written verification of required pressure testing.

PART 2 - PRODUCTS

2.1 GENERAL PIPING SYSTEMS

A. Unless otherwise shown on drawings or drawing schedule, piping system materials, fittings, and appurtenances are subject to requirements of specific technical specifications and shall be as follows:

SERVICE CATEGORY	SIZE RANGE INCHES	PIPING SYSTEM
CA - Compressed Air	½ - 1	Sch. 80-304 Stainless Steel, Welded (Above and Belowground)
	1¼ - 3	Sch. 40-304 Stainless Steel, Welded (Above and Belowground)
	4 - 14	Sch. 10-304 Stainless Steel, Welded (Above and Belowground)
	4 - 8	Sch. 40 PVC, Solvent Weld or Flanged (In Tank)
	3	SDR 26, 160 psi, Type 1120 PVC, Solvent Weld (In Tanl

SERVICE CATEGORY	SIZE RANGE INCHES	PIPING SYSTEM
CLE - Clarifier Effluent	30 - 36	Class 53 DI, Cement Lined, Flanged (Aboveground) Pressure Class 150 DI, Cement-Lined, MJ Fittings (Belowground)
CL2S - Chlorine Solution	1½ - 2	Sch. 80 PVC, Solvent Weld or Flanged (Above and Belowground)
AD - Air Duct	8 - 14	Fiberglass (Above and Belowground)
DR - Drain	2	Sch. 80 PVC (Aboveground)
	3 - 12	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground) Pressure Class 350 DI, Protecto 401 Lined, MJ (Belowground)
FE - Sand Filter Effluent	36	Pressure Class 150 DI, Cement-Lined, MJ Belowground
FEQ - Flow Equalization	8 - 16	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
	8 - 12	C-900 PVC, DR-18, MJ, Green (Belowground)
	20	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
GR - Grit	4	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
LC - Leachate	8	C-900 PVC, DR-18, MJ, Green (Belowground) Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
LC - Leachate (Perforated)	8	ASTM D3350 PE3408 HDPE (SDR17), Butt-fused, Perforated, Green (Belowground)
ML - Mixed Liquor	36 - 42	Pressure Class 150 DI, Protecto 401 Lined, MJ (Belowground)
OF - Overflow	18 - 30	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
	30	Pressure Class 150 DI, Protecto 401 Lined, MJ (Belowground)
PDFM - Plant Drain Force Main	8 - 10	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
	10	C-900 PVC, DR-18, MJ, Green (Belowground)
PW - Potable Water	6 - 8	C-900 PVC, DR-18, MJ, Blue (Belowground)
	8	Pressure Class 350 DI, Cement Lined, MJ (Under Existing Drainage Ditch)
RAS - Return Activated Sludge	6 - 24	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
	6	C-900 PVC, DR-18, MJ, Green (Belowground)
	16	C-905 PVC, DR-18, MJ, Green (Belowground)
	16	Pressure Class 250 DI, Protecto 401 Lined, MJ (Belowground)
	24	Pressure Class 200 DI, Protecto 401 Lined, MJ (Belowground)
REJ - Reject	8 - 12	C-900 PVC, DR-18, MJ, Pantone 522C (Belowground) Class 53 DI, Protecto 401 Cement Lined, Flanged (Aboveground)
RW - Reclaimed Water	1 - 3	Sch. 80 PVC, Flanged or Solvent Weld, Pantone 522C (Above & Belowground)
	6	C-900 PVC, DR-18, MJ, Pantone 522C (Belowground)
	24 - 30	Class 53 DI, Cement- Lined, Flanged (Aboveground) Pressure Class 150 DI, Cement- Lined, MJ (Belowground)

SERVICE CATEGORY	SIZE RANGE INCHES	PIPING SYSTEM
SC - Scum	6 - 8	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground) Pressure Class 350 DI, Protecto 401 Lined, MJ (Belowground)
SC - Stormwater Control (Perforated)	10	ASTM D3034 SDR35 PVC, Push-on Joint, Perforated, Green (Belowground)
SPW - Storage Pond Water	16	Pressure Class 250 DI, Cement- Lined, MJ (Belowground)
SS - Sanitary Sewers	6 - 15	ASTM D2241 SDR26(160) PVC, Push-on Joint, Green (Belowground)
TS - Thickened Sludge	6 - 10	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground) Pressure Class 350 DI, Protecto 401 Lined, MJ (Belowground)
	4	C-900 PVC, DR-18, MJ, Green (Belowground)
WAS - Waste Activated Sludge	8	C-900 PVC, DR-18, MJ, Green (Belowground)
	4 - 8	Pressure Class 350 DI, Protecto 401 Lined, MJ (Belowground)
	16	Pressure Class 250 DI, Protecto 401 Lined, MJ (Belowground)
	6 - 18	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
WW - Wastewater	36	Class 53 DI, Protecto 401 Lined, Flanged (Aboveground)
	36 - 48	Pressure Class 150 DI, Protecto 401 Lined, MJ (Belowground)

PART 3 - EXECUTION

3.1 DELIVERY, INSPECTION AND STORAGE

A. Inspect materials thoroughly upon arrival. Remove damaged or rejected materials from site.

B. Observe manufacturer's directions for delivery and storage of materials and accessories.

C. Store materials on-site in enclosures or under protective coverings above ground to keep clean and dry.

3.2 HANDLING OF PIPE

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

C. Erect piping to accurate lines and grades and support as required on drawings or described in specifications. When temporary supports are used, ensure that sufficient rigidity is provided to prevent shifting or distortion of pipe. Install expansion devices as necessary to allow expansion and contraction movements.

3.3 PIPING - GENERAL

A. Minimum bury. Unless otherwise shown on the drawings, provide a minimum of two (2) feet, six (6) inches earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions.

3.4 PIPING WITHIN BUILDINGS, STRUCTURES AND UNITS

A. Install piping in vertical and horizontal alignment as shown on drawings. Alignment of piping smaller than 4-inches may not be shown. However, install according to drawing intent and with ample clearance and allowance for:

1. Expansion and contraction.
2. Operation and access to equipment, doors, windows, hoists, moving equipment.
3. Headroom and walking space for working areas and aisles.
4. Install vertical piping plumb and horizontal piping runs parallel with structure walls.

B. Use methods of piping support as shown on the drawings and as required in Section 15141. Where pipes run parallel and as same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.

C. Locate and size sleeves required for piping system. Arrange for chases, recesses, inserts, or anchors at proper elevation and location.

D. Install service piping to provide every plumbing fixture and equipment requiring potable water with suitable supply and soil or waste and vent connection as required by code. Consult manufacturer's data and large scale details of rooms containing plumbing fixtures before roughing in piping. Plug or cap piping immediately after installation.

E. Use reducing fittings throughout piping systems. Bushings will not be allowed unless specifically approved.

F. Provide drain pans and piping from items of equipment where condensation may occur. Run drain piping to nearest floor drain or rainwater downspout. Condensate drain piping shall generally be 1-inch except where otherwise indicated.

G. Soil, waste, vent and rainwater piping installation:

1. Install horizontal soil or waste lines with fall to produce flow rate of 2 ft./sec or 1/8-inch/foot. Hold as close to construction as possible to maintain maximum headroom. Make changes of direction with 1/8 bends and junctions with wye fittings. Use short wye fittings in vertical pipe only. Install handhold test tee at base of each stack. Install cleanouts at deadends, at changes of direction, and at 50-foot intervals on horizontal runs. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to wall as required.
2. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures. Each vent stack shall originate from soil or waste pipe at its base. Where possible, combine soil, waste, or vent stacks before passing through roof so as to minimize roof openings. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing. Provide pipes passing through roofs with cast iron increases minimum of 12-inches below roof one size larger than pipe but in no case less than 4-inches. Terminate each vent with approved frostproof jacket.
3. Provide each vent pipe passing through roof with 4-lb sheet lead flashing consisting of 18 x 18-inch base with tubular vertical sleeve surrounding pipe with 1-inch minimum spacing and turning in 2-inches at top. Provide gasket seal between top and lead sleeve.
4. Carry vent stacks 4-inches and larger full size through roof. Extend vent stacks at least 12-inches above roofing.
5. Provide each roof drain with 4-lb sheet lead flashing 36 x 36-inch square clamped under flashing ring of drain.

H. Potable or service water piping installation:

1. Install drain tees with capped nipples of PIS brass 3-inches long at low points. If low points occurs in concealed piping, provide approved flush access panel. These drains are not shown on drawings.
2. Slope water lines down to drain points not less than 1-inch in 60-feet.
3. Wherever threaded piping is installed, provide clean-cut tapered threads with ends thoroughly reamed after cutting to remove burrs. Pipe joint cement permitted only on external threads. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
4. Install ball, butterfly, gate, check, and plug valves where indicated or required to adequately service all parts of system and equipment. Unless otherwise indicated, install valves on each branch serving restroom. Install valve on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.
5. Install union between valves and connections to each piece of equipment and install sufficient number of unions throughout piping system to facilitate installation and servicing. On copper pipe line, install wrought copper solder-joint copper to copper unions for lines 2-inches and smaller; for lines 2-1/2-inches and over, install brass flange unions.
6. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.

7. Where exposed pipes 6-inches in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to close hole completely around pipes. Secure plates to pipe by set screw in approved manner.
8. Size supply branches to individual fixtures as scheduled or indicated on drawings.
9. Install piping so as to be free to expand with proper loops, anchors, and joints with injury to system or structure.
10. Provide branches to wall hydrants or hose bibbs in exterior location with interior shutoff and drain valves.
11. Provide approved type vacuum breaker installations indicated or as required by Code.

3.5 PIPING OUTSIDE BUILDINGS AND STRUCTURES

A. Install piping as shown on drawings with ample clearance and allowance for expansion or contraction.

B. Install flexible joint within two (2) feet of point where pipe enters or leaves structure. Provide balance of piping with standard laying lengths and in accordance with drawings.

3.6 PIPE INTERSECTIONS WITH STRUCTURES AND UNITS

A. Enter and exit through structure walls by using wall seals specified or as shown on drawings.

3.7 EQUIPMENT PIPE CONNECTIONS

A. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.

B. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations.

C. Support and match flange face to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.

D. Permit piping connecting to equipment to move freely in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened. Align, level, and wedge equipment into place during fitting and alignment of connecting piping. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened. Test alignment by loosening flange

bolts to see if there is any change in relationship of piping flange with equipment connecting flange. Realign as necessary, install flange bolts, and make equipment connection.

E. Provide utility connections to equipment shown on drawings, scheduled or specified.

F. Obtain rough-in data from approved shop drawings on equipment. Obtain rough-in data for relocating existing equipment and coordinate with Owner.

G. Unless otherwise specified, make piping connections to equipment, including but not limited to installation of brass and fittings, strainers, pressure-reducing valves, flow control valves, and relief valves provided with or as an integral part of equipment.

H. Furnish and install sinks, brass, fittings, strainers, pressure-reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or an integral part of equipment.

I. For each potable or service water supply piping connection to equipment, furnish and install union and gate or angle valve. Minimum size to be 1/2-inch.

J. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system. Size trap as required by Plumbing Code.

K. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps, and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed. Run piping mains and branches in laboratory benches, built-in counters, and cabinet work if acceptable to Construction Manager.

3.8 ANCHORAGE AND BLOCKING

A. Block, anchor, or harness exposed piping subjected to internal pressure, in which mechanical, push-on, flexible, or similar joints are installed to prevent separation of joints.

B. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by internal pressure in buried piping tees, wye branches, plugs, or bends.

C. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints. Provide bearing area of concrete in accordance with drawing detail. In event that adequate support cannot be achieved against undisturbed soil, install restrained piping joints.

D. Provide reaction blocking, anchorages, or other supports for fittings as shown on drawings for piping installed in fills, unstable ground, above grade, or exposed within structures.

3.9 CLEANING

A. Clean interior of piping systems thoroughly before installing. Maintain pipe in clean condition during installation.

B. Before jointing pipe, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

C. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

D. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing or from other causes. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

3.10 TESTING AND INSPECTION

A. Upon completion of piping, but prior to application of insulation on exposed piping, test all piping systems. Utilize pressures, media and pressure test duration at specified on piping specification sheets. Isolate equipment which may be damaged by the specified pressure test conditions. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. Select each gage so that the specified test pressure falls within the upper half of the gage's range. Notify the Engineer 24 hours prior to each test.

B. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing pipe systems.

C. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.

D. Provide all necessary equipment and perform all work required in connection with the tests and inspections.

E. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

3.11 LOCATION OF BURIED OBSTACLES

A. Furnish exact location of buried utilities encountered and any below grade structures. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants, and related fixed structures. Include such information as location, elevation, coverage, supports, and additional pertinent information which will be required by future contractors for replacement servicing, or adjacent construction around any buried facility.

B. Incorporate information to "As-Recorded" drawings.

3.12 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

A. Insulating joints. Provide insulating joints where dissimilar metals are joined together and where specifically indicated on drawings. Type of joint shall be as detailed and in accordance with the following requirements:

1. Insulating flanges. Provide each unit to consist of flat-faced rubber gaskets.
2. Insulating unions. Provide "dielectric" union by Epco or equal.
3. Insulating couplings. When joining larger diameter dissimilar metal pipe, use insulating coupling equal to Rockwell No. 416, Dresser Style 39, or equal. When pipes have different outside diameters, use insulating reducing couplings equal to Rockwell No. 417, Dresser Style 39-62, or equal.

B. Dirt strainers:

1. Provide Y-type strainers to locations shown on drawings and/or scheduled.
2. Furnish composition bronze strainers rated for 150 psi working pressure at 450/F. Provide a 20-mesh monel screen. Install a threaded bronze plug in the blowoff outlet. Furnish threaded NPT end connections.
3. Subject to compliance with these specifications, furnish Mueller No. 351 strainers or equal.

C. Welding:

1. Have each welding operator affix an assigned symbol to all his welds. Mark each longitudinal joint at the extent of each operator's welding. Mark each circumferential joint, nozzle, or other weld in two places 180/F apart.
2. Use only certified welders meeting procedures and performance outlined in Section 9 of the ASME other codes and requirements per local building and utility requirements.
3. Have all welds conform to highest industrial practice in accordance with ANSI B31.3 and ANSI B31.1 or other codes and requirements per local building and utility requirements.

D. Protective coatings and linings:

1. Where coatings, linings, paint, tests and other items qualified in applications of service are stated, pipe and fittings shall be included in referenced conditions.
2. Where specified, provide coal-tar epoxy linings and coatings in accordance with AWWA C210 to a minimum thickness of 20 mils in not less than two coats.
3. Where specified, provide cement mortar lining in accordance with AWWA C205.
4. Where specified, provide Protecto 401 lining.
5. Where specified, galvanize surface in accordance with hot-dip method using any grade of zinc acceptable to ASTM B6.

6. Where specified, field paint pipe in accordance with Section 09900.
7. Where specified, coat pipe 24-inch in diameter and smaller with extruded polyethylene coating equal to EnCoat.

    a) Where specified, line pipe with a blend of high-density and low density polyethylene powders complying with ASTM D1248 and uniformly fused and bonded to the pipe to a minimum thickness of 40 mils.

E. Underground alarming tape. Provide underground warning tape constructed of heavy gage 0.004-inch polyethylene film to identify all buried utilities except 3-inch and smaller irrigation pipe. Provide 6-inch wide tape as follows:

Film Legend	Film Color
Electric line below	Red
Telephone line below	Orange
Water line below	Blue
Sewer line below	Green
Nonpotable water below	Brown
Reclaimed Water Below	Purple

F. Install tape directly above each buried utility at a depth of 24-inches below final grade.

END OF SECTION

SECTION 15060 - PIPES AND PIPE FITTINGS (HVAC AND PLUMBING)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing pipe and pipe fittings required by this Section, as specified in other Division 15 Sections and as shown on the Drawings and as specified.

B. Types of pipes and pipe fittings specified in this section include the following:

1. Copper Tube
2. Cast-Iron Soil Pipes
3. PVC-Polyvinyl Chloride Pipe
4. Miscellaneous Piping Materials/Products

C. Pipes and pipe fittings furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 15 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications. Firms regularly engaged in manufacturer of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.3 SUBMITTALS

A. Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping system.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

A. Piping Materials. Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or Class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

B. Pipe/Tube Fittings. Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube. ASTM B 88; Type "L" as indicated for each service; hard-drawn temper, except as otherwise indicated.

B. Cast-Copper Solder-Joint Fittings. ANSI B16.18.

C. Wrought-Copper Solder-Joint Fittings. ANSI B16.22.

D. Copper-Tube Unions. Provide standard products recommended by manufacturer for use in service indicated.

2.3 CAST-IRON SOIL PIPE FITTINGS

A. Hubless Cast-Iron Soil Pipe. ASTM A 74.

B. Hubless Cast-Iron Soil Pipe Fittings. Neoprene gasket complying with ASTM C 564 and stainless steel clamp holding band.

C. Cast-Iron Hub-and-Spigot Soil Pipe Fittings. Match soil pipe units; complying with same standards (ASTM A 74).

D. Lead/Oakum Joint Materials. Provide products complying with governing regulations for use in service indicated.

2.4 POLYVINYL CHLORIDE PIPE (PVC)

A. Polyvinyl Chloride Sewer Pipe. ASTM D 2729

B. Polyvinyl Chloride Drain, Waste and Vent Pipe. ASTM D 2665

C. Solvent Cement. ASTM D 2235

2.5 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Soldering Materials. Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements.

B. Tin-Antimony Solder. ASTM B 32, Grade 95TA

C. Brazing Materials. Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.

1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections within 1/16-inch misalignment tolerance.

1. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, expect as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, detail and notations, or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view by locating in column enclosures, in hollow wall construction or above suspended ceilings; does not encase horizontal runs in solid partitions, except as indicated. Provide piping to secure pipe both horizontally and vertically and at all changes in direction.

C. Electrical Equipment Spaces. Do not run piping through transformer vaults and other electrical or electronic equipment spaces and enclosures. Install drip pan under piping that must be run through electrical spaces.

3.2 PIPING SYSTEM JOINTS

A. Provide joints of type indicated in each piping system.

B. Braze copper tube-and-fitting joints where indicated in accordance with ASME B31.

C. Solder copper tube-and-fitting joints where indicated in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint where it hardens.

D. Hubless Cast-Iron Joints. Comply with coupling manufacturer's installation instructions.

E. Plastic Pipe/Tube Joints. Comply with manufacturer's instructions and recommendations, and with applicable industry standards.

3.3 PIPING INSTALLATION

A. Install drainage piping from lowest end of slope to highest. Shape bed for bells of piping (if any). Place bells/hubs of units up-stream.

3.4 CLEANING, FLUSHING, INSPECTING

A. Clean exterior surfaces of installed piping systems of superfluous materials and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

B. Refrigerant piping shall be evacuated prior to charging. Two-stage vacuum pump shall be capable of pulling 1000 microns (29.91" Hg) for a minimum of 2 hours at a capacity of 0.15 cfm/ton..

1. Inspect pressure piping in accordance with procedures of ASME B31.

3.5 PIPING TESTS

A. Test pressure piping in accordance with ASME B31.

B. Test HVAC refrigerant piping with dry nitrogen gas at a pressure of 150 psig for 24 hours. Note: System pressure will change approximately 3 psig with each 10°F rise or fall in ambient temperature.

C. Repair piping systems sections which fail required piping test, by disassembly and reinstallation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

D. Drain test water from piping systems after testing and repair work has been completed.

END OF SECTION

SECTION 15061 - STEEL PIPE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing stainless, galvanized, and black carbon steel pipe, fittings and appurtenances for interior and exterior use above and belowground as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Manufacturer shall design and fabricate the pipe and fittings to conform to the requirements of ANSI/AWWA C200 for combination internal design pressure and surge allowance of 200 psig. Design stress in the pipe wall under these conditions shall not exceed fifty percent of the minimum yield point of the steel. Minimum wall thickness shall not be less than that shown in AWWA M11, Steel Pipe, a Guide for Design and Installation; for the sizes and spans shown for steel pipe on concrete supports.

B. Fittings for steel pipe shall be fabricated to the dimensions shown in ANSI/AWWA C208.

1.3 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and installation. After verifying details and dimensions provide three sets of final drawings and installation instructions to Engineer for use in observing installation and for record purposes.

PART 2 - MATERIALS AND EQUIPMENT

2.1 STAINLESS STEEL PIPE

A. Pipe 3-inches and smaller shall conform to ASTM A-312, Grade TP 304L. Pipe larger than 3-inches shall conform to ASTM A778-80. Pipe sizes and wall thickness shall conform to ANSI B36.19 as follows:

1.	1-inch and smaller	Schedule 80S
2.	1-1/4-inches through 3-inches	Schedule 40S
3.	3-1/2-inches through 14-inches	Schedule 10S

4. Air headers 4 and 6 inches in diameter shall be fabricated of Schedule 40 stainless steel if stiffening gussets are not used for the diffuser connection.

B. Fittings 3-inches and smaller shall be threaded conforming to ASTM A 403, Class WP. Fittings for buried or submerged pipe larger than 3-inches shall be butt-welded, conforming to ASTM A 403, Class WP. Fittings for above ground or exposed pipe larger than 3-inches shall be flanged as shown.

C. Bolts and nuts for use with flanges shall be Type 304L stainless steel and shall have hexagonal heads and dimensions. Bolts and nuts shall conform to the requirements of ANSI/AWWA C207.

2.2 GALVANIZED STEEL PIPE

A. Galvanized steel pipe shall conform to the requirements of ASTM A120 or ASTM A53.

B. Fittings for use with galvanized steel pipe shall conform to the requirements of ASTM A181. They shall be galvanized in accordance with ASTM A123.

C. Galvanized steel pipe nipples shall conform to the requirements of ASTM A733.

2.3 BLACK CARBON STEEL (BCS) PIPE

A. Black Carbon Steel Pipe, Schedule 40, ¼" thru 4", with welded connections.

B. Materials:

1. Pipe, ¼" through 4", Schedule 40, carbon steel, electric-welded seam or seamless, butt-weld ends.
2. Fittings, ½" through 4", 150 lb, malleable iron, banded, butt weld ends.
3. Branches, ½" through 3", standard weight, forged steel, welding outlet fittings/butt weld ends.
4. Flanges, ½" through 4", Class 150, forged steel, raised face (or faced to match equipment), butt weld ends.
5. Gaskets, 1/16" thick, compressed asbestos.
6. Bolts and Nuts, Carbon steel, hex-head bolts, heavy, semi-finished, cold-punched hex nuts.

C. Specifications:

Specifications	Material ASTM	Dimensional ANSI (MSS)
Pipe	A53, Tp E or S	B36.10
Fittings	A197	B16.3
Branches	A105	--------
Flanges	A105	B16.5
Gaskets	--------	B16.21
Bolts and Nuts	A307, Gr B	B18.2.1, B18.2.2
Bolt Length	--------	B16.5
Bolt Threads	--------	B1.1

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect for defects, damage, dirt and debris in pipe. Clean if necessary. Discard and remove defective materials. Reject pipe found unsatisfactory.

3.2 WELDING

A. Certified welders providing proof of certification will be required. Welding technique shall be heliarc with an argon purge with no x-ray testing of the welds.

3.3 INSTALLATION

A. Install pipes in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Provide supports to prevent strain on joints, valves and equipment.

B. Threaded joints shall have American National Standard Taper Threads conforming to the requirements of ANSI B2.1. Pipe ends shall be reamed out to full size of bore. All burrs and chips shall be removed. Pipe joint cement or paint shall be applied only to the male ends of pipe and joints securely tightened.

C. Welded joints shall be made in conformance with the requirements of AWWA C206, Standard for Field Welding of Steel Water Pipe.

D. Flanged joints shall be installed so that contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

E. Coupling Joints. Pipe ends shall be sufficiently smooth to allow making a water tight joint with the mechanical type couplings specified. The couplings shall be installed, assembled and tightened in accordance with the coupling manufacturer's recommendations.

3.4 TESTING

A. Testing of completed pipelines shall be in accordance with the requirements of Section 01660 of this Specification.

END OF SECTION

SECTION 15062 - DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Install within the project site all materials and incidentals including flanged joint, mechanical joint, push-on joint, and restrained joint ductile iron pipe and/or ductile iron restrained, flanged, or mechanical joint fittings for wastewater and water mains, complete, as shown on the project drawings.

B. The Contractor shall coordinate all deliveries with the related Vendor(s) in a manner not to impede construction on individual projects.

1.2 SUBMITTALS

A. The Contractor shall transmit (from the related Vendor) for submittal to the Engineer, within ten days after receipt of individual Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all ductile iron pipe and fittings.

B. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results. In addition, all ductile iron pipe and fittings to be furnished under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of the disapproved pipe, will be borne by the Vendor.

C. Shop Drawings including layout drawings shall be submitted to the Engineer for approval and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished.

D. The Contractor shall transmit from the Vendor to the Engineer, the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

E. The Contractor shall coordinate all submittals with the related Vendor in a manner not to impede construction on individual projects.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe shall be supplied in lengths not in excess of 21-feet. Buried pipe 4 to 12 inches in diameter shall have mechanical joints fittings. Pipe 14-inches and greater in diameter shall be mechanical joint or rubber-ring type push-on joint as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, Clow-McWane-Tyton, Griffin or approved equal. Push-on and mechanical joints shall be restrained to the lengths of straight pipe as shown in the piping details on the drawings for all bends, tecs, and dead ends. Restraints shall be Megalug by EBAA Iron, Romac, or equal

B. Fittings shall have a pressure rating of 250 psi, shall be ductile iron, and shall meet the requirements of AWWA C110. Gaskets shall be EPDM (Ethylene-Propylene Dine Monomer) such as the "Fastite Gasket" of American Ductile Iron Pipe Co., or approved equal.

C. All ductile iron pipe and fittings shall be lined with cement lining and a 1 mil thick bituminous seal coat or with Protecto 401 ceramic epoxy as listed in the piping schedule in Section 15050.

D. Flanged ductile-iron pipe for above ground piping shall conform to current ANSI A21.15/AWWA C115 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be faced and drilled after being screwed on the pipe with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B16.1, 125 pounds standard.

E. Mechanical joint fittings may be compact ductile iron cast in accordance with ANSI/AWWA C153/A21.53. The working pressure rating for the fittings shall be 350 PSI.

F. Flanged fittings shall be ductile as specified herein. Flanges and flanged fittings shall be flat face and shall conform to ANSI A21.10 for 250 psi pressure rating. Full face type 1/16-inch thick rubber ring gaskets shall conform to AWWA C111.

G. Buried pipe shall be Pressure Class 350 for 4 to 12 inches diameter, Pressure Class 250 for 14 to 20 inches diameter, Pressure Class 200 for 24 inches diameter and Pressure Class 150 for 30 to 64 inches diameter. Flanged or other unburied pipe shall be minimum thickness Class 53.

H. Except as otherwise shown on the Drawings, either mechanical, restrained, or flanged joints shall be used. Prior to commencing work, jointing systems for pipe shall be submitted to the Engineer for approval.

I. Pipe and fittings exposed to view in the finished work to be painted shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Koppers No. 621 Rust inhibitive Primer or approved equal. All other pipe and fittings shall be shop coated on the outside with a 1.0 mils thick bituminous coat in accordance with ANSI A21.51.

1. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a non-bleeding sealer coat such as Inertol Tar Strop, or Mobil Anti-Bleeding Aluminum Sealer. Sealing shall be a part of the work of this Section.

J. Pipe and fittings to be buried shall receive the standard 1-mil tar or asphalt coat on the outside surface in accordance with ANSI/AWWA C151/A21.51.

K. Bolts and nuts on flanged fittings shall be Grade B, ASTM A-307, cadmium plated and conform to ANSI B16.1 for Class 125.

L. All buried ductile iron pipe and fittings shall be provided with a 4-mil thick cross laminated high density polyethylene encasement or an 8-mil thick polyethylene encasement per ANSI A21.5/AWWA C105. Color of encasement shall be in accordance with Manatee County requirements based on the service type of the pipe.

PART 3 - EXECUTION

3.1 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.

C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner.

3.2 UNDERGROUND PIPE INSTALLATION

A. Alignment and Grade: The pipelines shall be laid and maintained to lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.

B. Underground Conflicts: Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of the work and interfere so that an alteration of the Drawings is required, the Engineer will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Engineer, to provide

clearance as required by federal, state, or local regulations or as deemed necessary by the Engineer to prevent future damage or contamination of either structure.

C. Trench Construction:

1. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.

2. Bedding shall be provided and compacted in accordance with the Manatee County Standard Detail for Type A-1 Pipe Bedding.

3. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that slight depression may be provided to allow withdrawal of pipe slings or other lifting-tackle.

4. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves, and fittings for pipe sizes 24-inches or smaller, and 9-inches for pipe 30- inches and larger. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation.

5. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause fulcrum point.

6. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

7. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

8. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.3 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to pipeline material and protective coatings and linings. Under no circumstances shall pipeline materials be dropped off or dumped into the trench. The trench should be dewatered prior to installation of the pipe.

B. All pipe fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the engineer who may prescribe corrective repairs or reject the materials.

C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

D. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

E. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

F. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

H. Joint Assembly: Pipe joints shall be assembled in accordance with the Manufacturer's instructions and the requirements of ANSI/AWWA C600.

I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown in ANSI/AWWA C600.

J. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth and for push-on joint connections, the cut end shall be beveled.

K. Thrust Restraint:

1. All pipe joints, plugs, caps, tees, and bends shall be suitably restrained by attaching metal rods or restrained joints as specified.

2. Thrust-restraint design pressure shall be equal to the test pressure of the line.

3. Restrained mechanical joints utilizing setscrew retainer glands or metal harness and tie rods shall be used in place of concrete. Tie rods or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with ANSI/AWWA C105.

3.4 ABOVE GROUND PIPE INSTALLATION

A. Install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.5 TESTING

A. Hydrostatic pressure and leakage test shall conform with Section 4 of AWWA C600 Specification with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.

B. The pressure required for the field hydrostatic pressure test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure of 150psi. Corporation cocks at least 3/4-inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least one hour. The cost of these items shall be included as a part of testing.

C. The leakage test may be conducted at the same time as the pressure test, and shall be of not less than one hour duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

D. The amount of leakage which will be permitted shall be in accordance with AWWA C600 Standards for all pressure tests. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{133{,}200^*}$$

L = Leakage in gallons per hour
S = Length of pipe in feet
D = Nominal diameter in inches
P = Pressure in psi

* Note: If 20-foot pipe lengths are used, factor to be 148,000

3.6 SURFACE PREPARATION AND PAINTING

A. All piping and fittings exposed to view shall have its surface prepared and be painted with a prime coat as specified in Paragraph 2.1.L. Surface preparation and shop priming is a part of the work of this Section. It shall be part of the work of this Section to assist as required by the Engineer in identifying pipe contents, direction of flow and all else required for proper marking of pipe.

END OF SECTION

SECTION 15064 - PLASTIC PIPE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing plastic pipe and fittings for interior use in pressure or process streams as shown on the Drawings and as specified.

1.2 SUBMITTALS

A. Submit shop drawings shown fabrication of piping to fit equipment, valves and fittings to be used. Indicate gasket and joint allowances, working clearance necessary and supports required.

B. Submit certificate from manufacturer showing compliance with specified standards. Inspect for defects and damage at delivery.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS

A. PVC Plastic Pipe. ASTM D1785, Schedule 40 (Class 1120), for exposed piping and working pressures to 300 psi. PVC threaded pipe shall be ASTM D1785-76, Schedule 80 for underground piping.

1. Pipe shall bear the National Sanitation Foundation seal for potable water pipe and be marked with SDR and class number.

B. Fittings for PVC Plastic Pipe. ASTM D2466 socket fittings for Schedule 40 and ASTM D2467 socket fittings for schedule 80 with ASTM D2564 solvent cement.

C. CPVC Plastic Pipe. ASTM F 441, Schedule 80 CPVC pipe, threaded and socket weld. Pipe shall bear the National Sanitation Foundation seal for potable water pipe and shall be marked with SDR and/or Schedule number.

D. Fittings for CPVC Plastic Pipe. ASTM F-437 threaded fittings and ASTM F-439 socket fittings for Schedule 80 CPVC pipe with ASTM F-493 solvent cement.

E. PVDF Plastic Pipe. ASTM D-3035, Schedule 80 PVDF pipe, threaded and socket weld. Pipe shall bear the National Sanitation Foundation seal for potable water pipe and shall be marked with SDR and/or Schedule number.

F. Fittings for PVDF Plastic Pipe. ASTM D-2657 threaded and socket fittings for Schedule 80 PVDF pipe.

G. High Density Polyethylene Tubing. PE-3408, for potable water. Plastic tubing shall be manufactured from N.S.F. approved prime virgin PE-3408 high density polyethylene resin compound and meet the applicable standards of ASTM

D1248, ASTM D2737, NSF-14 and AWWA C901. All tubing supplied shall be DR-9, C.T.S., with a 200 psi operating pressure at 73.4°F. Approved Products: Driscopipe 5100, Endot/Yardly-Blue Jet.

H. Plastic Pipe shall be colored blue for potable water, green for wastewater and lavender (Pantone 522C) for reclaimed water.

I. Thermal Insulation for PVC Pipe Carrying Liquid Sodium Hydroxide. Pre-formed one-piece sections of fiberglass (minimum density 4 pounds per cubic foot) insulation for pipe and fittings, K-factor of 0.24 BTU-in per hr-. sq. ft-. ° F at 75°F complying with ASTM C585 dimensionally and ASTM E84 for surface burning characteristics of 25/50. Materials shall be Micro-Lok Type AP-T as manufactured by Manville Corporation, TMZ 250 as manufactured by Accessible Products Company, Snap-On as manufactured by Certainteed, or Equal. Pipe and fitting insulation indoors and outdoors shall be covered with a preformed PVC fitting cover. Materials shall be Zeston 2000 as manufactured by Manville Corporation, Thermazip 300 as manufactured by Accessible Products Company, Snap-Form Pipe Fitting System as manufactured by Certainteed, or Equal. Insulation thickness shall be ½-inch for PVC pipe ½" to 3" in diameter. All PVC pipe used for conveying sodium hydroxide (NaOH) solutions shall be insulated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Pipe shall be examined for defects, damage, dirt and debris in pipe. Clean if necessary. Discard and remove defective materials. Reject materials found unsatisfactory.

3.2 INSTALLATION

A. Install PVC, CPVC, PVDF, and HDPE pipe in accordance with the manufacturer's recommendations. Allow solvent weld joints to cure at least 24-hours at temperatures above 40° F before placing in use. Install insulation per manufacturer's recommendations.

B. Pipe shall be installed in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.3 TESTING

A. Test completed piping system in accordance with the requirements of Section 01660 - Testing Adjusting and Balancing of Systems.

END OF SECTION

SECTION 15090 - HOSE RACK, HOSE AND HOSE BIBBS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing a hose rack and hose and various accessories at the locations shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Guardian Fire Equipment, Inc. (Catalog Numbers shown below)

1.3 SUBMITTALS

A. Submit manufacturer's data or catalog sheets showing compliance with specifications and drawings.

PART 2 - MATERIALS AND EQUIPMENT

3.1 HOSE RACK

A. Fabricate the hose rack from 1/4-inch thick aluminum (ASTM B209-Type aa 5052 alloy-H34 Temper).

B. Front and rear plates shall be welded to the curved center portion.

C. Anchor to concrete or masonry with two stainless steel anchor bolts in expansion shields or to handrail with four stainless steel bolts and nuts and two stainless steel pipe clamps.

3.2 HOSE

A. Lightweight, flexible, general duty water service hose.

B. Construction. Tube: SBR rubber; Reinforcement: braided, high-tensile strength cotton cord; Cover: SBR rubber, weather resistant, semi-oil resistant, smooth finish.

3.3 NOZZLE

A. Three-adjustment (solid jet; heavy spray; pin-point) nozzle with fingertip control, rubber inner seal, leakproof, solid brass in combination with a plastic shut-off valve. Valve and knob to be of plastic with die cast chrome plated metal parts.

3.4 HOSE BIBBS (NON-POTABLE)

A. Hose bibbs shall be brass, polished chromium plated, as manufactured by Chicago Faucet Company or approved equal. Contractor shall install a non-potable water sign over every hose bibb connected to a non-potable water line. Letters shall be black on a lavender background (Pantone 522-C). Such signs shall be as shown in the Drawings and shall read:

REUSE WATER
NON-POTABLE

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and as shown on the Drawings.

END OF SECTION

SECTION 15100 - VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves and appurtenances shall be of the size shown on the Drawings and to the extent possible, all equipment of the same type shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. The equipment shall include, but not be limited to, the following:

1. Eccentric Plug Valves
2. Butterfly Valves
3. Resilient Seated Gate Valves
4. Swing Check Valve (Wastewater)
5. Air Cushioned Check Valve
6. Hydrants
7. Mud Valves
8. Ball Valves
9. Air Release Valve
10. Surge Relief Valve
11. Service Saddle and Corporation Stop
12. Valve Actuators
13. Valve Boxes
14. Flange Adapter Couplings
15. Solid Sleeve Couplings
16. Restraining Clamps
17. Mechanical Sleeve Seals
18. Sodium Hydroxide Storage Tank Heat Tracing
19. Sodium Hydroxide Pipe Heat Tracing
20. Eductors

1.2 DESCRIPTION OF SYSTEMS

A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed water, chemicals, wastewater, etc., depending on the applications.

1.3 QUALIFICATIONS

A. All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.4 SUBMITTALS

A. Submit to the Engineer within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01300 and the General Conditions.

1.5 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 - PRODUCTS

2.1 PLUG VALVES

A. All valves shall be eccentric plug valves unless otherwise specified. Valves shall be as manufactured by DeZurik, Homestead or approved equal.

B. Plug valves shall be tested in accordance with current AWWA Standard. Each valve shall be performance tested in accordance with paragraph 5.2 and shall be given a leakage test and hydrostatic test as described in paragraphs 5.3 and 5.4. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.5.

C. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWWA Standard C111-72. Bell ends shall be to the AWWA Standard C100-55 Class B. Screwed ends shall be to the NPT standard.

D. Valve bodies shall be of ASTM A126 Class B Semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA Standard C507-73, Section 5.1 and AWWA Standard C504-70 Section 6.4. Port areas for valves 20-inches and smaller shall be 80 percent of full pipe area. Valves 24 inch and larger shall have a minimum port area of 100 percent of full nominal pipe area. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

E. Valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with current AWWA Standard C-507 Section 8, Paragraphs 8.1, 8.3, and 8.5 and AWWA Standard C-504, Section 10.

2.2 BUTTERFLY VALVES

A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves except for those specified hereinafter, shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, American, Kennedy, Mueller, or equal. Butterfly valves for reclaimed water high service pumps shall be Class 250. The valve discs shall be constructed of ductile iron conforming to ASTM A536, Grade 65-45-12 for Class 150 or less and for Class 250.

B. The face-to-face dimensions of flanged end valves shall be in accordance with AWWA Standard Specification C504 for short-body valves. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1. Mechanical Joint end valve dimensions shall be in accordance with AWWA Standard Specification C504.

C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8 inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where rubber seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where rubber seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housing of the through boss-type. Butterfly valves of the "wafer": or "spool" type will not be accepted.

E. The valve shaft shall be turned, ground, and polished, constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The Class 150 valves shall be tested in conformance with AWWA C504. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve

body of each valve for a period of five minutes. During the hydrostatic test there shall be no leakage through the metal, the end joints or the valve shaft seal. The leakage test for the Class 250 valves shall be performed at a differential pressure of 230 psi and against both sides of the valves. No adjustment of the valves disc will be necessary after pressure test for normal operation of valve.

G. In general, the butterfly valve operators shall conform to the requirements of Section 11 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.

H. Gearing for the operators shall be totally enclosed in a gear case in accordance with the above mentioned AWWA Standard Specification.

I. Operators shall be capable of seating and unseating the disc against the full design pressure or velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

J. All valve operators shall conform to Section 11 of the AWWA Standard Specification and shall be manual unless otherwise shown or specified and shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Operators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions when valve is located above grade. They shall turn counterclockwise to open valves. Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel when valve is located above grade. Operator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme operator position without damage. Valves located above grade shall have handwheel operators, and valves located below grade shall be equipped with a two-inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box. Valve operators shall conform to AWWA C504, latest revision.

K. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of the specifications and the AWWA standard.

L. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.3 RESILIENT SEATED GATE VALVES

A. Gate valves with 4" - 24" diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 of latest revision and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Valves for wastewater service shall be epoxy coated.

B. The valves shall be non-rising stem with the stem made of cast, forged, or rolled bronze shown in AWWA C509. Two stem seals shall be provided and shall be of the O-ring type, one above and one below the thrust collar.

C. The sealing mechanism shall consist of a cast iron gate having a vulcanized synthetic rubber coating, or natural rubber seat ring. The resilient sealing mechanism shall provide zero leakage at 200 psi. differential pressure with the line flow in either direction.

D. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. A handwheel or wrench nut shall be provided for operating the valve. All valves shall be tested in strict accordance with AWWA C509.

E. Valves shall be equal to the following models: American AFC-500, M&H 3067; Kennedy Kenseal-II, Clow 6100, 6103 & 6110; , U.S. Pipe Metroseal 5460.

F. All internal parts shall be removable from the bonnet without removing the body from the pressure main.

G. Discs of valves shall be operated by methods which will allow operation in any position with respect to the vertical. Valves for interior piping or exposed above grade outside structures, shall be handwheel operated. Valves three inches and larger, buried in earth shall be equipped with 2 inch square operating nuts, valve boxes and covers. Valves shall be fitted with joints suitable for the pipe with which they are to be used. The direction of opening for all valves shall be to the left (counter-clockwise).

H. Unless otherwise shown or specified, valves shall be rated at not less than 150 psi cold water, nonshock. The manufacturer's name and pressure rating shall be cast in raised letters on the valve body.

2.4 SMALL GATE VALVES

A. Gate valves 2-1/2-in in diameter and smaller in size, shall have flanged or screwed ends as required; and shall be brass conforming to Federal Specification WW-V-54, Type I or II, solid wedge, rising-stem-type gate valves as manufactured by Jenkins Bros. or equal products as manufactured by Crane, Fairbanks, or Kennedy Valve Mfg. Co. or equal.

2.5 SWING CHECK VALVES (Wastewater)

A. Swing check valves shall conform to the requirements specified in AWWA standard for swing check valves, Type 1BBM, 2-inch through 24-inch N.P.S. (AWWA C508), except as modified or supplemented herein.

B. Valves shall be of the size shown, with cast iron bodies and stainless steel hinge pins with non-lubricated packing glands. Valves shall be non-slam design with outside lever and weight. Disks shall be cast iron, bronze faced. Rubber faced disks shall not be acceptable.

C. Valves shown for interior service or exposed above grade outside shall have flanged ends suitable for use with equipment and piping systems in which they are to be installed.

D. Approved Manufacturers: Mueller, Waterous, Kennedy, American, M&H, Clow.

E. Check valves located aboveground shall receive a primer coat compatible with the finish paint to be applied. Check valves buried belowground shall receive an epoxy coating conforming to ANSI/AWWA C550. The interior ferrous surfaces of all check valves, except stainless steel parts shall receive an epoxy coating conforming to ANSI/AWWA C550.

2.6 AIR CUSHIONED CHECK VALVES

A. Provide air cushioned swing check valves for high pressure reclaimed water pumps.

B. Air cushioned swing check valves shall be constructed of heavy cast iron body, having integral flanges (not Wafer) and a centrifugal cast stainless steel ring, suitable for a working pressure of 125 psi. The seat ring shall be locked in place with stainless steel lock screws and be field replaceable, without use of special tools. The shaft shall be single and continuous stainless steel, extending out both sides of the body with a lever and weight and cushion cylinder mounted on the side.

C. The cushion cylinder assembly shall be externally attached to either or both sides of the valve body and will permit adjustability to cushion the closure of the valve. The cushioning shall be by air and the cushion cylinder shall be fitted with a one way control check for adjustable air compression to prevent slamming.

D. The valve shall prevent backflow of the media on normal pump shut-off or power failure at zero velocity, and be watertight.

E. The disc shall be cast iron, utilizing a double clevice hinge connected to a cast bronze, malleable iron, or ductile iron disc arm. The disc arm assembly shall be suspended from a stainless steel shaft which passes thru a stuffing box on both sides of the valve body.

F. The valve exterior shall be painted for high resistance to corrosion.

G. All materials of construction shall be certified in writing to conform to ASTM specifications as follows.

1.	Body, Cover, Disc	Cast Iron	ASTM A126, Class B
2.	Disc Arm	Ductile Iron	ASTM A536
3.	Seat	Aluminum, Bronze	ASTM B148
		or Stainless Steel	ASTM A276
4.	Disc Seat	Buna-N or Metal to suit	
5.	Cushion Cylinder	Cast Bronze or Steel	Commercial

2.7 FIRE HYDRANTS

A. All fire hydrants shall fully comply with all provisions of American Water Works Association C502 Class 150 (Dry Barrel Fire Hydrants) or the latest revision thereof, including hydrostatic testing, F.M Approved, U.L. Listed (AWWA, U.L. AND F.M. colophons shall be cast in upper barrel of each hydrant) AND MEET THE FOLLOWING SPECIFIC PROVISIONS:

B. Hydrant shall be of the compression type, opening counterclockwise, against the pressure and closing with the pressure. Drain outlet shall be omitted. Hydrant shall be marked with an arrow and the work "open" to indicate the direction to turn for opening.

C. Hydrant bonnet assembly shall be provided with a grease or oil reservoir and lubrication system that automatically circulates lubricant to all operating stem threads and bearing surfaces each time the hydrant is operated. The system shall be completely sealed from the waterway and from external contaminants.

D. All hydrants shall be of the traffic "breakaway type with safety stem coupling and breakable flange that permits full 360° rotation of the nozzle section. Cut down bolts are not acceptable for this requirement. Hydrant shall be capable of being extended without removing any operating parts.

E. Main valve opening of the hydrant shall not be less than 5-1/4" and open against the pressure.

F. Hydrant nozzles shall consist of two 2½-inch hose nozzles and one 4½-inch pumper nozzle. Threads on these nozzles shall be American National Standard for screw threads and gaskets for fire hose couplings. All nozzles shall be field replaceable with non-corrosive locking devices. Caulked nozzles shall be prohibited. Each nozzle cap shall be provided with a Buna-N rubber washer.

G. The hydrant shall be so designed to permit the removal of all working parts, by one person, from the hydrant up through the barrel without disturbing the earth around the hydrant.

H. An all bronze hydrant valve seat ring shall thread directly into an all bronze ring and shall be located between the lower hydrant barrel and base securely retained in this position. Upper valve plate shall be B62 bronze, or epoxy coated.

I. The hydrant shall be designed with an anti-friction bearing so located that it will reduce the torque required to operate the hydrant. All stem pins shall be stainless steel.

J. The operating stem, safety stem coupling and main valve assembly shall be capable of withstanding an application of 200 ft-lbs. Of torque against either the full open or closed position with no damage to components. Downward stem travel shall be limited by a travel stop located in the upper housing of the hydrant or a stop in the shoe assembly.

K. Operating nut and nozzle cap wrench nuts shall conform to existing specifications for this utility. The opening between the operating nut and dome shall have a weather shield or seal.

L. The ferrous waterway of the hydrant's shoe shall be epoxy coated. The shoe assembly shall be designed to allow all of the MJ Gland tee bolts to be inserted from the shoe body side.

M. Inlet shall be 6" MJ, centerline of pumper connections shall be a minimum of 17" above ground line. Ground line shall be 3" or less below break flange. Hydrant shall be painted with two coats of safety yellow. Only factory authorized repair parts and extensions will be acceptable. APPROVED PRODUCTS AS MODIFIED TO MEET THE ABOVE SPECIFICATIONS: AMERICAN B-84-B, MUELLER A-423 Kennedy K-81, M&H 929.

N. All ductile iron parts below ground shall be pained with two coats of asphalt varnish per AWWA C502.

2.8 MUD VALVES

A. All mud valves shall be iron body bronze mounted designed for waterworks, sewage and/or filtration plants installations. Provide non-rising stem type with cast iron body. Stem, stem nut, disc ring and seat ring shall be bronze. All bolts and nuts shall be stainless steel.

B. Provide handwheel operation for this installation.

C. Provide extensions as required to complete installation to proper grade.

D. Valves shall be as manufactured by DeZurick, Homestead or approved equal.

2.9 PVC BALL VALVES

A. PVC ball valves shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan, Inc., Plastiline, Inc., or equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.10 TYPE 316 SS BALL VALVE

A. Type 316 stainless steel ball valve, 3-piece body construction, reinforced TFE seat, threaded end connections, 150 psig pressure rating.

2.11 AIR RELEASE VALVES

A. Provide and install air release valves in the Reclaimed Water High Service Pump Station as shown on the drawings. General locations of air release valves are as follows:

1. Reclaimed Water High Service Pump Station: "Well Service" Air Valve on Pump discharge pipe.

B. "Well Service" Air Valves

1. The air valves shall be designed to exhaust air which is present in the pump column on pump start-up and allow air to re-enter the column on pump shut-down. Valves shall have the same size inlets and outlets. All valves will be constructed of cast iron body and cover with stainless steel trim and float. The stainless float shall seat against a Buna-N seat to insure positive closure.
2. Sizes 1" to 3" will be equipped with a stainless steel diffuser screen to break up the solid water column before coming in contact with the float.
3. Sizes 4" and larger will be equipped with an anti-slam device which will throttle the flow of water into the air valve. The anti-slam device shall be so designed to permit full unrestricted flow of air both in and out of the air valve, but reduce the flow area for water to approximately 10%.
4. Valves shall be as manufactured by Val-Matic Valve & Mfg. Corp., Series #100WS or approved equal.
5. Valve Schedule

Location	Reclaimed Water High Service Pump Station
Pump Nos.	5 & 6
Pump Capacity-GPM	4,200
Quantity of ARV's	2
Valve Size-Inches	4
Inlet Size-Inches	4
Outlet Size-Inches	4
Max. Water Pressure-psi	150
Model No.	104WS

2.12 SURGE RELIEF VALVE

A. Provide and install a surge relief valve on the Reclaimed Water High Service Pump Station discharge header as shown on the drawings. Valve shall open when transmission main pressures exceed 150 psi.

B. The surge relief valve shall function to open to atmosphere when system pressure exceeds the pilot valve setting. The surge relief valve shall open rapidly and close slowly at a predetermined rate of speed. Controls shall be provided to regulate the closing speed of the valve.

C. The valve shall be of the globe body design with inlet pressure entering the valve under the piston. The valve shall be capable of installation in any position without impairing its functional valve.

D. The valve shall be hydraulically operated, designed with a differential type piston that will expose a greater area to the closing force than to the opening force. A vent to atmosphere from the side of the valve body shall produce the differential piston area and provide shock absorption, preventing hammer and shock.

E. The valve shall provide a full pipeline opening when opened at its full strcke, and shall drop tight when closed. The relief valve will be capable of being opened at any time by exhausting the pressure above the piston to atmosphere.

F. The liner and piston shall be equipped with renewable elastomer cups and the piston shall additionally have a leather or elastomer seat ring. All wear on the valve shall be absorbed by the cups and seat ring and there shall be no metal contacts within the main valve.

G. The pilot valve shall be the diaphragm operated, spring loaded type, single-seated, balanced design. Adjustment of the opening pressure of the main valve shall be accomplished by regulation of the pilot handwheel with a range of 20 psi.

H. Materials:

1. Main Valve:

   a) Body Lid: High grade cast iron ASTM A-126, Class B
   b) Piston: Stainless Steel, SAE 303
   c) Liner: Stainless Steel, SAE 303
   d) Seat: Stainless Steel, SAE 303

2. Pilot Valve: Body: Stainless Steel, SAE 303

I. Size: 6 inches

J. Ends: Flanged

K. Class: 150

L. Relief Pressure: 150 psi

M. Manufacturers:

1. Bermad Model 730
2. GA Industries Fig 6700-D
3. or Equal

2.13 SERVICE SADDLE AND CORPORATION STOP

A. Service saddle shall have a brass body, double stainless steel straps, O-ring sealed outlet, and 1 to 2-inch tap, meeting all applicable parts of ANSI/AWWA C800 and suitable for 200 psig maximum working pressure. Corporation stop shall be manufactured from 85-5-5-5 ASTM B62 brass, have double O-ring seals, a 1 to 2-inch copper flare compression outlet connection, PTFE coated ball, 1 to 2-inch AWWA taper inlet threads, suitable for a maximum working pressure of 300 psi, and manufactured to AWWA C800 standard.

2.14 VALVE ACTUATORS

A. General

1. All valve actuators shall conform to Section 3.8 of the AWWA Standard Specification and shall be manual.
2. Actuators shall be capable of seating and unseating the disc against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.

B. Manual Actuators: Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme actuator positions without damage. Valves located above grade shall have handwheel and position indicator. Valves located below grade shall be equipped with a two inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box.

2.15 VALVE BOXES

A. All buried valves shall have cast-iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be two-piece , sliding type, having 5 1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "WATER", "SEWER", or 'RECLAIM', as applicable, cast into the top. All valves shall have actuating nuts extended to top of valve boxes. Valve boxes shall be provided with concrete base.

2.16 FLANGE ADAPTER COUPLINGS

A. Flange adapter couplings shall be of the size and pressure rating required for each installation and shall be suitable for use on either cast iron or ductile iron pipe. They shall be similar or equal to Dresser Company, Style 128. All couplings shall have a sufficient number of factory installed anchor studs to meet or exceed the test pressure rating for this project, 150 psi minimum.

2.17 SOLID SLEEVES

A. Solid sleeve couplings shall be used in locations as shown on the Drawings.

1. Solid sleeve type couplings shall be used with all buried piping. The couplings shall be of ductile iron meeting the requirements of ANSI/AWWA C110/A21.10 as manufactured by U.S. Pipe, American Cast Iron Pipe, McWane, or Equal. Solid sleeves shall be furnished with mechanical joint fittings. The solid sleeve coupling shall be provided with 316 stainless steel bolts and nuts unless indicated otherwise.
2. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.18 RESTRAINING CLAMPS

A. Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the drawings, shall be as manufactured by EBAA Iron Sales, Inc., Eastland, TX, or Equal.

2.19 MECHANICAL SLEEVE SEALS

A. Sleeve seals shall be the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing and elements to expand when tightened, providing watertight seal and electrical insulation. Bolts shall be stainless steel. Sleeve seals shall be Link-Seal as manufactured by Thunderline Corporation, or approved equal.

2.20 SODIUM HYDROXIDE STORAGE TANK HEAT TRACING

A. Contractor shall provide constant wattage heating pads suitable for installation on FRP tanks. Tank information is as follows:

1. Diameter: 4'-0"
2. Height: 5'-6"
3. Bottom is flat resting on a concrete slab.
4. Top has one manhole.
5. Material is fiberglass reinforced plastic made from dark pigments.
6. Fluid is 50% sodium hydroxide.
7. Minimum fluid temperature: 50°F.
8. Minimum ambient temperature: 20°F.

B. Materials:

1. The tank heaters shall consist of constant wattage heating pads suitable for installation on FRP tanks. The heaters shall come with power outputs up to 420 watts.
2. Voltage: 240 volts AC.
3. Watt Density: 0.6 Watts/in^2
4. Materials: Stainless steel and silicone rubber.
5. T-rating: T4A (248°F).
6. Minimum and maximum dimensions: 14" x 24" to 24" x 36".
7. Installation kit for tank heaters shall be provided.
8. Thermostatic Control of Tank Heaters:

   a) Provide thermostatic control of tank heaters.
   b) Thermostat sensor shall be "in-fluid" using a thermowell protruding through the tank wall and into the fluid. Control of the heaters shall be achieved using a solid-state control device that receives its input from an RTD inside the thermowell. The thermostat shall turn the heaters on at any temperature below 51°F and turn the heaters off at any temperatures above 55°F.

C. Manufacturer and Model

1. Raychem Corp., Chemelex Division, Menlo Park, CA; Model RHS-L.

2.21 SODIUM HYDROXIDE PIPE HEAT TRACING

A. All pipelines carrying liquid sodium hydroxide shall be heat-traced. The pipeline information is as follows:

Pipeline Description	Diameter (in.)	Length (ft.)	Material
Storage Tank Fill Line	2	15	Sch. 80 CPVC
Pump Suction Line	2	10	Sch. 80 CPVC
Pump Suction Line	½	2	Sch. 80 CPVC

B. Each pipeline shall have 2 ball valves, one at each end.

C. Other pipeline information:

1. Minimum pipeline temperature: 50°F.
2. Minimum ambient temperature: 20°F.
3. Minimum pipe insulation thickness: ½-inch.

D. Materials:

1. Self regulating heating cable:

   a) The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used

directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185°F or 85°C) without use of thermostats.

b) The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in a type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.

c) In order to provide rapid heat-up, to conserve energy, and to prevent overheating of fluids and plastic pipe, the heating cable shall have the following minimum self-regulating indices:

Heating Cable	S.R. Index (W/°F)	S.R. Index W/°C)
3 W/ft	0.038	0.068
5 W/ft	0.060	0.108
8 W/ft	0.074	0.133
10 W/ft	0.100	0.180

The self-regulating index is the rate of change of power output in watts per degree Fahrenheit or watts per degree Celsius, as measured between the temperature of 50°F (10°C) and 100°F (38°C) and confirmed by the type test and published data sheets.

d) In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self-ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350°F (177°C) for 30 minutes. After the test, if the cable is reenergized, it must not have an increasing power output leading to thermal runaway.

e) The heating cable shall be BTV-CT, with continuous exposure (maintain) capacity up to 150°F (65°C) and intermittent exposure capability up to 185°F (85°C), as manufactured by the Chemelex Division of Raychem Corporation.

2. Thermostat Controls:

a) Pipe temperature shall be maintained by providing a line-sensing thermostat that will enable and disable electric current flow in both buses of the heat-tracing cable.

b) One thermostat and pipeline temperature sensor shall be provided for each heat-traced pipeline.

c) Temperature sensor shall be a fluid-filled (silicone) bulb and 9-foot capillary. Sensor material shall be 300 series stainless steel.

d) Thermostat shall activate heat tracing cable at a temperature below 51°F and deactivate heat-tracing cable at a temperature above 56°F.

e) Thermostat and pipeline temperature sensor shall be Model No. AMC-2B as manufactured by Raychem Corporation, Chemelex Division of Raychem Corporation. Menlo Park, CA or approved equal.

2.22 EDUCTORS

A. Provide and install liquid operated eductors for pumping air in the Flow Equalization Tank as shown on the Drawings.

B. Specifications

1. Manufacturer and Model: Penberthy Model Jet #LL 3" PVC, or Equal.
2. Fabrication Material: PVC.
3. Material to be Pumped: Air (Atmospheric).
4. Operating Medium: Wastewater.
5. Air Inlet Diameter: 3 inches.
6. Wastewater Inlet Diameter: 2 inches.
7. Discharge Diameter: 3 inches.
8. Throat Diameter: 0.906 inch.
9. Wastewater Flow: 100 GPM.
10. Air Flow: 50 SCFM.
11. Wastewater Pressure: 20 psi.
12. Discharge Pressure Range: 0 to 8 psi.
13. Nominal Discharge Pressure: 5 psi.

C. Piping: Provide all piping required for complete working eductor units.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.

E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.

F. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.

G. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.2 RESTRAINING CLAMPS AND TIE RODS ON PIPE RUN

A. Restraining clamps and tie rods shall be used on all pipe runs, as directed by the Engineer and/or shown on the Drawings. Restraining devices shall be JCM Industries, Inc. - Sur-Grip, Ebba Iron, Inc. - Megalug, Romac, or approved equal. Other types shall be submitted to the Engineer for approval.

3.3 SHOP PAINTING

A. Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.4 FIELD PAINTING

A. All metal valves and appurtenances specified herein and exposed to view will be painted a color appropriate to its usage in accordance with the color code.

3.5 INSPECTION AND TESTING

A. Completed pipe shall be subjected to hydrostatic pressure test for four hours at full working pressure. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

SECTION 15102 - POWER-ACTUATING DEVICES FOR VALVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing power-actuating devices that are externally mounted on plug and butterfly valves as shown on the Drawings and as specified. Actuator types included are electric-motor type producing a multiturn rotary motion or used to drive a gearhead for a quarter-turn application.

1.2 SUBMITTALS

A. Coordinate with Instrumentation and Valve suppliers. Check installation arrangements to prevent conflicts with piping and other equipment. Provide three sets of final Shop Drawings to Engineer for use in observing installation and for record purposes.

B. Submit certificates from manufacturer showing compliance with specified requirements and standards.

1.3 QUALITY ASSURANCE

A. Power-actuating devices shall conform to the requirements of ANSI/AWWA C540 except as modified in this Section.

B. Actuators shall be assembled to valves at the valve manufacturer's factory, bench tested for alignment, and shipped to the job site as a complete assembly.

1.4 ACCEPTABLE MANUFACTURERS

A. Subject to complying with specified requirements, manufacturers offering actuators which are acceptable for use on this project are limited to the following:

1. Limitorque
2. EIM or
3. Rotork

PART 2 - MATERIALS AND EQUIPMENT

2.1 ACTUATOR SIZING

A. Actuators shall be sized for the required operational characteristics of the valves as listed in the Valve Actuator Data Sheet and for the required torque or thrust, shaft diameter, thread characteristics and keyway dimensions of the valve actually furnished.

2.2 ELECTRIC MOTORS

A. Electric motors shall have Class F insulation.

B. Electric motors shall be for three phase power unless otherwise shown.

C. Motor enclosures shall be as listed in the Valve Actuator Data Sheet.

D. Motors in modulating service shall be capable of 100 starts per hour.

2.3 ELECTRICAL CONTROLS

A. Electric control enclosures shall be as listed on the Valve Actuator Data Sheet.

B. Components of the electrical controls shall be coordinated with the requirements of instrumentation Sections of the Specification.

C. Provide control options and accessories required by the particular application as shown or specified in Instrumentation and Control schematics and Specifications. Equipment required may include but is not limited to reversing contactors mounted inside the motor operator, control transformers, additional limit switches and feed-back potentiometer.

D. Components required to perform the specified control functions shall be provided. All interposing wiring shall be brought to heavy duty terminal strips within the actuator.

E. Limit switches shall not be subject to breakage from over travel.

F. Switch design shall permit visible verification of switch position without disassembly. Position limit switches and torque switches shall be heavy duty, NEMA 1CS-2-125, rated for 600 volts.

2.4 POSITION INDICATION

A. Provide a dial to indicate valve position at all times during power or manual operation. In addition indicator lights shall be furnished to show valve open-close position.

2.5 PAINTING AND COATINGS

A. Actuators shall be painted in accordance with the requirements of the specified Standard with finish coats and colors conforming to the requirements of Sections 09900 and 09902 of these Specifications.

PART 3 - EXECUTION

3.1 SHIPPING, HANDLING AND STORAGE

A. Assembled actuators and valves shall be packaged, shipped and stored in accordance with the requirements of the specified Standard.

3.2 INSTALLATION

A. Install assembled actuators and valves as specified for valve installations. Make necessary piping, electrical and instrumentation connections.

3.3 TESTING

A. After installation, test valves and actuators in accordance with the requirements of Section 01660, Testing, Adjusting, and Balancing.

VALVE ACTUATOR DATA SHEET

1. Number assigned to valve on "C" and "P" Plans. Quantity of valves on this project underneath in parentheses()..
2. Nominal diameter of valve.
3. Type of valve: Gate, Ball, Plug, Butterfly.
4. Maximum differential pressure across closed valve at time of actuation.
5. Stroking time: Time for full travel operation of valve.
6. Available Voltage.
7. Maximum flow rate through the fully open valve at time of actuation.
8. Type of valve operation required: Open-Close; Throttle; Modulate.
9. Electric enclosure required: NEMA 4 (Water-tight); NEMA 6 (Submersible); NEMA 7 (Hazardous).

1	2	3	4	5	6	7	8	9
Valve No.	**Valve Diameter**	**Valve Type**	**Max.Diff. Pres.**	**Stroking Time**	**Voltage**	**Max. Flow Rate**	**Type of Operation**	**Electrical Enclosure**
CV-208	6"	Plug	50 psi	60 sec.	480 3-Phase	500 gpm	Modulate	NEMA 4
CV-212	18"	Plug	10 psi	60 sec	480 3-Phase	3,000 gpm	Modulate	NEMA 4
CV-217	24"	Butterfly	150 psi	60 sec.	480 3-Phase	7,000 gpm	Open-Close	NEMA 4
CV-218	18"	Butterfly	150 psi	60 sec.	480 3-Phase	7,000 gpm	Open-Close	NEMA 4
CV-509	8"	Plug	50 psi	60 sec.	480 3-Phase	800 gpm	Modulate	NEMA 4
CV-510	8"	Plug	50 psi	60 sec.	480 3-Phase	800 gpm	Modulate	NEMA 4

END OF SECTION

SECTION 15111 - TELESCOPIC VALVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing telescopic valves as shown on the Drawings and as specified.

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Enviroquip
2. Envirex, Inc.
3. Waterman Industries, Inc.

1.3 SUBMITTALS

A. Submit Certificate of Compliance with requirements.

PART 2 - MATERIALS AND EQUIPMENT

2.1 TELESCOPIC VALVES

A. The valves shall be of the non-rising stem type, designed to provide the vertical travel shown on the Drawings.

B. Slip Tube. Slip tube shall be welded Type 304 stainless steel with a minimum wall thickness of 1/8-inch. Tube length shall be as shown on the Drawings.

C. Receiving Tube. The receiving tube shall be ductile iron pipe.

D. Connecting bails and hardware shall be stainless steel.

E. Two rectangular weirs located 180° apart to control sludge withdrawal shall be provided at the top of the tube.

F. Seal Flange. A cast iron or stainless steel companion flange and neoprene or Buna-N gasket or teflon packing ring shall be used to provide a friction seal around the sliding tube.

G. Stem and Operator. A minimum 1-inch diameter solid Type 304 stainless steel rod shall bolt to the bail to connect the valve to the operator. The manual operator shall consist of a cast iron floorstand with a minimum 12" diameter cast iron handwheel and bronze thrust collar lift nut assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 15120 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes the piping specifications required for this project as shown on the Drawings and as specified.

B. Type of piping specialties specified in this section include the following:

1. Pipe Escutcheons
2. Dielectric Unions
3. Mechanical Sleeve Seals
4. Fire Barrier Penetration Seals
5. Water Hammer Arresters
6. Drip Pans
7. Pipe Sleeves
8. Sleeve Seals
9. Cleanouts Outside Building

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications. Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards. Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

PART 2 - MATERIALS AND EQUIPMENT

2.1 PIPING SPECIALTIES

A. Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 PIPE ESCUTCHEONS

A. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas. For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas. Provide sheet steel escutcheons, solid or split hinged.

D. Available Manufacturers. Subject to compliance with requirements, manufacturers offering pipe escutcheons which may be incorporated in the work include; but are not limited to, the following:

1. Chicago Specialty Mfg. Co.
2. Producers Specialty & Mfg. Co.
3. Sanitary-Dash Mfg. Co.

2.3 DIELECTRIC UNIONS

A. Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance)# prevent galvanic action, and stop corrosion.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include; but are not limited to, the following:

1. B & K Industries, Inc.
2. Capital Mfg. Co.; Div. of Harsco Corp.
3. Eclipse, Inc.
4. Epco Sales, Inc.
5. Perfection Corp.
6. Rockford-Eclipse Div.

2.4 MECHANICAL SLEEVE SEALS

A. Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing and elements to expand when tightened, providing watertight seal and electrical insulation.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering mechanical sleeve seals which may be incorporated in the work include; but are not limited to, the following:

1. Thunderline Corp.

2.5 FIRE BARRIER PENETRATION SEALS

A. Provide UL rated sealing system for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork. Verify piping and penetration material with UL system used with UL fire resistance directory.

1. Cracks, Voids, or Holes Up to 4-inch Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

2. Openings 4-inches or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F (121 to 177°C), UL-listed.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering fire barrier penetration seals which may be incorporated in the work include; but are not limited to, the following:

1. 3M Fire Protection Products

2.6 WATER HAMMER ARRESTERS

A. Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering water hammer arresters which may be incorporated in the work include; but are not limited to, the following:

1. Amtrol, Inc.
2. Smith (Jay R.) Mfg. Co.
3. Tyler Pipe; Sub. of Tyler Corp.
4. Zurn Industries, Inc.; Hydromechanics Div.
5. Josam

2.7 CLEANOUTS OUTSIDE BUILDING

A. Cleanout on Grade (COG). Coated cast iron cleanout with square, heavy duty, scoriated nickel bronze top, adjustable to finished grade. Provide 16" x 16" x 4" concrete pad around cleanout. Install pad and cleanout flush with grade.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering cleanouts which may be incorporated in the work include; but are not limited to, the following:

1. Zurn Industries, Inc.
2. Josam

2.8 FABRICATED PIPING SPECIALTIES

A. Drip Pans. Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2-inches and overlap equipment by 4-inches. Reinforce top, either by structural angles or by rolling top over 1/4-inch steel rod. Provide hole, gasket, and flange at low point for watertight joint and I-inch drain line connection.

B. Pipe Sleeves. Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages; 3-inches and smaller, 20 gage; 4-inches to 6-inches 16 gage, over 6-inches, 1 gage.
2. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.
4. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

C. Sleeve Seals. Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

1. Lead and Oakum: Caulked between sleeve and pipe.
2. Mechanical Sleeve Seals: Installed between sleeve and pipe.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons. Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Dielectric Unions. Install at each piping joint between ferrous and non-ferrous piping and at all hot and cold water connections to water heaters. Comply with manufacturer's installation instructions.

C. Mechanical Sleeve Seals. Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

D. Fire Barrier Penetration Seals. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions.

E. Water Hammer Arresters. Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans. Locate drip pans under piping passing over or within 3-feet horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect I-inch drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Pipe Sleeves. Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/2-inch above level floor finish, and 3/4-inch above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other material from entering sleeves.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
2. Install iron-pipe sleeves at exterior penetrations; both above and below grade.
3. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.

C. Sleeve Seals. Install in accordance with the following:

1. Lead and Oakum: Fill and pack annular space between sleeve and pipe with oakum, caulk with lead, on both sides.

END OF SECTION

SECTION 15131 - PRESSURE GAGES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing pressure gages of the type indicated and in the locations shown on the Drawings and as specified.

B. Gages shall be the following type:

1. Pressure Gages
2. Accessory Items

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Gages and Tools. Ashcroft; Crosby; Marshalltown; Marsh, or equal.
2. Gage Protectors. Red Valve Co., Inc ., or equal.

1.3 SUBMITTALS

A. Submit Certificate of Compliance with referenced standards.

B. Submit manufacturers catalog data and descriptive literature. Call out materials of construction by ASTM reference and grade.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GAGE DESIGN

A. Gages 4-1/2-inches and larger shall comply with ANSI B40.1, Grade 2A. Gages shall incorporate the following features:

1. Solid or open front with side or rear blowout relief.
2. Pressure tight.
3. 270-degree arc with adjustable pointer.
4. Stem mounted.
5. Hermetically sealed unless specified to be liquid filled.

B. Size of gage shall be 4-1/2-inches, unless otherwise indicated on the Drawings. Stem or connection size shall be 1/2-inch, except that gages connected to gage protector spools or rings shall have 1/4-inch connections. The gage shall be filled with glycerin or silicone. Pressure range shall be:

1.	Plant Drain P.S.	0 - 50 psi
2.	Reject P.S.	0 - 50 psi

3.	Flow Equalization Return P.S.	0 - 50 psi
4.	Flow Equalization Recirculation	0 - 100 psi
5.	Reclaimed Water High Service Pumps	0 - 150 psi
6.	RAS Pumps	0 - 50 psi
7.	WAS Pumps	0 - 50 psi
8.	Thickened Sludge Pumps	0 - 150 psi

2.2 MATERIALS

A. Materials of construction shall be as shown in the following table.

	Item	Material	Specification
1.	Case	Stainless steel	AISI 316
2.	Bourdon Tube	Stainless steel	AISI 316
3.	Windows	Acrylic plastic	--------
4.	Ring	Stainless steel	AISI 316
5.	Stem	Stainless steel	AISI 316
6.	Dial face	Aluminum with clear baked on acrylic coating	6061-T6, ASTM B 209

2.3 GAGE PROTECTORS

A. Gage protectors shall consist of three parts: a flexible, impermeable, elastomer cylinder; a captive sensing liquid; and a steel housing. The process liquid pressure shall be transmitted through the elastomer-lined cylinder wall and the sensing liquid to the pressure gage. An attached 4-1/2-inch pressure gage shall indicate the pressure. Gage outlet in the spool or ring shall be threaded, 1/4-inch, per ANSI B2.1. Spools of sizes 1-inch through 4-inches shall be of the isolation-spool type with flanged ends. Spools of sizes 6-inches through 24-inches shall be of the isolation-ring type, fitting between two adjacent flanges. Determine the flange rating based on the test pressure shown in the piping schedule on the Drawings. For test pressures 200 psi and less, use Class 150 flanges, ANSI B16.5. For test pressures greater than 200 psi, use Class 300 flanges, ANSI B16.5. Materials of construction shall be as follows:

	Item	**Material**	**Specification**
1.	Housing flanges	Carbon steel	ASTM A 36, A53 (Type E or S) A 135, A283, A 285, or A570
2.	Flexible cylinder	Buna N or Neoprene	
3.	Sensing liquid	Silicone oil	

2.4 PIPE NIPPLES AND FITTINGS

A. Nipples for connecting gages to piping shall be Schedule 80S, Grade TP 304 seamless stainless steel, conforming to ASTM A 312. Fittings shall conform to ASTM A 403, Class WP (304). Threads shall conform to ANSI B2.1. Size of pipe nipple shall match the gage connection size.

2.5 TOOLS FOR GAGES

A. Provide one gage tool kit, containing a hand jack set, screwdriver, five reamers (minimum), two pin vise holders, wiggler, tweezer, and carrying case.

2.6 GAGE COCKS

A. Gage cocks shall be three way. Gage cocks shall be brass or bronze, ASTM B16 or B62. End connections shall be NPT, female. Cocks shall be Crane 306, Lunkenheimer 573, or equivalent.

PART 3 - EXECUTION

Install gages before conducting pressure tests. Do not disassemble gages from the factory-assembled diaphragm seals or isolation sleeves or rings.

END OF SECTION

SECTION 15140 - SUPPORTS AND ANCHORS (HVAC)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing supports and anchors required by this Section as specified in other Division 15 Sections or as shown on the Drawings and as specified.

B. Types of supports and anchors specified in this section include the following:

1. Horizontal-Piping Hangers and Supports
2. Vertical-Piping Clamps
3. Hanger-Rod Attachments
4. Saddles and Shields
5. Miscellaneous Materials
6. Anchors
7. Equipment Supports

C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 15 sections.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications. Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

C. MSS Standard Compliance:

1. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
2. Select and apply pipe hangers and supports, complying with MSS SP-69.
3. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
4. Terminology used in this section is defined in MSS SP-90.

1.3 SUBMITTALS

A. Submit Certificate of Compliance along with manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

PART 2 - MATERIALS AND EQUIPMENT

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, or one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems. All other piping systems shall have 304 stainless steel hangers and supports.

B. Adjustable Steel Clevis Hangers. MSS Type 1. 316 SS

C. Steel Double Bolt Pipe Clamps. MSS Type 3. 316 SS

D. Steel Pipe Clamps. MSS Type 4. 316 SS

E. Pipe Hangers. MSS Type 5. 316 SS

F. Adjustable Swivel Pipe Rings. MSS Type 6. 316 SS

G. Adjustable Steel Band Hangers. MSS Type 7. 316 SS

H. Adjustable Band Hangers. MSS Type 9. 316 SS

I. Adjustable Swivel Rings, Band Type. MSS Type 10. 316 SS

J. Split Pipe Ring. MSS Type 11. 316 SS

K. Extension Split Pipe Clamps. MSS Type 12. 316 SS

L. U-Bolts. MSS Type 24. 316 SS

M. Clips. MSS Type 26. 316 SS

N. Pipe Saddle Supports. MSS Type 36, including galvanized steel pipe base-support and cast-iron floor flange.

O. Pipe Stanchion Saddles. MSS Type 37, including galvanized steel pipe base support and cast-iron floor flange.

P. Adjustable Pipe Saddle Supports. MSS Type 38, including galvanized steel pipe base support and cast-iron floor flange.

2.2 VERTICAL-PIPING CLAMPS

A. Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select sizes of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems. All other piping systems shall use 304 stainless steel hangers and supports.

B. Two-Bolt Riser Clamps. MSS Type 8. 316 SS

2.3 HANGER-ROD ATTACHMENTS

A. Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems. Provide 304 stainless steel hanger rod attachments for all other piping systems.

B. Steel Turnbuckles. MSS Type 13. 316 SS

C. Swivel Turnbuckles. MSS Type 15. 316 SS

D. Malleable Iron Sockets. MSS Type 16.

2.4 BUILDING ATTACHMENTS

A. Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper piping systems. Provide 304 stainless steel building attachments for all other piping systems.

B. Concrete Inserts. MSS Type 18. 316 SS

C. Steel Brackets 316 SS. One of the following for indicated loading:

1. Light Duty: MSS Type 31
2. Medium Duty: MSS Type 32.
3. Heavy Duty: MSS Type 33.

2.5 SADDLES AND SHIELDS

A. Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields. MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation. 316 SS

C. Available Manufacturers. Subject to compliance with requirements, manufacturers offering thermal hanger shields which may be incorporated in the work include, but are not limited to, the following:

1. Elcen Metal Products Co.
2. Pipe Shields, Inc.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Available Manufacturers. Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, but are not limited to, the following:

1. B-Line Systems, Inc.
2. Carpenter and Patterson, Inc.
3. Corner & Lada Co., Inc.
4. Elcen Metal Products Co.
5. Fee & Mason Mfg. Co.; Div. Figgie International
6. ITT Grinnel Corp.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing. Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars. Provide products complying with ASTM A 36.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which supports and anchors are to installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

D. Provisions for Movement. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

E. Load Distribution. Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes. Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

3.5 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Anchor Spacings. Where not otherwise indicated, install anchors at end of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.6 EQUIPMENT SUPPORTS

A. Provide structural steel stands to support equipment not floor mounted. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank supports for tanks mounted on wall.

3.7 ADJUSTING AND CLEANING

A. Hanger Adjustments. Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustments. Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15141 - PIPE SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General

1. Furnish all labor, materials, tools, equipment and services for all pipe support and anchor systems, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. The layout of pipe supports is the responsibility of the Contractor, and must take into consideration pipe material, joint type, location, and other requirements of these specifications.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. American National Standards Institute (ANSI).
2. American Society of Mechanical Engineers (ASME).
3. American Society for Testing and Materials (ASTM).
4. ASTM A575 Merchant Quality Hot-Rolled Carbon Steel Bars.
5. American Welding Society (AWS).
6. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
7. MSS SP-58-67 Pipe Hangers and Supports - Materials and Design.
8. MSS SP-69-66 Pipe Hangers and Supports - Selection and Application.
9. National Bureau of Standards (NBS)
10. NBS Handbook H-28.

1.3 SUBMITTALS

A. See Section 01340.

B. Submit itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.

C. Submit scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanize all structural steel angles, rods, channels, special devices integral to pipe support systems. Locate supports and accessories to support pipe system at concentrated loads and in accordance with minimum suggested by MSS SP-69-66.

2.2 PIPE SADDLES

A. Provide pipe support saddles for pipe supported from the floor, unless otherwise indicated on the drawings. Pipe saddles equal to B-Line Figure B3092, or equal.

B. Use Schedule 40 galvanized steel support pipe risers and floor plate recommended by saddle manufacturer.

2.3 WALL BRACKETS

A. Provide wall bracket supports for pipe located near walls, including all horizontal pipe and all vertical pipe 8-feet or more above floor elevation or as indicated on the drawings. Provide wall brackets at all changes of direction and as shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supports capable of supporting the pipe for all service and testing conditions. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

B. Install pipe support system in accordance with highest industry practices, and in full accordance with manufacturer's recommendations. Adjust supports and hangers to allow for proper pitch of pipes.

C. Ensure design, materials of construction, and installation of pipe hangers, supports, guides, restraints, and anchors for chemical and waste piping are in accordance with ANSI B31.3, and MSS Standard SP-58 and SP-69, except where modified by this specification.

D. Check all physical clearances between piping, support system, and structure. Provide for vertical adjustment after erection.

E. Provide piping system exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition. Movements from trap discharge, water hammer, and similar internal forces are included in this requirement. No system will be accepted until the adequacy and safety of the system is assured under all anticipated conditions of operation.

F. Weld supports in accordance with the requirements of AWS Code D1.1 Structural Welding.

G. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

H. After erection of piping systems, and prior to pipe testing and flushing, inspect for adequacy of clearance for piping and supports.

I. Support pipes for lateral movement with clamps or brackets.

J. Provide 20-gauge galvanized steel pipe saddle for fiberglass and plastic support points to insure minimum contact width of 4 In.

3.2 SUPPORT SPACING

A. General: Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the drawings. Provide at least one support for each length of pipe, at each change of direction and at each valve.

B. Steel, stainless steel, cast-iron, and ductile iron support schedule:

Pipe Sizes - In.	Maximum Span - Ft.*
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

3.3 WELDING

A. Identify welding rods clearly identified meeting the requirements of ASTM and American Welding Society Standards.

B. Integral attachments include welded-on ears, shoes, plates, and angle clips. Ensure material for integral attachments is of good weldable quality. Have preheating, welding, and postheat treating in accordance with Chapter V of ANSI B31.3.

3.4 PAINTING

A. Comply with Section 09900.

END OF SECTION

SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing the plumbing to be performed under this project. The work shall provide a complete, safe and satisfactory system as shown on the Drawings and as specified.

B. All equipment and systems shall be installed complete, tested and ready for operation. Omission of a specific item obviously necessary for the proper functioning of the equipment or system shall not relieve the Contractor of the responsibility of furnishing and installing the item as a part of this Contract.

C. The mechanical arrangements as shown on the Drawings may vary with different but equal equipment manufacturers. The Contractor shall, at no additional cost to the Owner, make the piping, structural or electrical changes necessary to accommodate the specific equipment installed.

1.2 CODES AND STANDARDS

A. The Contractor shall be responsible for approval of the plumbing by the local governing authority.

1.3 QUALITY ASSURANCE

A. The plumbing system and all components shall meet all governing codes, be complete in every respect, thoroughly comply with these specifications and support drawings, be acceptable to local inspection authorities, then receive final approval of the Engineer.

1.4 JOB CONDITIONS

A. Provide all piping required for this project. Arrange piping as shown on the drawings insofar as practical and applicable. Rearrange piping to avoid obstructions only as required in a manner approved by the Engineer.

1.5 SUBMITTALS

A. Submit the following items to the Engineer for review: (provide any other submittal items called for elsewhere in the Specifications or on the Drawings which have been omitted unintentionally from the following list):

1. Plumbing Fixtures
2. Plumbing Equipment
3. Piping Specialties
4. Piping Systems and Supports
5. Piping Insulation

PART 2 - MATERIALS AND EQUIPMENT

See other 15400 sections for materials and equipment

PART 3 - EXECUTION

3.1 INSTALLATION

A. Where applicable, provide anchors, expansion connections, expansion elbows and expansion loops for all anticipated pipe expansion and contraction whether or not shown in detail on the drawings.

B. All pipe assemblies must be adequately anchored, isolated and provided with water hammer arresters as required to permanently prevent water hammer, vibration or friction noises.

C. Pipe sizes shall not be less than shown on the drawings. All changes in size must be made with reducing fittings. Bushings will not be permitted.

D. Where dissimilar metals are joined, provide an approved isolating coupling, in an accessible location, to insulate against electrolysis.

E. Where pipe is embedded in concrete slab or passes through concrete (without sleeve), it shall be protected by bituminous coating or protective wrapping.

F. Pipes must be brought through partition surfaces at the best possible elevations and horizontal positions to assure access to fixture "stops" (which shall be provided on all fixtures), noninterference with baseboards or cabinets, straight piping to points of connections with fixtures, consistency of positions and neatness. Fixture manufacturer's "roughing-in" drawings must be followed carefully.

G. In erecting plated piping, fittings and fixtures, care must be exercised. Friction wrenches must be used, and no wrench marks shall show on completion.

H. All pipes shall be well reamed and thoroughly cleaned before assembling joints. All piping work left incomplete shall be capped or plugged watertight each night.

I. Sewer piping below floor slabs shall be arranged so as to have as few joints as practical. No fittings, joints or connections shall be permitted below the floor slab on potable water lines.

J. Joints between cast iron soil pipe and other metallic pipe shall be screwed and made with approved joint compound. No other screwed joints shall be permitted in cast iron soil, waste or vent piping.

K. All horizontal pipe shall be laid to uniform grade of 1/4-inch per foot where practical and never less than 1/8-inch per foot unless otherwise specifically shown on Drawings. All changes in direction shall be made with long sweep bends. Connections to horizontal lines shall be made with Y-branches and vertical stacks with sanitary tees.

L. The plumbing installation shall include a complete venting system for all fixtures and vent piping shall extend a minimum practical distance (8-inches to 18-inches) through the finished roofs. All vents shall be thoroughly flashed with sheet lead (3 lbs. per square foot).

M. Cleanout plugs shall be placed as required by code and as noted. Cleanouts shall have brass plugs.

N. Staples, bands, wires, cement, adhesives, sealers and protective coatings shall be as recommended by the insulation manufacturer for the applications indicated.

3.2 PAINTING

A. All uninsulated plumbing piping, pipe hangers, supports, other equipment and ironwork (installed in concealed locations) shall be thoroughly cleaned and painted with one coat of black asphaltum varnish. Piping installed in or through concrete or tile or underground shall be given one coat of acid-resisting paint having a bituminous base.

B. Finish painting of above items (in finished or exposed locations) and all painting of insulated piping shall be performed under the requirements of Section 09900 - Painting and Coatings.

3.3 TESTS AND DISINFECTION

A. All sanitary, waste, vent and drainage piping installed in, under or outside the buildings shall be tested by means of water, smoke or air in accordance with the applicable plumbing codes.

B. Give all soil, waste or vent piping two hour standing water test (to prove completely leaktight) supporting a 10-foot minimum water column at conclusion of such tests.

C. All domestic hot and cold water piping shall be subjected to a hydrostatic pressure of 150 psig and proven tight and free of leaks prior to insulating, covering or concealing of piping.

D. Pressure tests shall be performed with the use of an air compressor to provide the required test pressure. Isolate relief valves when tests are applied to the chilled water system.

E. Permanent or temporary pressure gages shall be installed when tests are performed. Each pressure test shall be applied for a period of no less than 8 hours with no appreciable pressure drop indicated on the pressure gage.

F. Any leaks or imperfections shall be corrected and new tests run. Upon the completion of tests, written approval of that portion of system or systems tests will be presented to the Contractor. Only after receiving written approval of tests shall the Contractor apply pipe covering or in any fashion conceal or allow piping

to be concealed. This written approval does not relieve the Contractor of the responsibility of correcting any leaks or piping failures during the guarantee period.

G. Before the system is put into operation, wash out to remove all oil and other residue.

END OF SECTION

SECTION 15411 - POTABLE WATER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing and testing a potable water system as shown on the Drawings and as specified.

B. Insulation for potable water piping is specified in other Division 15 sections, and is included as work of this section.

C. Refer to other Division 15 sections for plumbing fixtures; not work of this section.

D. Trenching and backfill required in conjunction with exterior water piping is specified in applicable Division 2 sections, not work of this section.

E. Trenching and backfill required in conjunction with potable water piping inside of building foundations is specified in Division 2 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications. Firms regularly engaged in manufacture of potable water systems products, of types, materials, and sizes required, whose products have been satisfactory use in similar service for not less than 5 years.

B. Codes and Standards. Plumbing Code Compliance: Comply with applicable portions of Standard Plumbing Code pertaining to selection and installation of plumbing materials and products.

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance of equipment along with technical product data and installation instructions for potable water systems materials and products.

B. At project closeout, submit record drawings of installed potable water systems piping and piping products, in accordance with requirements of Section 01700 - Project Closeout.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with

Standard Plumbing Code where applicable. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPES AND PIPE FITTINGS

A. Provide pipes and pipe fittings complying with Section 15060 - Pipes and Pipe Fittings, in accordance with the following listing:

1. Interior Water Piping. Tube Size 2-Inches and Smaller: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder joints.

   a) Above Slab: 95-5 soldered joints
   b) Below Slab: Silver soldered joints or Type "L" soft copper tubing

2. Exterior Water Piping. Tube Size 3/4-Inches through 2-Inches: Copper tube; Type K, soft-annealed temper; wrought-copper fittings, silver-soldered joints.

2.3 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Section 15120 - Piping Specialties, in accordance with the following listing:

1. Pipe escutcheons
2. Dielectric unions
3. Mechanical sleeve seals
4. Fire barrier penetration seals
5. Water hammer arresters
6. Drip pans
7. Pipe sleeves
8. Sleeve seals
9. Cleanouts outside building

2.4 BASIC SUPPORTS AND ANCHORS

A. Provide supports and anchors complying with Section 15140 - Supports and Anchors in accordance with the following listing:

1. Adjustable steel clevises for horizontal piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-clamps, and steel brackets for building attachments.
4. Protection shields for insulated piping support in hangers.

2.5 BASIC VALVES

A. Provide valves complying with Section 15101 - Valves for HVAC and Plumbing, in accordance with the following listing:

1. Sectional Valves. 2-Inches and Smaller: Gate valves.

2. Shutoff Valves. 2-Inches and Smaller: Gate valves.
3. Drain Valves. 2-Inches and Smaller: Gate valves.

2.6 HYDRANTS

A. Projecting Freeze-Proof Wall Hydrants. Cast-bronze hydrant, chrome plated face, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, 3/4-inch inlet, hose outlet.

B. Projecting Wall and Lawn Faucets. Nickel plated on brass, 3/4-inch hose thread, 3/4-inch NPT inlet, vacuum breaker.

C. Available Manufacturers. Subject to compliance with requirements, manufacturers offering hydrants which may be incorporated in the work include, but are not limited to, the following:

1. Josam Mfg. Co.
2. Smith, (Jay R) Mfg. Co.
3. Tyler Pipe; Sub. of Tyler Corp.
4. Woodford Mfg. Co.
5. Zurn Industries Inc., Hydromechanics Div.

2.7 BACKFLOW PREVENTERS

A. Provide reduced pressure principle backflow preventers consisting of assembly including shutoff valves on inlet and outlet. Backflow preventers shall include test cocks, and pressure-differential relief valve located between 2 positive seating check valves. Construct in accordance with ASSE Standard 1013.

B. Available Manufacturers. Subject to compliance with requirements, manufacturers offering backflow preventers which may be incorporated in the work include, but are not limited to, the following:

1. Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
2. Hersey Products, Inc.
3. ITT Lawler; Fluid Handling Div.
4. Watts Regulator Co.

2.8 RELIEF VALVES

A. Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves. Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F (99°C), and pressure relief at 150 psi.

C. Available Manufacturers. Subject to compliance with requirements, manufacturers offering relief valves which may be incorporated in the work include, but are not limited to, the following:

1. Cash (A.W.) Valve Mfg. Corp.
2. Conbraco Industries, Inc.
3. Watts Regulator Co.
4. Zurn Industries, Inc.; Wilkins-Regulator Div.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF POTABLE WATER DISTRIBUTION PIPING

A. Install water distribution piping in accordance with Section 15060 - Pipes and Pipe Fittings.

B. Install piping level with no pitch.

C. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.3 INSTALLATION OF EXTERIOR WATER PIPING

A. Install exterior water service piping systems in compliance with local governing regulations.

B. Service Main Connection. Cut into and install new tap for water service in water main, at location indicated, in accordance with local Water Utility Company requirements.

C. Water Service Piping. Extend water service piping of size and in location indicated to water service entrance in building. Provide sleeve in foundation wall and/or floor for water service entry; make entry watertight. Provide shutoff valve at water service entry inside building; pressure gage.

D. Copper Tube. Install in accordance with recommended procedures of the Copper-Development Association.

3.4 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Section 15120 - Piping Specialties.

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors in accordance with Section 15140 - Supports and Anchors.

3.6 INSTALLATION OF VALVES

A. Shutoff Valves. Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

B. Drain Valves. Install on each plumbing item located to completely drain equipment for service or repair.

C. Hydrants. Install where indicated, in accordance with manufacturer's installation instructions.

3.7 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated.

3.8 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Standard Plumbing Code.

B. Mechanical Equipment Connections. Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.9 FIELD QUALITY CONTROL

A. Piping Tests. Test potable water piping in accordance with testing requirements of Section 01660 - Testing, Adjusting and Balancing.

3.10 ADJUSTING AND CLEANING

A. Cleaning, Flushing and Inspecting. Clean, flush, and inspect potable water systems in accordance with requirements of Section 01650 - Disinfection.

B. Disinfection. Disinfect water service line in accordance with requirements of Section 01650 - Disinfection.

3.11 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION

SECTION 15412 - SOIL AND WASTE SYSTEMS (FOR BUILDING ONLY)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing the soil and waste systems as shown on the Drawings and as specified.

B. Refer to appropriate Division 2 sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.

C. Insulation for soil and waste systems is specified in applicable Division 15 sections, and is included as work of this section.

D. Trenching and backfilling required in conjunction with underground building drain piping is specified in applicable Division 2 sections, and is included as work of this section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications. Firms regularly engaged in manufacturer of soil and waste systems products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards.

1. Plumbing Code Compliance: Comply with applicable portions of 1994 Standard Plumbing Code pertaining to plumbing materials construction and installation of products.

2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.

3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.

4. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of soil and waste systems.

1.3 SUBMITTALS

A. Submit manufacturer's Certificate of Compliance of equipment along with technical product data for soil and waste systems materials and products.

B. At project closeout, submit record drawings of installed soil and waste systems, in accordance with requirements of Section 01700 - Project Closeout.

PART 2 - MATERIALS AND EQUIPMENT

2.1 MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Proved sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems. Where more than one type of materials or products are indicated selection is Installer's option.

B. Provide pipes and pipe fittings in accordance with the following listing:

C. Above Ground Soil, Waste, and Vent Piping.

1. Pipe Size 15-Inches and Smaller: Cast-iron hub-and-spigot soil pipe; Service weight; Cast-Iron, hub-and-spigot soil pipe fittings.
2. Pipe Size 10-Inches and Smaller: Hubless cast-iron soil pipe; Service weight; Hubless cast-iron soil pipe fittings, hubless joints.
3. Pipe Size 8-Inches and Smaller: Polyvinyl Chloride plastic pipe (PVC); Type DWV; PVC plastic type DWV socket-type fittings, solvent cement joints.

D. Underground Building Drain Piping.

1. Pipe Size 15-Inches and Smaller: Cast-iron hub-and-spigot soil pipe; Service weight; Cast-iron hub-and-spigot soil pipe fittings.
2. Pipe Size 6-Inches and Smaller: Polyvinyl chloride (PVC) sewer pipe; standard weight; PVC sewer pipe fittings, solvent cement joints.

2.2 BASIC SUPPORTS AND ANCHORS

A. Provide supports and anchors complying with Section 15141 - Pipe Hangers and Supports, in accordance with the following listing:

1. Adjustable stainless steel clevis hangers, stainless steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.
2. Two-bolt riser clamps for vertical piping supports.
3. Concrete inserts, C-Clamps, and stainless steel brackets for building attachments.

2.3 DRAINAGE PIPING PRODUCTS

A. Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations.

B. Cleanout Plugs. Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

C. Floor Cleanouts. Cast-iron body and frame; cleanout plug; adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturers standard cast unit of the pattern indicated:
2. Pattern: Exposed flush type, standard non-slip scored or abrasive finish.

D. Wall Cleanouts. Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.

E. Flashing Flanges. Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

F. Vent Flashing Sleeves. Cast-iron caulking type roof coupling for cast-iron stacks.

G. Available Manufacturers. Subject to compliance with requirements, manufacturers offering floor drains which may be incorporated in the work include; but are not limited to , the following:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Tyler Pipe; Subs. of Tyler Corp.
4. Zurn Industries, Inc., Hydromechanics Div.

2.4 FLOOR DRAINS

A. Provide floor drains of size as indicated on drawings; and type, including features, as specified herein.

B. Floor Drain. Cast-iron body and flashing collar with closure plug, weepholes, nickel bronze adjustable strainer head with secured square hole grate, with the following features:

1. Sediment bucket
2. Heel-proof grate
3. Trap primer connection
4. Round strainer head
5. Bottom outlet, inside caulk

C. Available Manufacturers. Subject to compliance with requirements, manufacturers offering piping products which may be incorporated in the work include, but are not limited to, the following:

1. Josam Mfg. Co.
2. Smith (Jay R.) Mfg. Co.
3. Tyler Pipe; Subs. of Tyler Corp.
4. Zurn Industries, Inc., Hydromechanics Div.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which soil and waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF ABOVE GROUND PIPING

A. Install soil and waste piping in accordance with Section 15060 - Pipes and Pipe Fittings, and with standard Plumbing Code.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

A. Install underground building drains as indicated and in accordance with Standard Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

B. Install soil and vent piping pitched to drain at minimum slope of 1/4-inch per foot (2%) for piping 2-inches and smaller, and 1/8-inch per foot (1%) for piping 3-inches and larger.

3.4 INSTALLATION OF SUPPORTS AND ANCHORS

A. Install supports and anchors in accordance with Section 15141 - Pipe Hangers and Supports.

3.5 INSTALLATION OF DRAINAGE PIPING PRODUCTS

A. Cleanouts. Install in above ground piping and building Drain piping as indicated, as required by Standard Plumbing Code; and at each change in direction of piping greater than 45 degrees at minimum intervals of 50-feet for piping 3-inches and smaller and 80-feet for 4-inch to 8-inch piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

B. Flashing Flanges. Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

C. Vent Flashing Sleeves. Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.6 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Coordinate flashing work with work of waterproofing and adjoining substrate work.

C. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.

D. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

F. Position drains so that they are accessible and easy to maintain.

3.7 INSTALLATION OF TRAP PRIMERS

A. Install trap primers as indicated, and in accordance with manufacturer's installation instructions. Pitch piping towards drain trap, minimum of 1/8-inch per foot (1%). Adjust trap primer for proper flow.

3.8 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures. Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by Standard Plumbing Code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.9 FIELD QUALITY CONTROL

A. Piping Tests. Test soil and waste systems in accordance with requirements of Standard Plumbing Code.

3.10 ADJUSTING AND CLEANING

A. Clean, flush, and inspect soil and waste piping in accordance with requirements of Section 15060 - Pipes and Pipe Fittings.

3.11 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with construction materials and debris, and to prevent damage from traffic and construction work.

END OF SECTION

SECTION 15420 - PLUMBING EQUIPMENT

PART 1 - GENERAL

2.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing the plumbing equipment specified in this Section and as shown on the Drawings and as specified.

B. Types of plumbing equipment required for project include the following:

1. Electric water heaters

2.2 QUALITY ASSURANCE

A. Manufacturers. Firms regularly engaged in manufacturer of plumbing equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. UL and NEMA Compliance. Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters Laboratories and comply with NEMA standards.

C. NEC Compliance. Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

D. ASME Relief Valve Stamps. Provide water heaters with safety valve relief valves bearing ASME valve markings.

2.3 SUBMITTALS

A. Certificate of Compliance. Submit manufacturer's Certificate of Compliance with manufacturer's plumbing equipment. Include installation and start-up instructions, and capacity and ratings, with selection points clearly indicated. Submit assembly type drawings indicating dimensions, weights, required clearances, and methods of assembly of all components.

B. Wiring Diagrams. Submit ladder type wiring diagrams for all components, clearly indicating all required field electrical connections.

C. Maintenance Data. Submit maintenance data and parts lists for each item of plumbing equipment, Include "trouble-shooting" maintenance guides. Include this data in maintenance manual.

PART 2 - MATERIALS AND EQUIPMENT

2.1 ELECTRIC WATER HEATERS

A. Provide commercial electric water heaters of size, capacity, and electrical characteristics as indicated on schedule. Comply with ANSI/ASHRAE/IES 90A for energy efficiency. Provide UL listing.

B. Heater. Working pressure of 150 psi; magnesium anode rod; glass lining on internal surfaces exposed to water.

C. Heating Elements. Low watt density with zinc plated copper sheath.

D. Safety Controls. Equip with high temperature cutoff for each element, factory wired.

E. Jacket. Equip with full size control compartments with front panel opening. Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish.

F. Warranty. Furnish limited warranty for tank leakage, applicable to heater specified.

G. Accessories. Provide brass drain valve; 3/4-inch relief valve; cold water drip tube, cold water shut-off valve, hot and cold water dielectric unions and heat transfer.

H. Controls. Provide thermostat for element, factory wired.

I. Available Manufacturers. Subject to compliance with requirements, manufacturers offering residential electric water heaters which my be incorporated in the work include, but are not limited to, the following:

1. Smith, Consumer Products Div.
2. Rheem Water Heater Div., City Investing Co.
3. Ruud Water Heater Div., City Investing Co.
4. State Industries

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC WATER HEATERS

A. Electric Water Heaters. Install electric water heaters as indicated, in accordance with manufacturer's installation instructions, and in compliance with applicable codes.

B. Wall Support. Support units from manufacturer's wall brackets. Support drain pans from same bracket, if practicable, or from structural steel supports below unit. Orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.

C. Electrical Supply. Furnish wiring diagram to Electrical Installer. Refer to Division 16 for wiring of units; not work of this section.

D. Piping. Connect cold water piping to units with shutoff valves and unions. Pipe T&P relief and pan drain to outside or as shown on Drawings.

E. Start-up. Start-up, test, and adjust electric water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

END OF SECTION

SECTION 15465 - SUMP PUMP

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing and installing a sump pump within the valve pit of the RAS/WAS pump station as specified.

1.2 QUALITY ASSURANCE

A. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Sta-Rite
2. Hydraulic Pumps, Inc.
3. Myers

1.3 SUBMITTALS

A. Submit manufacturers Certificate of Compliance for all items used in the sump system.

PART 2 - MATERIALS AND EQUIPMENT

2.1 SUMP PUMP

A. Provide a sump pump capable of pumping 30 GPM at 35-ft. TDH. Motor shall be 3/4 Hp, totally enclosed, submersible type.

B. Discharge shall be into the wet well.

C. Provide an independent float switch mounted in the top of the motor housing for automatic operation of pump.

D. A mechanical seal shall prohibit water from entering the motor housing and an enclosure shall surround the pump and motor.

E. The sump pump shall include a heavy-duty, 6-foot long electrical cord.

2.2 PIPE AND VALVES

A. Discharge shall be a 1-1/4-inch PVC through two 1-1/4-inch check valves and one bronze gate valve.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturers recommendations and with piping and valving shown on the Drawings.

END OF SECTION

SECTION 15483 - COMPRESSED AIR SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes furnishing all labor, tools, material, equipment and incidentals required to install a compressed air system for the proposed sand filters as shown on the Drawings.

1.2 QUALITY ASSURANCE

A. The equipment specified under this section shall be supplied by manufacturers who are fully experienced, reputable, qualified and are regularly engaged in the manufacture of the components and equipment to be furnished.

B. The contractor shall have the sole responsibility for the proper operation of the system and local service shall be available.

C. Available Manufacturers. Subject to compliance with requirements, provide from the following:

1. Ingersoll-Rand Co., Tampa, FL (Model 10E, 10Hp, 208V/2PH/60 cycle)

1.3 SUBMITTALS

A. Submittals shall include, but are not limited to:

1. Certificates of Compliance with requirements.
2. Drawings showing dimensions, weights and important details of construction.
3. Motor data for compressor as described in part two products.
4. Manufacturers performance curves showing compressor pressure, brake H.P. and actual delivery in cfm.
5. Schematic wiring diagrams and piping layout.
6. Parts list, installation and operating instructions for each piece of equipment.

PART 2 - MATERIALS AND EQUIPMENT

2.1 COMPRESSED AIR SYSTEM

A. The compressed air system shall consist of two (2) duplicate air compressor/ receiver package units. Each compressor/receiver shall be a totally self contained packaged unit. Each air compressor shall be two-stage, single acting reciprocating type with air cooled inter cooler, after cooler, 120 gal. ASME code horizontal air receiver and automatic condensate trap. The unit shall have separate cast iron cylinders of V type design. The running gear shall be of heavy duty design and shall include a balanced over-hung crankshaft assembly and non-rotating crankshaft journal sleeve.

B. Each unit shall be equipped with a pressure regulator with gage, dry type inlet filter, compressed air filter rated to 0.01 micron with 99.99% efficiency, differential pressure gage, electrically timed solenoid drain valve, and low oil level shutdown switch.

C. Each unit shall be rated for 39.0 ACFM actual delivery at 100 psig and shall be capable of supplying compressed air to maintain 150-175 psig in the air receiver.

D. Each unit control shall be by a dual control capable of either auto-start/stop or constant speed.

E. Each unit shall be completely packaged for one point air and electrical connections and furnished with a one year parts and labor factory warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment specified under this section shall be installed in accordance with the manufacturers recommendations and shall be located as shown on the plans or as approved by the Engineers.

3.2 INSPECTIONS AND TEST

A. The contractor shall require supplier of the complete system to furnish the services of a qualified representative to check over the complete system installation to the satisfaction of the engineer.

B. A running test shall be made on the air compressor systems to prove automatic operation. During the test the Engineer may operate the equipment to simulate normal and emergency conditions.

3.3 MANUFACTURER'S REPRESENTATIVE

A. Provide service of qualified manufacturer's service representative to inspect equipment and installation and to perform required field tests. Refer to Section 01660 - Testing, Adjusting and Balancing.

3.4 TOOLS AND SPARE PARTS

A. Refer to Section 01700 - Contract Closeout.

B. Provide the Following spare parts:

1. Two (2) oil filters.
2. One (1) year supply of lubricants and oils.
3. Two (2) air intake filter elements.
4. Two (2) separator elements.

END OF SECTION

SECTION 15600 - FUEL PIPING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The work of this section includes all labor, materials and equipment required for the installation and testing of the fuel piping systems complete and ready for operation. The system will include new aboveground fuel storage tanks, fuel piping systems with secondary containment, fuel storage tank monitoring systems and accessories.

1.2 RELATED WORK

A. Related work specified in other sections:

1. Section 02221 - Utilities Trenching, Bedding, and Backfilling
2. Section 16216 - Diesel Engine Driven Generator

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. All work shall conform to the applicable requirements of the city, county, state and federal codes. Where the requirements of such agencies are more stringent than specified herein, abide by such requirements and consider this specification as supplementary to those requirements.

B. All work shall conform to the applicable requirements of the US Environmental Protection Agency.

C. All work shall conform to the applicable requirements of the following: National Fire Protection Association (NFPA) 30 -Flammable and Combustible Liquids Code; and NFPA 321 - Basic Classification of Flammable and Combustible Liquids.

D. All work shall conform to the applicable requirements of the following: Department of Environmental Protection, State Fire Marshall's Rules and Regulations (Florida Fire Prevention Code); Southern Fire Prevention Code, and the Standard Building Code.

E. The tank shall meet the current requirements of Underwriters Laboratories (UL) Standard 142. All components of the fuel distribution system shall be UL listed, unless otherwise specified, or approved by the Engineer.

F. The tank and fuel systems shall be designed and fabricated according to best practices and methods available to date.

1.4 QUALIFICATIONS

A. Installer shall have had supervisory experience with two similar fuel systems in the past three years and shall hold a valid pollution control contracting license as required by the State of Florida, Department of Environmental Protection. A copy of the license shall be submitted, prior to proceeding with construction.

B. Tank installers shall be certified in writing by the tank manufacturer as being qualified to install the equipment. A copy of the certificate shall be submitted, prior to proceeding with construction.

1.5 SUBMITTALS

A. Complete shop drawings shall be submitted, including certification of shop test to the Engineer for review, according to General Conditions.

1. The shop drawings shall include sufficient information to demonstrate compliance with the specified tank design standards, including copies of applicable sections of the specified design standards, manufacturer's catalog data and descriptive literature for the tank, fully dimensioned shop layout drawing (1/4" = 1' scale or larger) showing all piping, manholes, valves, equipment connections, tank outline dimensions, platform and stair dimensions, and foundation requirements. recommended tank installation and test procedures.

2. The shop drawings for pipe, fittings, and each item listed in the Specifications shall include manufacturer's catalog data and descriptive literature, fully dimensioned shop layout drawing (1/4" = 1' scale or larger) showing all piping, manholes, valves, equipment connections, nozzle locations and installation clearance requirements.

3. Submit all manufacturer's recommended installation and test procedures for all equipment including tanks, piping, etc.

4. Submit manufacturer's Test Reports for each tank and specific service application.

5. Submit manufacturer's warranty for each tank and specific service application.

6. Operation and Maintenance Manuals -- Submit two (2) copies for each site plus one additional copy of operation and maintenance manuals, including parts lists and guarantees for each item furnished.

1.6 PRODUCT HANDLING

A. Deliver materials and equipment to project site in manufacturer's original, unopened containers with labels intact and legible. Labels shall indicate manufacturer's name and model number. Store equipment in dry protected area. All damaged items shall be replaced with new at no additional cost to Owner.

B. Piping shall be supplied to the site with sealed end caps which shall remain in place until installation. Tanks shall be delivered to the site with all openings sealed which shall remain in place until installation. The tanks shall be properly supported during transportation to the site and during installation in accordance with the manufacturer's instructions.

PART 2 - PRODUCTS

2.1 ABOVEGROUND FUEL OIL STORAGE TANK

A. Storage Tank

1. Steel (primary) Tank: listed by UL as an aboveground tank for flammable and combustible liquids and manufactured in accordance with UL 142 and UL Standard 2085 with a two-hour fire rating.

2. Emergency Vent: as required by NFPA 30 with no size reduction allowed for concrete encasement (insulation).

3. Normal Vent: independent of the emergency vent as required by NFPA 30.

4. Steel Tank Openings: threaded and located in the top of tank.

5. Steel Tank (rectangular in shape): with two (2) lugs for connecting ground conductors for lightning protection in accordance with NFPA 78.

6. Steel tank shall be pressure tested at the tank factory at 5 psi per UL 142.

7. Outer Surface of Steel Tank: covered by a minimum of 1/4 inch thick insulating spacer panels of polystyrene, or equally acceptable thermal insulation, which melts on contact with leaking petroleum products.

8. Secondary Containment: 30 mil. high density polyethylene geomembrane, or equally acceptable material (which includes a secondary steel tank). However, a double wall steel tank with 6 inch thick concrete in between the two (2) steel tanks is not permitted.

9. No steel or insulating spacer panels in unit shall come in direct contact with concrete or any other corrosive material. Tank top openings shall be powder coated to resist corrosion.

10. Steel primary tank and secondary containment shall be encased in a homogenous layer of 4,000 psi reinforced concrete 6 (six) inches think to create a protected (vaulted) tank with no penetrating metal elements except at the top. Concrete encasement (insulation) shall be of a monolithic (seamless) pour and contain no cold joints or direct (heat-transfer) connections between the steel and the outside face of the concrete encasement on bottom or sides.

11. Steel tank shall be pressurized to 5 psi at the casting facility and shall remain pressurized until concrete sets, to provide expansion space between concrete and steel tank during use. This is in addition to the test required by UL 142.

12. Insulated (vaulted) tank shall have capability of physical monitoring between primary and secondary containment.

13. Insulated (vaulted) tank shall have appropriate warning signs as required by the local jurisdiction.

14. Steel tank shall have an integral seven gallon UL listed spill containment system, as a part of the tank, with internal reservoir and normally closed UL listed drain port.

15. Insulated (vaulted) tank shall be placed on reinforced concrete pad made to manufacturer's specifications, or properly engineering for the weight and conditions.

16. Insulated (vaulted) tank shall have an exterior light reflecting and weather resistant Epoxy Coating.

17. Hurricane Restraints shall be installed where required by local jurisdictions.

18. Vault shall be ballistic and vehicle impact resistant.

19. Vaulted tank design shall have been in manufacturing production and commercial use for a minimum of five (5) years.

20. The tank shall be as manufactured by ConVault - Florida, or equal.

B. Tank Accessories

1. A mechanical level gauge system shall be provided to indicate the liquid level within the tank. The level gauge shall have a circular gauge indicator mounted on top of the tank. The tank shall include all openings required for the level gauge system.

2.2 FUEL OIL TANK ACCESSORIES

A. The following equipment shall be furnished along with the necessary piping and fittings required to provide a complete diesel fuel piping system.

1. Vent piping shall be 2-in and shall rise on an adjacent wall to as shown on the Drawings.

2. Vent cap shall be of the size indicated on the drawings and shall be constructed of cast iron with removable stainless steel screen, similar to No. 63 as made by Dover Corp. or equal.

3. Furnish and wire a thermally actuated safety switch in system Generator Room. Switch shall be set in place and wired so as to shut down the generator, when tripped by excessive room temperature.

4. Fuel resistant boot shall provide flexible secondary containment and incorporate stainless steel clamps. Rivas or approved equal.

2.3 PIPE AND FITTINGS

A. Aboveground piping not within containment and underground double containment piping and fittings shall be UL listed fiberglass pipe and fittings equal to A.O. Smith Fiberglass " Red Thread II".

1. Terminating fittings to product pipe shall be the manufacturer's standard fittings applied as recommended by the manufacturer. The termination fittings shall be rated to 5 psi test pressure.
2. Concentric spacers shall be supplied in accordance with the manufacturers spacing requirements.
3. Flexible test couplings shall be installed where shown on the drawings and shall be rated to 5 psi test pressure.
4. All double wall fittings shall consist of two halves with flanged tabs and assembled with either 1/4-in - 20 standard or 1/4-in - 20 carriage bolts with adhesive. Adhesive shall be Type DS-7014 or DS-7069 and shall be used for the secondary containment piping system.
5. Long sweep elbows shall be used for all changes in direction at the containment piping.
6. Provide seals at building wall to seal between the pipes within the containment piping and the inside of the containment piping.
7. Provide a pressure test port with threaded plug for each double wall fuel oil line.

B. Aboveground pipe and underground pipe within double containment shall be Schedule 80 black iron in conformance with ASTM A-795 and ANSI B31.3-1980 with 125 lb. galvanized threaded malleable iron fittings conforming to ANSI B16.3 and ANSI B31.3-1980.

C. Fuel, vent and level gauge piping and fittings shall be Schedule 80 black iron in conformance with ASTM A-795 and ANSI B31.3-1980 with 125 lb. threaded malleable iron fittings conforming to ANSI B16.3 and ANSI B31.3-1980.

D. Metallic marking tape shall be laid above all product lines for the purpose of identification with a metal detector. Electro Mark 4012, or approved metal.

2.4 JOINT COMPOUND

A. Joint compound for steel pipe threaded connections shall be a non-hardening, non-solvent joint sealer No. 55 by Radiator Specialty Company, Charlotte, North Carolina, or approved equal.

2.5 FUEL LEVEL/LEAK MONITORING EQUIPMENT

1. GENERAL: Furnish electrical monitoring equipment including tank level detection, tank leak detection, double containment pipe/sump leak sensing and associated modules for all the aboveground diesel fuel storage tanks. The system shall be the Veeder Root TLS-250 monitoring system or equal. One monitoring panel is existing that requires modifications. See drawings for panel locations.

B. Tank Level Detection: Tank level detection probes shall be the magnetostrictive type. Probes shall be the Veeder-Root 0.2 GPH, Part No. 847390-204 and shall be complete with the magnetostrictive probe installation kits. Probe lengths shall be appropriately sized for the tanks supplied.

C. Double Wall Interstitial Leak Sensing: Double wall interstitial leak sensing shall be capable of detecting the presence of any liquid in the annulus of the aboveground storage tanks. Probes shall be the Veeder- Root Part No. 794390-420, complete with riser cap and ring set and other installation hardware as required.

D. Double Containment Tank Sump Leak Sensing: Double containment tank sump leak sensing shall be capable of detecting the presence of any liquid in the sump of double wall piping systems. Probes shall be the Veeder Root Part No. 794390-420, complete with riser cap and ring set and other installation hardware as required.

E. Monitoring Panel

a) Furnish new modules as required in the existing TLS-250 monitor panel to accept signals from new measuring equipment specified above. In addition to tank level and leak monitoring modules, a relay module shall be provided to shutdown the day tank pump if a leak is sensed.

(1) Furnish modules as required in the TLS-250 monitor panel to accept signals from new measuring equipment specified above. In addition to tank level and leak monitoring modules, a relay module shall be provided to shutdown the day tank pump if a leak is sensed.

b) Modules shall include Gilbarco four input probe interface modules (Part No. PA02630000104) for level detection and Gilbarco eight input interstitial/liquid sensor interface modules (Part No. PA02630000102) for the double wall interstitial and double containment pipe/sump leak detection. A four relay output control module shall be provided and installed in each monitoring panel that will be energized whenever a leak is sensed in any of the containment piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Equipment shall be installed in accordance with the manufacturer's recommendations.

2. All materials and equipment shall be new and free from defects or damage and shall be installed in accordance with the approved recommendations of the manufacturer to conform to the contract documents. The installation shall be accomplished by workmen skilled in this type of work. Equipment shall be erected in a neat manner, shall be aligned, leveled and adjusted to provide satisfactory operation. Installation shall be such that connection and disconnection of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements to provide proper access may be made.

B. Storage Tanks

1. tanks shall be placed on a solid concrete foundation. Thickness and reinforcing of the concrete slab shall be per the tank manufacturers requirements. Backfill around the tank shall be clean washed sand.

2. All control, alarm, sensing, etc. panels shall be mounted 5-ft-6-in from the top of the panel to the floor.

3. Tanks shall be grounded. Where fittings cause a break in the electrical continuity of the system approval jumpers shall be provided.

4. Any damage to tank exteriors shall be repaired or replaced

C. Containment Piping

1. All pipe shall be cut accurately to measurements established at the site and shall be installed into place without traps or pockets and pitched 1 inch in 40-foot minimum to drain to observation manholes.

2. Piping shall be installed to minimize the quantity of piping joints. Single length solid straight piping sections shall be installed between all offsets, elbows and terminations where possible.

3. Joints shall be fabricated in accordance with manufacturer's instructions. All joints shall be gas tight.

4. Underground piping shall be installed in a 6-in minimum clean, washed sand bed, backfilled with a minimum of 6-in of the same material on sides and top.

D. Fuel Piping

1. All pipe shall be cut accurately to measurements established at the site and shall be worked into place without forcing or bending. All pipe shall be installed into place without traps or pockets and pitched 1 inch in 40-foot minimum to drain. All underground fuel piping shall be installed in containment piping.

2. Piping shall be installed to minimize the quantity of piping joints. Provide unions and/or flexible connections at all equipment connections.

3. Joints shall be fabricated in accordance with standard industry practices and manufacturer's instructions. All joints shall be liquid tight, screwed joints except where flanged connections to equipment or valves are required. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Cut a complete thread, using sharp dies properly set and centered, while applying oil graphite cutting lubricant.

4. Underground steel piping shall be grounded. Where fittings cause a break in the electrical continuity of the system approval jumpers shall be provided.

5. Underground steel piping shall be provided with cathodic protection using sacrificial anodes.

E. Flexible Fuel Piping

1. Provide flexible piping connectors at all day tank connections, all generator connections, all storage tank connections and all equipment connections.

2. Flexible connections shall be a minimum of 12 inches long or as required for equipment removal or maintenance. Protect flexible connectors where physical damage may occur due to adjacent equipment, other piping, wiring, or where subject to possible damage from operating personnel.

F. Leak Sensor Installation

1. Install all level and leak sensing equipment, monitoring panel interface modules and all wiring, conduit, junction boxes, sealing fittings and other material required for a complete operating system.

2. Install all monitoring equipment in accordance with the manufacturer's instructions including compliance with hazardous locations as defined in the National Electrical Code as locally amended and local codes which have jurisdiction.

3.2 CLEANING

A. At the conclusion of the work thoroughly clean all pipelines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period.

B. If defective piping or joints are discovered at this time, they shall be repaired or replaced by the Contractor at no cost to the Owner.

3.3 TESTING

A. Piping shall be tested in strict accordance with the manufacturer's testing requirements. Piping system shall be tested upon completion of the roughing-in before setting equipment. The entire system shall be pressure tested with fuel at 25 psig and proved tight at this pressure for a period of 4 hours. The secondary containment pipe shall be leak tested at 5 psi for 4 hours or at the manufacturer's suggested pressure and/or method. Defective work or material shall be replaced and retested. The system shall be test plugged or capped prior to testing to prevent test pressure from reaching any equipment or storage tank.

B. Storage tanks and piping shall be precision tested by a state qualified tester.

C. Storage tanks shall be pressure tested at 5 psi and all fittings soaped for a period of at least 12 hours prior to placing tanks into excavation. Tanks under test pressure shall not be left unattended.

D. Contractor shall provide fuel for any required testing and retesting. If the fuel subsequently becomes contaminated, Contractor shall dispose of the fuel at no cost to the Owner and in accordance with all D.E.P. regulations. Upon completion of the testing and prior final acceptance of the system, the Contractor shall fill the tanks to capacity.

END OF SECTION

SECTION 15800 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work includes all labor, materials and equipment required to provide a complete, safe and workable air conditioning, heating and ventilation system as outlined in the Drawings and hereinafter specified. The following list is included as a guide to the Contractor, but work is not necessarily limited to these principal items briefly mentioned.

1. Air distribution devices.
2. Ductwork.
3. Air conditioning units.
4. Filters.
5. Vibration isolation.
6. Electric temperature controls.
7. Condensate and refrigeration piping.
8. Insulation.
9. Exhaust Fans.

1.2 QUALIFICATIONS

A. Wherever manufacturer's model and/or catalog numbers are noted on the Drawings or in the Specifications, such numbers indicate the grade, type, quality, physical arrangement, size, performance characteristics and availability of parts and service necessary to perform the function of that item.

B. Substituted equipment will be approved only when the Contractor can demonstrate to the Architect's or Engineer's satisfaction that all of the above listed requirements can be met. Any architectural, structural, mechanical or electrical changes required to adapt substituted equipment to the Drawings and Specifications shall be included in this Contract.

C. Where additional manufacturers are listed in either the Specifications or Drawings, equipment shall be limited to items manufactured by those firms specifically named.

1.3 SUBMITTALS

A. Thoroughly coordinated shop drawings shall be submitted for approval in accordance with Section 01340, where specifically called for on the Drawings, or as specified herein.

1. Submit shop drawings and complete performance data for all major pieces of equipment, showing dimensions arrangement, connection sizes, electrical wiring diagram, power requirements and clearances required for access of service. When equipment being submitted is a substitution, shop drawings shall include factory certification that the

equipment has the required capacity, or shall include copies of manufacturer's published performance data. Any calculations that may be required to prove that the equipment will operate as required shall be submitted together with the factory data.

2. Equipment proposed of different manufacturer, size of arrangement than that shown will require complete shop drawings, which clearly show how the equipment fits the available space and in relation to adjacent equipment, with all connections shown such as piping, duct work, etc. Plan views shall be supplemented with two sections or more.

3. Provide submittal data for air distribution devices, installation materials and duct work.

B. All shop drawings submitted for approval shall be stamped by the Contractor before submission to indicate that the shop drawings are complete, checked and comply with all aspects of the requirements of all Contract Documents.

C. All shop drawings shall be submitted within 30 days from the date contract is awarded.

D. Shop drawing approvals by the Engineer will not relieve the Contractor from responsibility for his own errors, nor from his responsibility for full compliance with the Contract Documents.

E. All data and drawings shall be submitted simultaneously in an indexed booklet.

F. Coordination with work specified under other divisions:

1. Submit for approval complete power and control field wiring diagrams for all equipment supplied in this Section of the work.

2. Submit for approval a drawing indicating location and sizes of all roof penetrations, curbs and pitch pans required for this work.

G. Warranty for the equipment in accordance with Sections 01030 and 01740.

1.4 OPERATING AND MAINTENANCE MANUALS

A. When the installation is completed, submit to the Engineer, as required in Section 01730, copies of the following, bound in a hard cover booklet:

1. General operating instructions, including copies of posted specific instructions and automatic control diagrams.

2. Maintenance instructions, followed by tabulated manufacturer's descriptive literature, shop drawings, performance curves and rating data, spare parts lists and manufacturer's maintenance manuals.

3. Names, addresses and telephone numbers of local service representatives of the manufacturers of the installed equipment.

PART 2 - PRODUCTS

2.1 AIR DISTRIBUTION DEVICES

A. Grilles, registers and diffusers shall be of all aluminum construction with baked enamel finish. Performance of all units shall be based on tests conducted in accordance with ADC Standard 1062 R 2 "Air Diffusing Equipment Test Code" and the ASHRAE Standard 36-72. Provide rubber gaskets on all supply units. Model numbers are shown on the drawings.

2.2 DUCT WORK

A. General:

1. In each branch connection, as required, install splitters. Splitters shall be constructed of galvanized sheet iron, one gauge heavier than the duct. Splitters shall be securely attached to an iron pivot rod which shall be set in sockets, attached to duct. Operating rods shall be installed through the duct, and each rod shall be provided with a set screw locking device. On insulated ducts, the locking device shall be placed on a bracket so that set screw is on surface of insulation.

2. In all elbows except full radius elbows, install sheet metal turning vanes. Vanes shall be constructed of metal, one gauge heavier than required for duct. Double thickness vanes shall be installed according to SMACNA Standards.

3. On the inlet and outlet connection of all fans install a flexible connection. These connections shall be 4 inches in width and shall be constructed of rubberized asbestos canvas, which shall be securely fastened to the fan and to the duct work by a galvanized iron band.

4. Where it is necessary to provide openings through the duct work for the insertion of the pivot tube, provide a screwed square head plug. In duct work which is insulated, provide a metal ring against which the insulation shall be finished, and in the ring provide a removable plug of approved insulation material.

5. All necessary allowances and provisions shall be made in the installation of the structural conditions of the building, and ducts shall be transformed or divided as may be required and wherever necessary to do this, the required area shall be maintained. All of these changes, however, must be approved. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering.

6. Where ducts are shown connecting to masonry openings and/or along the edges of all plenums, at masonry construction, there shall be a continuous 1-1/2-inch x 1-1/2-inch galvanized angle iron which shall be bolted to the masonry construction and made tight with fire-proof caulking compound. The duct of these locations shall be fastened securely to the angle iron.

B. Metal Ductwork:

1. Provide galvanized steel ductwork for all supply, return and exhaust ductwork shown in accordance with SMACNA Duct Construction standards and details on the Drawings.

2. Provide aluminum ductwork for all toilet exhaust ductwork shown in accordance with SMACNA Duct Construction standards and details on the Drawings.

3. Provide flexible steel reinforced fiberglass duct for air distribution shown in accordance with SMACNA Duct Construction standards and details on the Drawings. Flexible ductwork shall meet Underwriters' Laboratories Standard 181 for Class 1 air ducts.

2.3 AIR CONDITIONING UNITS

A. Provide and install air cooled systems as scheduled on the Drawings.

B. Furnish manufacturer's five (5) year parts warranty for each motor compressor.

C. Provide smoke detectors in the supply and return ducts of all air conditioning unit air handlers. Smoke detectors shall be suitable for installation in HVAC ductwork and shall be connected to the control circuit of each unit to stop unit operation if smoke is detected in the ductwork.

D. Provide all accessories, coatings as specified on the Drawings. Units without specified accessories and coatings shall not be accepted as equal. Provide units meeting the capacity and efficiency ratings scheduled on the Drawings. Units not meeting specified capacities and efficiency ratings shall not be accepted as equal. Unit shall be installed in accordance with the manufacturer's recommendations.

2.4 FILTERS

A. The air conditioning contractor shall include in his bid the cost of maintaining clean filters during the initial starting and testing period.

B. The air handling and heating-ventilating units shall be equipped with 2-inch thick replaceable filters consisting of cardboard frames and glass filament media equal to Farr 30/30 . The Contractor shall furnish two complete sets of these filters; one for use during initial starting and testing, and one for final acceptance or at the beginning of beneficial use.

2.5 SOUND ADSORPTION AND ISOLATION

A. Neoprene vibration isolation supports shall be provided on all air conditioning units, fans, motors, and other equipment that may transmit noise or vibration to the building structure.

B. Unless otherwise noted, isolators shall be Korfund selected for 5 percent transmissibility for weights and lowest disturbing frequency of equipment as provided. Isolators exposed to weather shall be cadmium plated.

2.6 TEMPERATURE CONTROLS

A. Furnish and install for all Electrical Room HVAC units, a total of 3 units, a single stage cooling only, wall mounted electronic thermostat with locking cover.

B. Furnish and install for each Blower Room exhaust fan, a total of 3 units, a heavy duty corrosion resistant, line voltage, wall mounted thermostat with locking cover.

C. Furnish and install for the Generator Room supply fan, a total of 2 units, a heavy duty corrosion resistant, line voltage, wall mounted thermostat with locking cover which shall be installed in parallel with an interlock to bring the supply fans on whenever the Emergency Generators are in operation.

2.7 CONDENSATE PIPING

A. Condensate piping shall be type "L" rigid copper with forged or wrought copper long radius fittings made with sweat soldered joints using silver brazing alloy. Insulate all aboveground suction lines with 3/4-inch thick Armstrong Armaflex 22 flexible foamed plastic. Installation shall be in strict accordance with manufacturer's recommendations.

2.8 REFRIGERANT PIPING

A. Refrigerant piping shall be type "L" rigid copper with forged or wrought copper long radius fittings made with sweat soldered joints using silver brazing alloy. Insulate all underground refrigerant lines and above ground suction lines with 3/4-inch thick Armstrong Armaflex 22 flexible foamed plastic. Installation shall be in strict accordance with manufacturer's recommendations.

2.9 ELECTRIC DUCT HEATERS

A. Furnish and install as indicated open coil heaters of the voltage, size, wattage, number of steps and accessories as indicated.

B. Heaters shall be U.L. listed for zero clearance and meet all the applicable requirements of the 1981 National electrical Code.

C. Heaters shall be made with aluminized steel frame.

D. The terminal box shall be provided with solid cover in order to minimize dust infiltration, and this cover shall be hinged if built-in fuses are provided. Heater terminal box must be totally enclosed and must be without perforated or expanded sheet metal covers, louvers or grilles in order to meet paragraph 21 of U.L. Standard 573 which prohibits venting into false ceiling space, hollow spaces in the wall or other concealed spaces of a building structure.

E. All resistance coil terminals and nuts shall be made of stainless steel, and terminal insulators and bracket bushings shall be made of high grade ceramic and securely positioned. Resistance wire shall be iron free, 80 percent nickel and 20 percent chromium. Bracket supports for the resistance wire shall be reinforced with stiffening ribs and gussets, and spaced no more than four (4) inches apart. Heaters shall be tested dielectrically for 1,000 volts plus twice the rated voltage or 2,000 volts, whichever is higher. Heaters rated 150 KW and over shall be furnished with heavy duty coils, derated to 35 watts per square inch of wire surface, to insure long life.

F. Heaters shall be interchangeable for mounting in a horizontal or vertical duct, and air flow may be through the heater in either direction.

G. Electric heaters shall be of the flanged air handler fan outlet type.

H. Three phase heaters shall be furnished with balanced three phase steps. A transformer shall be required if control voltage differs from supply voltage.

I. Heaters shall be supplied with overcurrent protection per 1981 NEC. Overcurrent protection shall consist of built-in prewired fuses with one overcurrent device for each 48 ampere circuit.

J. A disc type automatic reset thermal cutout shall be furnished for primary protection. For secondary protection, a sufficient number of heat limiters (fusible links) in the power lines shall deenergize the elements in case the primary cutout fails. Both devices shall be serviceable through the terminal box without having to remove heater from duct.

K. Provide a built-in pressure type, air flow switch.

2.10 ACCESSIBILITY

A. All equipment requiring adjustment or service shall be fully accessible by means of location, clearance to structure, etc. All access panels shall be readily removed and replaced. All fire dampers shall be accessible for inspection or repair. Unless otherwise required or noted, all access doors shall be 12-inch x 12-inch Milcor Style "A" for acoustical tile, Style "B" for acoustical plaster and Style "K" for plaster or stucco.

2.11 MATERIALS

A. All materials specified herein shall be new and of domestic manufacture.

2.12 FIRE DAMPERS

A. Fire dampers shall be supplied where required by duct work penetrating rated wall, floor, ceiling or roof assemblies.

B. Fire dampers shall be installed in the assemblies in accordance with manufacturers requirement and UL guidelines. Each damper shall be rated as required to protect the duct penetration of the rated assembly and maintain its integrity. Provide all dampers with integral sleeves and angle iron reinforcing at all wall penetrations.

C. Fire dampers shall have the damper blades completely out of the airstream when installed.

2.13 INSULATION

A. All insulation shall be applied on clean dry surfaces. All insulation shall be continuous through walls, floors, ceilings, sleeves and hangers.

B. Rigid pipe insulation inserts shall be installed at each hanger location between duct and hangers of thickness equal to adjoining insulation. Rigid insulation inserts shall be of length as recommended by the insulation manufacturer. Insulation jacket over insert shall form a continuous vapor barrier with the adjoining insulation.

C. All insulated covering shall be guaranteed for a period of one year. Insulation shall be as specified below.

D. All concealed supply, return, transfer, makeup and exhaust duct work, except bathroom exhaust ducts, shall be insulated throughout with flexible fiberglass duct wrap with All Service Jacket, 2-in thick, 2.5 PCF density or approved equal. All joints, penetrations and tears in the insulation shall be sealed vapor tight with fiberglass fabric imbedded in non-flammable mastic. Adhere insulation to duct work with non-flammable insulation adhesive applied with 100% coverage. No metal bands, metal pins or staples will be allowed unless otherwise indicated. Welded pins may be used in addition to adhesive for duct work exceeding 36 inches in width. All pin penetrations shall be sealed with fiberglass fabric and mastic to form a vapor tight barrier. Adhere 3-in wide fiberglass strips over all butt and longitudinal joints between each section of insulation to insure a continuous vapor barrier. Extreme care shall be exercised to insure the sealing adhesive will hold in place during and after installation.

E. All exposed supply, return, transfer, makeup and exhaust duct work, except bathroom exhaust ducts, shall be insulated throughout with rigid fiberglass duct board insulation with a polyester reinforced scrim jacket, 2-in thick, 2.5 PCF density or approved equal. All joints, penetrations and tears in the insulation shall be sealed vapor tight with fiberglass fabric imbedded in non-flammable mastic. Adhere insulation to duct work with non-flammable insulation adhesive applied with 100% coverage. No metal bands, metal pins or staples will be allowed unless otherwise indicated. Welded pins may be used in addition to adhesive for duct work exceeding 36 inches in width. All pin penetrations shall be sealed with fiberglass fabric and mastic to form a vapor tight barrier. Adhere 3-in wide fiberglass strips over all seams joints between each section of insulation to insure a continuous vapor barrier. Extreme care shall be exercised to insure the sealing adhesive will hold in place during and after installation.

F. Insulation shall be continuous through all sleeves except fire dampers at the full thickness of the insulation. Insulation at fire dampers shall be sealed to the fire damper frame to form a continuous vapor barrier.

G. Provide aluminum insulation cover with stainless steel or aluminum bands for all exterior duct work insulation.

2.14 FANS

A. Fans shall be factory assembled, complete with fan wheel, fan housing or cabinet, bearings, drives, drive guard, motor, motor base, unit base, vibration isolators and bird screens, unless otherwise specified. All fans shall be statically and dynamically balanced before shipment. All fans shall be AMCA rated for sound and air performance per AMCA 210-85 and 330-86.Inlet and/or discharge screens shall be provided for fans that are not directly duct connected. Fans shall be UL listed for the specific application.

B. Propeller Wall Exhaust Fans - fans shall be furnished with factory fabricated wall housings, dampers, and accessories as called for on the Drawings. Fans shall be aluminum construction with galvanized steel housing and supports unless other materials of construction are specified on the Schedule. Provide fan and accessories with a factory applied coating equal to Heresite epoxy phenolic finish. Manufacturers shall be Greenheck Fan Co. or equal.

C. Centrifugal cabinet fans shall be belt or direct drive as scheduled. Manufacturers shall be Greenheck Fan Co. or equal.

D. Refer to the Drawings for accessories and other requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of all equipment and materials shall be in strict accordance with the best practice of the several trades and with the respective manufacturer's instructions and recommendations.

B. Install Air Conditioning Units and Air Handling Units as shown on Drawings and in accordance with the manufacturer's recommendations.

C. Install all fans to prevent vibration and drumming and be certain that all fan bearings are properly greased before starting fans.

3.2 TESTING AND BALANCING

A. The Contractor shall obtain the services of an independent test and balance agency that specializes in and whose business is limited to testing and balancing of air conditioning systems. The agency selected shall be fully certified by the Associated Air Balance Council and shall have at least one member of the agency qualified as a certified test and balance engineer that has been issued this certification by the National Examining Board, United States and Canada. All final reports shall be signed by this certified test and balance engineer and shall include his official stamp.

B. Testing and balancing shall be performed in complete accordance with AABC National Standards for Field Measurement and Instrumentation, form number 81266, Volume One, section applicable to air distribution and section applicable to hydronic balancing.

C. Instruments used for testing and balancing of air and hydronic systems must have been calibrated within a period of six (6) months and checked for accuracy prior to start of work.

D. The complete test report shall be submitted to the consulting mechanical engineer prior to final acceptance of the project.

E. Selected and approved agency shall submit AABC National Warranty certificate which includes pre-construction plan check and continuous inspection program immediately upon receipt of the test and balance contract.

F. The Contractor shall submit name of the test and balance agency to architect and consulting mechanical engineer for approval within 30 days after receipt of construction contract by air conditioning contractor.

END OF SECTION

SECTION 15895 - FIBERGLASS DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of fiberglass ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Types of non-metal ductwork required for project include the following:

1. Air Exhaust Systems for Odor Control at the Headworks and Flow Splitter Structure.

1.2 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to, the following:

1. Perry Fiberglass Products, Inc.
2. Rigidon/Heil Process Equipment
3. Or Equal

B. Standards:

1. Materials, construction and workmanship, physical properties, and methods of testing reinforced polyester materials shall comply with Voluntary Product Standard PS 15-69, U.S. Department of Commerce National Bureau of Standards, (SD Catalogue No. C13.20 2:15-69, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402), and industry initiated development standards.
2. Base component products shall meet applicable established standards or manufacturer's published standards.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and fabricated ductwork, used for work on this section.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC (FRP) DUCT

A. Exhaust FRP Duct: Materials, construction and workmanship, physical properties, and methods of testing reinforced polyester materials shall comply with Standards listed in Part 1.

2.2 MATERIALS

A. Resin: Resin used shall be of a commercial grade and shall either be evaluated as a laminate by test or determined by previous service to be acceptable for the environment. Resin shall be Ashland Chemical Hetron 197 or Koppers Dion 6693 with 5% antimony trioxide added.

B. Fillers and Pigments: The resins shall not contain fillers except as required for viscosity control or fire retardance.

C. Reinforcing Material: The reinforcing material shall be commercial grade of glass fiber having a coupling agent which will provide a suitable bond between and glass reinforcement and the resin.

D. Surfacing materials: The material used as reinforcing on the surface exposed to chemical attack shall be commercial grade chemical-resistant glass having a coupling agent. A surfacing veil is required on the I.D. of the duct, and ultraviolet protection is required on the O.D. of the duct as an inhibitor to sunlight exposure.

E. Laminate: The laminate shall consist of an inner surface, an interior layer, and an exterior layer or laminate body. The composition specified for the inner surface and interior layer are intended to achieve optimum chemical resistance.

F. Cut Edges: All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled. Structural elements having edges exposed to the chemical environment shall be made with chopped-strand glass reinforcement.

G. Joints: Finished joints shall be built up in successive layers and be as strong as pieces being joined and as crevice free as is commercially practical. The width of the first layer shall be 2-inch minimum. Total minimum width of joint shall be 3-inches for 1/8-inch thickness, 4-inch for 3/16-inch thickness, and 6-inches for 1/4-inch thickness. Crevices between jointed pieces shall be filled with resin or thixotropic resin paste, leaving a smooth inner surface. The interior joints may also be sealed by covering with not less than 0.100-inch of reinforced resin-rich surface.

H. Ells: Standard ells shall have a centerline radius of one and one-half times the duct diameter.

I. Reducers, Concentric or Eccentric: Length of standard reducers shall be five times the difference in diameters (D1-D2). Minimum wall thickness shall be that required for the larger diameter duct.

J. Flanges:

1. Flange attachment - Duct wall at hub of flange shall be at least one and one-half times the normal thickness and tapered to normal thickness over a distance of at least one flange width. Fillet radius shall be at least 3/8-inch at point where the hub meets the back of the flange.
2. Face of flange - Face of flange shall have no projections or depressions greater than 1/32-inch and shall be perpendicular to the centerline of the duct within 1/2 degree. A camber of 1/8-inch with respect to the centerline, measured at the O.D. of the flange shall be allowable. The face of the flange shall have a chemical-resistant surface.
3. Gasket material - Gasket material shall be fabricated from flexible plasticized PVC of suitable gauge to seal (minimum of 1/8-inch). Field installation gaskets shall be cemented to one of two mating flanges. The flexible PVC gasket shall be fabricated with unbroken circumference or perimeter.
4. Bolts, nuts and washers - Bolts, nuts and washers shall be of stainless steel material. Metal washers shall be used under all nut and bolt heads.

K. Pipe hangers and spacing: Pipe hangers shall be stainless steel band type hangers 6-inches in width and contacting a minimum of 180 degrees of the pipe surface. Maximum spacing for pipe hangers and supports shall be 8-ft. Hangers are to be securely fastened to avoid vibration, and care shall be taken to install hangers so as to avoid creating conditions of stress in the finished installation.

L. Expansion: Proper consideration should be given to accommodate overall linear expansion.

M. Flexible Connections: Flexible connections shall be fabricated from flexible plasticized PVC using material not less than 3/32-inches thick. Connections shall be fabricated with a longitudinal seam lapped not less than 1-1/2-inches and clamped with stainless steel bands to ducts or equipment collars. In cases where flexible connections are provided for connections to fans or equipment, a support or hanger shall be provided at the unsupported location. In general, ductwork shall be supported independently of fans or other equipment.

2.3 CONTROL DAMPERS

A. Provide manual type, opposed multiblade, butterfly type damper consisting of a singular circular blade as specified and indicated. Provide damper constructed of FRP suitable for hydrogen sulfide environment, with lever-type accessible locking-quadrant operator identified with OPEN and CLOSE positions. All metal parts shall be stainless steel. Damper shall include a firm closed cell neoprene seal sandwiched between two blades. Damper shall be manufactured by:

1. Perry Fiberglass Products, Inc.
2. Rigidon/Heil Process Equipment
3. Or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow manufacturer's recommendations and Standards listed.

3.2 TESTING, ADJUSTING AND BALANCING:

A. Testing, adjusting and balancing for supply and exhaust ventilation systems of low pressure ductwork is specified in Section 01660 - Testing, Adjusting and Balancing. The ventilation contractor shall be responsible for the testing, adjusting and balancing with the work performed by a certified Test and Balance agency with the assistance of the ventilation contractor.

TABLE 15895 - I
REINFORCED-POLYESTER ROUND DUCT DIMENSIONS

I.D. inches	Wall thickness (min.) inch	Allowable vacuum-2 inches of water	Allowable pressure-2 inches of water	Flange diameter (O.D.) inches	Flange thickness inch	Bolt circle diameter inches	Bolt hole diameter inch	No. of bolt holes
2	0.125	405	750	6-3/8	1/4	5	7/16	4
3	0.125	405	500	7-3/8	1/4	6	7/16	4
4	0.125	210	410	8-3/8	1/4	7	7/16	4
6	0.125	64	350	10-3/8	1/4	9	7/16	8
8	0.125	30	180	12-3/8	1/4	11	7/16	8
10	0.125	16	340	14-3/8	3/8	13	7/16	12
12	0.125	9	280	16-3/8	3/8	15	7/16	12
14	0.125	7	220	18-3/8	3/8	17	7/16	12
16	0.125	6	290	20-3/8	1/2	19	7/16	16
18	0.125	5	240	22-3/8	1/2	21	7/16	16
20	0.125	5	190	24-3/8	1/2	23	7/16	20
24	0.187	9	140	28-3/8	1/2	27	7/16	28
30	0.187	7	100	34-3/8	1/2	33	7/16	28
36	0.187	5	70	40-3/8	1/2	39	7/16	32
42	0.250	10	120	46-3/8	5/8	45	7/16	36
48	0.250	9	100	54-3/8	5/8	52	9/16	44
54	0.250	7	80	60-3/8	5/8	58	9/16	44
60	0.250	6	60	66-3/8	5/8	64	9/16	52

1 5 to 1 design factor of safety based on data in table 1. Also based on 10-foot lengths between stiffener rings for vacuum service.

2 These ratings are suitable for use up to 180 degrees F (82.2 degrees C) in pressure service and ambient atmosphere temperatures on vacuum service. For ratings at higher temperatures consult the manufacturer.

TABLE 15895 - II
REQUIREMENTS FOR PROPERTIES OF REINFORCED-POLYESTER LAMINATES

Property at 73.4F degrees F	Fiberglass Thickness 1/8 to 3/16 Inch	Fiberglass Thickness 1/4 Inch
Min. ultimate tensile strength psi (1)	9,000	12,000
Min. flexural strength psi (2)	16,000	19,000
Min. flexural modulus of elasticity (tangent) psi (3)	700,000	800,000

(1) ASTM Designation D638-68

(2) ASTM Designation D790-66

(3) ASTM Method D790-66

END OF SECTION

SECTION 16050 - ELECTRICAL - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical system at the Southeast Regional Wastewater Treatment Plant, Manatee County, Florida, as hereinafter specified and shown on the Drawings.

B. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter and/or shown on the Drawings. Certain equipment will be furnished as specified in other sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the CONTRACTOR to provide complete power, lighting, communication systems, instrumentation, wiring and control systems as indicated on the Drawings and/or as specified herein.

C. The CONTRACTOR shall furnish and install the necessary cables, transformers, motor control centers, protective devices, conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.

D. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; sub-standard work will be rejected.

E. Mount and wire speed indicators, variable frequency drives and process instruments furnished under other Divisions of these Specifications.

F. Mount and wire isolation transformers, operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these specifications.

G. Mount and make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.

H. For process instrumentation furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators and receivers.

I. Furnish necessary devices and make connections to provide power to drinking fountains, kitchen units, shop equipment, lab equipment and other equipment. This will require appropriate receptacles in some cases and direct wiring in other cases, depending upon equipment furnished.

J. Install and wire all thermostats, aquastats and other devices furnished under other Divisions of this Specification directly controlling HVAC equipment or fan motors.

K. Mount and wire electric heaters furnished under other Divisions of this Specification.

L. Wire all duct mounted heaters and ventilation equipment furnished under other Divisions of this Specification.

M. Each bidder or his authorized representatives shall, before preparing his proposal, visit all areas of the existing buildings, site and structures in which work under this division is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that he or his representative has visited the buildings and noted the locations and conditions under which the work will be performed and that he takes full responsibility for a complete knowledge of all factors governing his work.

N. All power interruptions to existing equipment shall be at the Owner's convenience. Each interruption shall have prior approval.

O. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

P. Provide all temporary power as required to facilitate the CONTRACTOR's phased construction plan.

1.2 SERVICE AND METERING

A. Permanent electrical power and metering will be provided by the Florida Power & Light Company as indicated on the Drawings. The CONTRACTOR is responsible for all coordination regarding this item.

B. Install the primary conduits provided by FP&L as required to permit relocation of the high voltage overhead power line to underground. See drawing E-2 for additional requirements.

C. Contact Don Sayer at 941-708-2900 for additional information.

1.3 CODES, INSPECTION AND FEES

A. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.

B. Pay all fees required for permits and inspections including any charges associated with the service modifications. Coordination with Florida Power & Light Company is required.

1.4 TESTS

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

B. The following minimum tests and checks shall be made prior to the energizing of electrical equipment. Test shall be by an independent testing firm, and a certified test report shall be submitted stating that the equipment meets and operates in accordance with the Manufacturer's and job specifications, and that equipment and installation conforms to all applicable Standards and Specifications:

1. Testing and setting of protective relays for calibration and proper operation.
2. Mechanical inspection of all circuit breakers to assure proper operation.
3. Motors: Megger to ground each motor winding. Record date, motor temperature, terminal, reading and operator and have Owner representative sign off on each reading.
4. Conductors: Megger to ground prior to termination all 600 volt conductors not used for service conductors. Record the date, conductor, reading and operator and have Owner representative sign off on each reading.
5. Service Conductors: Megger to ground prior to termination in the presence of the Engineer or his representative all 600 volt service conductors. Record date, conductor, reading, operator, and have the Owner representative sign off on each reading.
6. 480 Volt Switchgear: After installing, with circuit breakers closed, but prior to terminating any conductors or bus to the switchgear, megger each phase to phase and phase to ground. Record date, test (i.e. A/B or A/G), reading and operator and have Owner representative sign off on each reading.
7. 480 Volt Motor Control Centers Power Panels: After installing, with circuit breakers closed, but prior to terminating any conductors or bus to the motor control center, megger each phase to phase and phase to ground. Record the date, test (i.e. A/B or A/G), reading and operator and have Owner representative sign off on each reading.
8. Connections & Terminations:
   a. 480 Volt Switchgear and MCCs: Torque to Manufacturer's values in the presence of the Engineer or his representative. Record the date, conductor, torque, operator and have the Engineer sign off on each reading.

9. Data Base: After equipment suppliers test, calibrations, and inspection, megger all circuits leaving all switchgear and motor control centers. Record the date, conductor, circuit condition (i.e. load connected or unconnected), reading and operator and have Owner representative sign off on each reading.

10. Hot Spot Testing: Perform infra red hot spot inspection of the 480 volt switchgear, motor control centers and associated equipment as soon as determined by the engineer that representative loads are present. Record the date, gear conditions found, operator and have the owner's representative who must be present for the inspection sign off in each instance.

11. Repeat the above infra red hot spot inspection one more time as directed by the Engineer and in the presence of the Owner's representative.

12. Miscellaneous:

    a. Meggering must be done at 1000 VDC for one minute. The ground plane used must be the one established at the main source of energy for conductors, switchboards and control centers. The motor frame may be used for the ground plane for motors.

    b. In the course of construction, it will become necessary to temporarily energize some systems for testing. Confirm that any motor has been meggered prior to connection and testing. Do not leave any motor or system unattended and energized without written authorization.

    c. An unsuccessful test will be one in which any one of the three megger readings differs from another by more than 25% or a value measures less than 20 meg ohms. Engineer shall determine if cables and/or equipment bussing shall be replaced.

1.5 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

1.6 CUTTING AND PATCHING

A. All cutting and patching shall be done in a thoroughly workmanlike manner.

1.7 INTERPRETATION OF DRAWINGS

A. The Drawings are not intended to show exact locations of conduit runs.

B. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.

C. Unless otherwise approved by the Engineer conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

D. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

E. The CONTRACTOR shall coordinate the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required to accomplish this shall be furnished and installed by the CONTRACTOR without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless which was installed first.

F. Verify with the Engineer the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

G. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

H. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

I. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.

J. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can determined in advance of the purchase of equipment.

K. All connections to equipment shall be made as shown, specified, and directed and in accordance with the Manufacturer's approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

1.8 SIZE OF EQUIPMENT

A. Investigate each space in the building where equipment must pass to reach its final location. If necessary, the Manufacturer shall be required to ship his material in sections, sized to permit passing through such restricted areas in the building.

B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.9 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of project Contract Drawings. When the project is completed, furnish a complete set of reproducible "As-built" drawings for the Project Record Documents. These documents shall be 24" x 36" in size.

B. As-builts may be inspected monthly by the Resident Inspector.

1.10 COMPONENT INTERCONNECTIONS

A. Component equipment furnished under this Specification will not be furnished as integrated systems. CONTRACTOR shall field install and wire completely all components.

B. CONTRACTOR shall analyze all systems components and their shop drawings, identify all terminals and prepare drawings and wiring tables necessary for component interconnection. CONTRACTOR shall provide crimp on wire numbers on both ends of all control wiring installed between all panels furnished under this contract. These numbers shall directly relate to the interconnect wiring drawing furnished by the CONTRACTOR and be reflected in the As-built drawings submitted.

1.11 SHOP DRAWINGS

A. As specified under other sections shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.

B. Shop drawings shall be submitted for the following equipment:

1. 480 Volt Switchgear
2. Low Voltage Motor Control Centers
3. Dry Type Transformers
4. Panelboards
5. Lighting Fixtures
6. Disconnect Switches
7. Enclosed Circuit Breakers
8. Motor Starters
9. Lighting Contactors
10. Emergency Battery Units
11. Wire and Cable
12. Variable Frequency Drives
13. Generator and ATS
14. Security camera system.

C. The Manufacturer name, product designation and catalog data sheet shall be submitted for the following material:

1. Conduit
2. Receptacles
3. Boxes and fittings
4. Switches
5. Lamps
6. Control Relays

D. Prior to submittal by the CONTRACTOR, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

E. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

F. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

G. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

1.12 MANUFACTURER SERVICES

A. Provide Manufacturer services for testing and start-up of the following equipment:

1. 480 Volt Switchgear
2. Emergency Generator
3. 480 Volt Motor Control Centers
4. Other items as required by appropriate specification sections.

B. The Manufacturer of the above listed equipment shall provide experienced Field Service Engineer to accomplish the following tasks:

1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "As-built" equipment configuration

will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity. The Manufacturer shall provide written approval that equipment supplied is approved for energization.

2. The Field Service Engineers shall provide engineering support during the energization and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the Manufacturer's performance specifications.

3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with Manufacturer's test specifications.

4. One (1) 4-hour training session on operation, and one (1) 4-hour training session on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The maintenance and trouble-shooting sessions shall be conducted with record "As-built" electrical drawings sufficient for a class of eight personnel.

5. A final report shall be written and submitted to the CONTRACTOR within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action. The CONTRACTOR shall forward a copy of this report to the ENGINEER for approval.

1.13 MATERIALS

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or Manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the expense of the CONTRACTOR, or shall be replaced by the CONTRACTOR at his own expense.

1.14 COORDINATION AND SHORT CIRCUIT STUDY

A. General:

1. The CONTRACTOR shall provide a Power System Study for the electrical power distribution and motor control equipment. The study shall be a totally independent effort to verify adequacy of all of the

existing equipment as well as new additions being implemented under these Specifications. The study shall be prepared by a professional engineer, registered in the State of Florida, with demonstrated experience in the performance of industrial power system analysis. The Engineer may not be an employee of an equipment manufacturer or supplier.

2. The CONTRACTOR shall provide data necessary to perform the study. This includes feeder cable sizes, approximate feeder length motor data, generator data, existing protective relay settings and any other information relevant to the study.

3. A summary of the short circuit analysis shall be provided to the CONTRACTOR at the time shop drawings for all of the new equipment is submitted for approval.

4. The CONTRACTOR shall provide complete sets of switchgear and emergency generator shop drawings for use in the study.

B. Scope:

1. The short circuit study shall be in accordance with ANSI Standard C37.010 and C37.13, shall be performed to check the adequacy, and to verify the correct application of circuit protective devices and other system components specified. The study shall address the case when the system is being powered from the normal source. Maximum possible fault conditions shall be adequately covered in the study.

2. Fault contribution of all motors shall be considered. The CONTRACTOR shall be responsible for obtaining all required data of equipment. All back-up calculations shall become part of the final report. The calculations shall be in sufficient detail to allow easy review.

C. Contents:

1. The study shall include representation of the power company's system, the base quantities selected, impedance source-data, calculation methods and tabulations, one-line and impedance diagrams, conclusions and recommendations. Short-circuit momentary duties, shall be calculated on the basis of an assumed bolted three-phase short circuit at each 480 volt bus, low voltage switchboard bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the systems. The short circuit tabulations shall include significant X to R ratios, asymmetry factors, KVA, and symmetrical fault current.

2. A protective device time current coordination study shall be included with coordination plots of key and/or limiting devices, tabulated data, rating, and/or settings selected. The study shall present an engineering balance between the competing objectives of protection and continuity of service for the system specified, taking into account the basic factors of sensitivity, selectivity and speed.

3. Separate plots shall be provided for each mode, "normal," and, "standby," operation. Maximum fault values shall be shown in each case. Both power sources shown in one plot will not be accepted.

4. Required settings for breakers and relays shall be maximized to provide the most effective protection possible whether the system is fed from the normal or emergency source.

5. Tabulations indicating recommended set points for all protective devices shall be provided.

D. Motor Starting Study:

1. A motor starting study for all large electric drives (150 HP and larger) to determine voltage dip or power inrush limitations at selected locations due to starting of motors shall be provided.

E. General Information for Time-Current Curves Presentation:

1. The coordination plots shall include complete titles, representative one-line diagrams, legends, associated power company's relay or system characteristics, significant motor starting characteristics, complete parameters for power, and substation transformers, and complete operating bands for low-voltage circuit breaker trip devices.

2. The coordination plots shall define the types of protective devices selected, together with the proposed coil taps, time-dial settings and pickup settings required.

3. The short-time region shall indicate the medium voltage relay instantaneous elements, the magnetizing in-rush, and ANSI withstand transformer parameters, the low-voltage circuit breaker instantaneous trip devices, fuse manufacturing to tolerance bands, and significant symmetrical and asymmetrical fault currents.

4. Each primary protective device required for a delta-to-wye connected transformer shall be selected so that the characteristic or operating band is within the transformer parameters; which, where feasible, shall include a parameter equivalent to 58 percent of the ANSI withstand point to afford protection for secondary line-to-ground faults.

5. Low-voltage power circuit breakers shall be separated from each other and the associated primary protective device, where feasible, by a 16 percent current margin for coordination and protection in the event of secondary line-to-line faults.

6. Protective relays shall be separated, where feasible, by a 0.3 second time margin when the maximum three-phase fault flows, to assure proper selectivity.

1.15 CONDUIT DRAWINGS

A. In addition to the manufacturer's equipment shop drawings, the CONTRACTOR shall submit for the approval, electrical installation working drawings for all site work and structures containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, motor control centers, transformers, panelboards, control panels and equipment, motors, switches, motor starters, large junction or pull boxes, instruments, and any other electrical devices connected to concealed or buried conduits.

2. Site electrical layout detailing underground conduit sections and routings.

3. Plans shall be drawn on ACAD version 14, size 36-inch x 24-inch. Engineer will provide base drawing files if requested in writing.

4. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit lavouts are approved.

1.16 DISPOSITION OF REMOVED MATERIALS AND EQUIPMENT

A. In general, it is intended that all materials and equipment indicated to be removed and disposed of by the CONTRACTOR shall, upon removal, become the CONTRACTOR's property and shall be disposed of off the site by the CONTRACTOR, unless otherwise directed by the Owner.

B. Reuse of wire will not be permitted. An exception is the reuse or relocation when wire is part of an existing lighting branch circuit and reuse or relocation is specifically designated and can be accomplished without removing and re-pulling the wire.

C. All reusable and salvageable disconnect switches, starters, control devices, control panels and instruments, receptacles, light fixtures, etc. shall be sorted and returned to the Owner.

D. All electrical equipment to be salvaged shall be removed and shall be moved by the CONTRACTOR to a location on the site for storage as directed by the Owner.

1.17 OPERATION AND MAINTENANCE DATA

A. Submit complete operations and maintenance data for all equipment furnished under this Division in accordance with other Sections. The manuals shall be prepared specifically for this installation and shall include all required cuts, Drawings, equipment lists, descriptions, complete part lists, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.18 WARRANTY

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections, but in no case less than one year from date of Owner acceptance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 16106 - 480 VOLT SWITCHGEAR

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install the 480 Volt switchgear as shown on the Drawings and as specified herein.

B. Equipment furnished under this section shall be the responsibility of the generator supplier as defined by 16216. As such, the generator supplier is responsible for the proper operation of the equipment defined in 16106 and 16216.

1.2 RELATED WORK

A. Concrete for equipment pad is specified in Division 3.

B. A power system study shall be provided and is included in Section 16050. The completed study shall be approved by the Engineer before the switchgear submittal will be reviewed.

1.3 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data, for the follows:

1. Equipment shop drawings showing elevation and plan views, conduit entrance spaces, nameplate data, bus arrangement, dimensions, weight, shipping splits and metering layouts. Indicate all options, special features, ratings and deviations from this Section.
2. Point-to-point compartment wiring diagrams for metering, relay, and control circuits. Show wire and terminal numbers.
3. Product data sheets and catalog numbers for circuit breakers, trip devices and protective relays. List all options, trip adjustments and accessories furnished specifically for this project.
4. Itemized bill of materials for metering, protective relays, accessories and control equipment.
5. Instruction and renewal parts books.
6. Itemized list of spare parts furnished specifically for this project, including quantities, description and part numbers.
7. Certified shop test reports.
8. Field test and inspection reports.

1.4 REFERENCE STANDARDS

A. Switchgear and components shall be designed, built and tested in accordance with the latest revision of the following standards:

1. UL1558 - Ul Standard for Safety Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear.
2. NEMA SG.5 - Power Switchgear Assemblies.
3. NEMA SG.3 - Low voltage power circuit breakers.
4. ANSI C37-20.1 and related standards.
5. National Electrical Code (NEC)

B. Solid-state circuitry shall meet or exceed the Transient Overvoltage Withstand Test per NEMA ISCI-109 and the Surge Withstand Capability Tests (SWC) per IEEE Standard 472 (ANSI C37.90A). In addition, where UL Standards exist for components, devices and/or assemblies, such standards shall apply.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

A. The equipment furnished under this Section shall be the product of a manufacturer who has produced this same type of equipment for a period of at least 10 consecutive years.

B. Switchgear shall be designed, assembled and tested by the manufacturer of the circuit breakers used in the switchgear.

C. All sections and devices shall be UL listed and labeled. Service equipment shall be UL labeled as suitable for use as service entrance equipment.

1.6 SYSTEM DESCRIPTION

A. Source Transfer Controls

1. Provide automatic source transfer controls as shown on the Drawings and as specified herein. Programmable logic controllers (PLC) will be permitted for the switchgear controls. However, manual controls utilizing relay logic with timers shall be provided. The source transfer controls shall be designed and manufactured by the generator switchgear supplier.

2. The transfer scheme shall include the following features and controls:

   a. Drawout type voltage transformers with primary and secondary fuses on the line side of each incoming main.
   b. AUTO-MANUAL mode selector switch. In the MANUAL mode, automatic switching shall be inhibited and local electrical manual operation using the circuit breaker control switches shall be permitted.
   c. Three phase undervoltage, open/reverse phase and negative sequence voltage sensing relays or devices.
   d. Electrical interlocks to prevent parallel connection of the two incoming sources.

e. A switch to permit either source to be selected as the preferred source.

f. A switch to permit either automatic or manual return to the preferred source.

g. Field adjustable 10 second time delay between transfer, either direction.

h. Source voltage available indicator lights, push-to-test, each source.

i. Manual retransfer pushbutton.

j. Provide voltage and current transformers for each main (No. 3 & No. 4).

3. System operation shall be as follows:

a. Protective relays and timing relays shall be provided as required for automatic operation. The incoming utility line shall be the preferred source. "Power Failure" and "Return to Normal" sensing relays shall be provided as required to signal the generator to start and stop as outlined hereinafter. A Manual/Automatic selector switch shall be provided in the Station Switchgear. The manual position of the selector switch shall override all automatic circuits and open all automatic circuits to the generator control panel. Safety interlocks shall prevent closing main, tie breaker and the generator breaker as indicated on the Drawings. The safety interlocks shall be independent of the Manual/Automatic selector switch. A key operated test switch shall be provided that will simulate a power failure for full load test by disconnecting the under voltage relay.

b. Normal operation of the system shall be with the selector switch in the automatic position. The source-transfer control shall utilize the split-bus primary-selective system. The normal condition shall be with the two main circuit breakers closed and with the bus-tie circuit breaker and generator circuit breaker open, so that each section of low-voltage bus is energized by its associated, separate source. The source-transfer control shall monitor the condition of both utility sources and shall initiate automatic operation when voltage has been lost (or reduced to a predetermined level) on either source for a period of time sufficient to confirm that the loss is not transient. Failure of the utility source shall energize timing relays, adjustable from 0 to 15 seconds, and open the main breakers. Opening of the main breaker shall close the station tie breaker and energize the generator run relay GR. Contacts on the generator run relay shall signal the generator to start. Once the contacts have closed, the generator shall complete a normal cycle. Contacts shall be provided to operate emergency lockout relays in the motor control centers to prevent selected loads from operating on emergency.

c. Relay contacts in the Generator Control Panel will signal the Generator Circuit Breaker to close when the generator has reached rated voltage and frequency.

d. Return of utility power shall energize "Return to Normal" timing relays, adjustable 3 to 30 minutes, to time out and stop the generators. Transfer timing relays, set at 5 seconds, shall delay closing of the main circuit breakers to prevent the utility source from being connected to spinning motors.

e. Should the generator fail, "Return to Normal Bypass" timing relay, adjustable 0 to 3 minutes, shall bypass the "Return to Normal" timing relays and close main breaker on a short time delay when normal power returns. A lockout relay (Device 86) shall prevent further automatic operation.

f. Operation of the current operated lockout relays (Device 86) on the breakers shall render all closing circuits (both manual and automatic) inoperative on the breakers. A lockout alarm light shall indicate the faulty breaker. Contacts for a remote, general station alarm shall be provided on each breaker.

1.7 MAINTENANCE

A. Furnish the following maintenance accessories for the switchgear.

1. Crank for racking breakers.
2. Circuit breaker floor crane.
3. Manual charging handle and maintenance slow closing device for electrically operated breakers.
4. Portable trip device test set and cables.

B. Furnish the following maintenance accessories with the switchgear control battery.

1. Hydrometer, if batteries are lead-acid type.
2. Post cleaning brushes

C. Provide the following spare parts in the quantities specified:

1. One dozen each of cover bolts, cage nuts and door fasteners.
2. One quart of touch-up paint.
3. One box (10 min.) Of each color and type of lens caps.
4. 10 pilot lamps of each size and voltage.
5. 10 control power fuses of each size.
6. 2 replacement sets of (3) breaker current limiters of each size.
7. 2 replacement sets of fuses of each size.

D. Spare parts shall be boxed or packaged for long term storage and clearly identified on the exterior of the package. Identify each item with manufacturers name, description and part number.

PART 2 - PRODUCTS

2.1 RATINGS

A. Service: 480 Volt, 3 Phase, 3 Wire, 60 Hz.

B. The switchgear and protective devices shall have a fully rated, short circuit withstand rating of 65,000 rms symmetrical Amps. Systems employing series connected ratings shall not be used. Main and feeder devices shall be coordinated for selective tripping.

C. The continuous current rating of the bus shall be 3000 Amps. The bus shall be designed to carry its rated continuous current in the specified ambient temperature without exceeding the temperature rise limits specified in ANSI Standard C37.20.1. Bus bracing shall exceed the specified equipment short circuit rating. Line and load bus connections to feeder devices shall be rated to carry the full continuous current of the device frame.

D. The switchgear, including devices shall be designed for continuous operation at its rated current in a 40 degree C ambient temperature.

2.2 CONSTRUCTION

A. General: The general arrangement of the Switchgear is shown on the Drawings. Switchgear shall be Type DS as manufactured by Cutler Hammer/Westinghouse; Type PZ-III by Square D Company; or Type AKD-8 as manufactured by the General Electric Company.

B. Structure

1. Switchgear shall be indoor NEMA 1 gasketed type, completely metal enclosed and sectionalized to isolate and minimize the effects of internal short circuit currents. The structure shall consist of a framework of preformed steel channels or angles covered with bolted steel sheets. Each individual breaker/metering cell shall be completely segregated from adjacent compartments and sections by steel barriers at top, bottom, rear and sides.

2. Breaker compartments shall be equipped with shutters to protect against contact with the energized primary disconnects when the breaker is removed from its compartment. Each individual breaker cell, metering and auxiliary compartment shall be provided with a hinged front panel door.

3. Provide side barriers between adjacent vertical structures in cable and bus compartments. The vertical bus shall be so arranged as to have insulating barriers interposed between phases to inhibit phase-to-phase faults. In addition, protective devices shall be completely

compartmentalized by the addition of barriers above and below each device to minimize fault communication.

4. Line and/or load terminals of each circuit breaker shall be extended to the rear so that it will be unnecessary to reach across or beyond a line bus to make connections. Removable insulation boots shall be provided to insulate the cable connections after the feeder cables have been installed. Rear cable compartments shall be isolated from the main and riser bus by insulated or grounded steel barriers. Provide cable supports in each vertical section. Cable compartments shall be standard depth with bending space in accordance with the NEC. Provide hinged and bolted covers on the rear of each vertical section.

5. All live buses shall be phase-isolated in the rear to help prevent accidental contact with buses when making upload terminations. The vertical buses shall be isolated from the main buses with full length glass polyester barriers. The main buses shall be phase-isolated from each other and from the device load/line lugs by means of isolating barriers. Joint bolts in the isolated bus system shall be insulated yet, maintainable without removal of the barriers. Insulation and isolation shall be designed to reduce entrance of foreign objects and contaminants, serving as a deterrent to fault initiation, yet designed to facilitate inspection and maintenance.

6. The switchgear shall be provided with adequate means for lifting, and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.

7. Protective devices shall be arranged so they are individually removable and readily interchangeable from the front of the switchgear. Rotary operating handles for all protective devices shall be of the same design and shall be prominently labeled to indicate device ampere ratings, and color coded for device type. ON/OFF and other indication shall be clearly shown by prominent markings and handle position. The protective devices shall be individually mounted with front hinged cover plates and all necessary buses and straps shall be provided.

C. Auxiliary Sections: The switchgear shall include an auxiliary cable pull section for transition from overhead cable feed. Provide bus extensions and compression lugs for number and size of incoming cables as shown on the Drawings.

D. Buses:

1. Main bus, riser bus, and circuit breaker connections shall be tin plated copper, with bolted connections. All bus bars shall be 98 percent conductivity copper with a current density of 1200 amperes per square inch. Surfaces shall be tin-plated by the Alstan 70 (or comparable) process to have a uniform appearance, free of blisters. The bus structure shall be mounted on supports of high impact non-tracking insulating material. Bus bars shall be uniformly arranged to provide A-B-C sequency left to right (from front), front to rear and top to bottom.

2. Bus bars shall not be tapered. Bolted connections shall be made with high strength bolts and locking hardware. Individual horizontal and vertical phase bus bars shall be insulated where industry standard 600 Volt clearances cannot be met. Breaker run backs shall be insulated.

3. Provide a continuous, 1/4-inch by 2-inch (minimum), tin plated copper ground bus extending throughout the entire length of the switchgear, bolted to each vertical section, equipped with lugs for external ground connections, sized for cables shown on the Drawings.

4. All hardware used on conductors shall be zinc or cadmium plated, have a tensile strength of 120 psi.

5. Provide 6-600 MCM lugs per phase on the load side of Main Breaker No. 3 for the generator connections.

E. Low Voltage Power Circuit Breakers

1. Circuit breakers shall be a product of the switchgear manufacturer and shall be metal frame construction, low voltage, drawout type, manually or electrically operated with stored energy closing mechanism. Circuit breakers shall be the switchgear manufacturer.

2. Where required to meet the specified equipment short circuit rating, breakers shall be equipped with integrally mounted current limiting fuses, coordinated with the trip devices. Each breaker shall be equipped with an open fuse tripping device and blown fuse indicator.

3. Circuit breakers shall be equipped with a temperature insensitive, adjustable, static overcurrent trip device with true three phase RMS sensing of sinusoidal and non-sinusoidal currents.

4. Trip devices shall have as a minimum, the following independent trip adjustments and functions:

   a. Interchangeable rating plugs.
   b. Adjustable long time pick-up.
   c. Adjustable long time delay.
   d. Adjustable short time pick-up.
   e. Adjustable short time delay.
   f. Adjustable ground fault pick-up.
   g. Adjustable ground fault delay.
   h. Trip mode targets for ground fault, overload and short circuit.
   i. Adjustable instantaneous on feeder breakers.

5. Manually operated circuit breakers shall be charged by a fixed operating handle. Tripping and closing shall be initiated by pushbutton or levers mounted on the front of the breaker. Racking position indicators shall be provided.

6. Electrically operated circuit breakers shall be charged by an electric motor. Electrically operated breakers shall also be provided with a mechanically operated manual trip pushbutton or lever mounted on the front of the breaker, a manual charging handle and racking position indicator.

7. Circuit breakers shall be equipped with a shunt trip and provisions for remote closing when automatic control is required.

8. Circuit breakers shall be capable of being racked out without exposing the operator to live parts. Interlocks shall be provided to prevent the following operations:

   a. Racking a closed breaker into or out of the CONNECTED position.
   b. Closing a circuit breaker until it is fully racked into the TEST or CONNECTED position.
   c. Withdrawing a circuit breaker from the cubicle while the closing springs are charged.
   d. Insertion of a breaker of incorrect frame size or inadequate interrupting capacity.

9. Each breaker shall have a secondary control power plug which automatically engages a cell mounted mating receptacle in the CONNECTED position and disengages as the circuit breaker is racked out to the TEST/DISCONNECT position. Provide a means to manually engage the control power plug in the TEST/DISCONNECT position.

10. Breaker contacts on the removable element (TOC) auxiliary switch shall be wired to terminal blocks. Provide 6 normally open and 6 normally closed spare auxiliary contacts in addition to the auxiliary contacts required for breaker operation. Normally closed auxiliary contacts shall break before the normally open auxiliary contacts make.

11. Circuit breakers shall be equipped with mechanism operated (MOC) auxiliary switch contacts for remote status indication. Provide 6 spare "a" and 6 spare "b" contacts wired to terminal blocks.

12. Circuit breaker frame sizes and trip ratings shall be as shown on the Drawings.

13. Cells for future breakers shall be fully equipped with drawout carriage, racking mechanism, primary and secondary contacts, and current transformers. Unless otherwise shown on the Drawings, future breakers shall be for up to 1600 Amp ratings.

14. Circuit breakers shall have additional auxiliary contacts for the controls and interlocks as required and as shown on the Drawings. The circuit breakers shall be provided with a key interlock and bell alarm switches. The following but not limited to shall be provided, in addition to the trip devices; power supply, trip coil, close coil, interpole phase barriers with

manual trip button and position indicator. The trip button shall also permit mechanical simulation of overcurrent tripping for test purposes.

F. Control Power

1. Each breaker shall be electrically operated at 48 volts DC from the station battery console specified herein. Breaker operating mechanism shall be electrically charged, stored energy type. Charging motor shall include a limit switch feature and an anti-pump relay. Make provisions for manual charging of the mechanism and for slow closing of the contacts for inspection and adjustment.

2. Tripping and Closing Battery:

   a. The tripping and closing battery shall be a console-mounted, nickel-cadium, or type especially designed for switchgear service.

   b. The battery shall be rated 48 Volt, DC, and shall be sized for no less than 6 close-open-close cycles per breaker, for each breaker operated in succession at the end of a 6 hour period at a battery temperature of 45 degrees F.

   c. Furnish and install an automatic battery charger for charging the nickel-cadmium battery being supplied. The charger shall be a phase-modulated type using solid-state control circuits and SCR in the power circuit, with d-c voltmeter, d-c ammeter, adjustable float and equalizing voltage potentiometer, with AC and DC circuit breakers and "ON" pilot lamp mounted on the front of the hinged door, and 0-72 hour automatic equalizing timer. The charger shall maintain a float charge of 1.43 volt/cell and an equalizing charge of 1.55 volt/cell. A ground detection relay and alarm and a low voltage relay and alarm shall be furnished. It shall operate from 120 volt, single-phase, 60 Hertz supply, and shall be capable of automatically recharging the battery in 12 hours when the battery is 50 percent discharged. The charger batteries and accessories shall be mounted in a free-standing, NEMA-1 ventilated enclosure. The battery system shall be manufactured by Exide, LaMarche or approved equal, and shall be furnished by the switchgear manufacturer.

G. Secondary Wiring and Control Devices

1. Wiring: 600 Volt, stranded tinned copper, type SIS, flameproof switchboard wire, minimum size No. 14 AWG for control, No. 12 AWG for power and instrument transformer secondaries. Wiring shall be grouped together with harnesses or in ducts and shall be secured to the structure. Pull out type fuse holders shall be used for control circuits.

2. Identification and termination: All wiring shall be numbered at each end with type-written heat shrinkable markers. Terminal blocks shall be rated

20 amps minimum, 600 volt, screw type with white marking area. Current transformer secondaries shall be wired to shorting type terminal blocks.

3. Instrument and control switches: 600 Volt switchboard rotary type, rated 20 Amps continuous, with black molded phenolic escutcheon plates, white characters, switchgear manufacturer's standard.

   a. Circuit breaker control switches shall be of the momentary contact, spring return type having mechanical target or flag (target position shall not prohibit operation in any cases) and a black, fixed, pistol grip handle.
   b. Ammeter and voltmeter transfer switches shall be maintained contact, non-spring return type with black, fixed, knurled handle.

4. Indicator lights: Provide green, red and amber pilot lights for each circuit breaker OPEN, CLOSED and TRIP indication. Indicators shall be full size, LED type.

H. Control and Metering Transformers

1. Potential transformers: Two-winding, encapsulated drawout type with primary and secondary fuses. Voltage ratings shall be as required for the application. Thermal rating and metering accuracy per ANSI standards, ±1%.

2. Current transformers: Toroidal type suitable for mounting on breaker stabs. Continuous thermal current rating, relaying and metering accuracy shall conform to ANSI standards, ±1%.

3. Control power transformers: Two-winding dry type with primary fuses, secondary circuit breaker, NEMA sized for the application.

I. Instrumentation and Metering

1. Power circuit monitors shall be provided on the circuit breakers as indicated in the single line diagrams. The circuit breaker monitor shall have the system display and shall be capable of monitoring up to 16 remotes on a standard RS-485 communications link, 10,000 feet (maximum). The power circuit monitors shall replace the standard voltmeters and ammeters and shall be Square D Company's "Power Logic", Class 3070, or equal, with all features available for field connection.

2. Uninterruptible Power Supply (UPS) shall be provided for operating all Power Monitors within the switchgear. UPS shall be provided with overcurrent protection.

3. Monitoring and Control Functions

   a. Provide four self-powered digital status inputs to monitor the following points:

Circuit breaker OPEN status
Circuit breaker CLOSED status
Circuit breaker TRIPPED status
Circuit breaker OUT OF SERVICE (withdrawn) status

b. Provide one auxiliary analog input rated 1.0 VAC/VDC nominal full scale input which can be used to measure an external variable such as transformer temperature, air temperature, or battery voltage.

c. Provide one auxiliary analog output (4-20ma) proportional to any measured parameter.

d. Provide three Form C dry contact control relay outputs rated 277 VAC or 30 VDC at 10 Amp maximum load current, that can each function as:

Setpoint relays that operate as a function of any measured parameter for demand, power factor, or load control. Seventeen programmable setpoints shall each have programmable operate and release limits and time delays on operate and release. Relays shall provide selectable pulse mode or latch mode operation.
Remote control relays operated by commands via the communications port.
Breaker trip relay (over/under volt, volt unbalance, phase reversal, current unbalance, over/under frequency).
KWH or KVARH pulse output relay
Alarm relays

4. Operational Features

a. Provide the following operating features:

True RMS measurements.
Connect directly to PT's and CT's for systems over 600 volts.
Provision for a fourth current input for measurement of ground or neutral current.
300 amp, one second surge protection on all four current inputs.
3-field, 20 character, high visibility 0.4-in character height vacuum-fluorescent display with a programmable time out feature.]

J. Protective Relays

1. Provide protective relays as shown on the Drawings. Relay characteristics shall be selected by the Engineer based on the short circuit and coordination study.

2. Protective relays shall be self-contained, induction disc type mounted on a drawout chassis with a dust-tight removable cover. Chassis units shall be easily removable for inspection and testing. Current transformer secondaries shall be automatically grounded when the relay chassis is removed from the case. Test plugs and cables shall be provided. Quantities shall be as required or as shown on the Drawings. Relays shall be of the following types:

   a. Device 27 undervoltage relay shall be General Electric, Type NGV or approved equal.
   b. Device 50/51 instantaneous and time overcurrent relay shall be General Electric, Type IFC or approved equal.
   c. Device 51 time overcurrent relay shall be General Electric, Type IFC or equal.
   d. Device 51N time overcurrent relay (residual type) shall be General Electric, Type IFC or equal.
   e. Device 60 negative sequence voltage relay shall be General Electric, Type NBV with harmonic filter or equal.
   f. Device 62 time delay relay shall be as manufactured by Agastat or approved equal.
   g. Device 86 lockout relay shall be General Electric, Type HEA or equal.
   h. Device 51G time overcurrent relay (neutral grounding resistor type) shall be General Electric, Type IFC or equal.
   i. Device 47 phase sequence relay shall be G.E. Type IRC or equal.
   j. Device 81 under frequency relay shall be G.E. Type SFF202 or equal.

K. Lightning and Surge Protection: Bus connected lightning and surge protection: 600 Volt, 3 Phase lighting protection shall be Advanced Protection Technologies surge protectors as shown on the drawings.

L. Marking and Identification

1. Provide nameplates on each breaker cell door and for each control or indicating device. Nameplates shall be engraved as specified on the Drawing or as directed, using lettering approximately 3/8-in high for unit identification nameplates and 1/4-in high elsewhere. The nameplates shall be black and white laminated phenolic material. The engraving shall extend through the black exterior lamination to the white core. Nameplates shall be screw fastened.

2. Provide permanent master nameplate for switchgear designation, manufacturer's name, model number, order number and voltage, current and interrupting ratings.

3. Provide warning label marked "DANGER - 480 VOLTS KEEP OUT" on each rear compartment door. Labels shall be adhesive backed mylar, OSHA approved.

2.3 SURFACE PREPARATION AND SHOP COATINGS

A. All non-current carrying metal parts of the switchgear assembly shall be cleaned of all weld spatter and other foreign material and given a hot iron-phosphate chemical treatment. A zinc rich, heat cured, epoxy primer shall be applied to inhibit rust.

B. Indoor equipment shall be painted with one finish coat of manufacturer's standard air dried enamel. Color shall be light grey ANSI 61 or ANSI 49.

C. Unpainted non-current carrying parts shall receive a protective zinc plating to prevent corrosion. Printed circuit boards shall be coated with a protective conformal epoxy. All device contacts shall be gold or silver plated.

2.4 SHOP TESTING

A. Perform manufacturers standard production testing and inspection in accordance with ANSI standards. The manufacturer shall submit certified copies of test results to indicate proof of compliance with ANSI C37.50 and C37.51.

2.5 MANUAL TRANSFER SWITCH

A.. Service: 3000 Amp, 480 volt, 3-phase, 3-wire, 60 Hertz.

B. The overall short circuit withstand rating of the equipment and devices shall be 65,000 Amperes RMS symmetrical at 480 volts. Systems employing series connected ratings shall not be used.

C. Circuit Breakers

1. Power circuit breakers shall match the station switchgear as specified herein. Circuit breakers shall operate on the 48 VDC station switchgear batteries specified herein. Trip device shall be temperature insensitive and have the following characteristics and functions:

    a. Independently adjustable long time pick-up and delay.
    b. Independently adjustable short time pick-up and delay.
    c. Adjustable instantaneous.
    d. Independently adjustable ground fault pick-up and delay.
    e. Trip mode targets for over load, short circuit, and ground fault.

D. The manual transfer switch shall be housed in a free standing floor mounted, NEMA 1 gasketed enclosures 90" high as shown on the drawings. Enclosures shall be painted ANSI-61 light grey. Each circuit breaker shall be labeled and provided with signage which reads as follows "DANGER 480 VOLTS - KEEP OUT".

E. Manufacturer shall provide bussing, metering, etc. as specified herein and as shown on the drawings.

F. The transfer switch shall be listed under U.L. 1008. Switches utilizing reversing contactor mechanisms as a means to transfer load will not be considered. Transfer switch shall be of the circuit breaker construction.

G. Manual transfer switch shall include the following accessories:

1. A manual source selector switch with source identification.
2. For each circuit breaker provide indication for open, closed and tripped.
3. Full phase protection.
4. Adjustable time delay on transfer to either source in neutral position (i.e. both circuit breakers open).
5. Two sets of normally closed and open auxiliary contacts shall be provided on each breaker in addition to those required for controls.
6. Ground bar.
7. Ground fault protection.
8. Controls and interlocks shall be provided so that only one source can be connected at any one time. Additional controls and interlocks as required to integrate the existing and new generator controls systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment shall be leveled and anchored directly to a concrete equipment pad or finished floor as shown on the Drawings. Provide hardware and metal shims for installation. Grout and caulk all voids beneath the equipment base. Anchor bolts shall be 5/8-in stainless steel, minimum sized and installed in accordance with the manufacturer's recommendation.

B. Install the equipment in accordance with the manufacturers' instructions.

C. Remove temporary lifting angles, lugs, and shipping braces. Touch-up damaged paint finishes.

D. Make wiring interconnections between shipping splits.

E. Install bus splice plates and torque the connections.

F. Caulk seams, cracks, and openings in outdoor enclosures.

3.3 FIELD TESTING

A. A certified factory representative of the switchgear manufacturer shall inspect and test the installed equipment prior to energization. The switchgear manufacturer shall provide all material, labor, equipment and technical supervision to perform the tests and inspection.

B. Equipment testing and inspection shall be performed before energizing the switchgear in accordance with NETA Standard AT5 and shall include the following.

1. Visual and mechanical inspection.
2. Ratio and polarity tests on current and voltage transformers.
3. Ground resistance test.
4. Insulation resistance tests (phase-to-phase and phase-to-ground).
5. Meter calibration
6. Circuit breaker contact resistance test.
7. Insulation power factor and resistance test for surge arresters.
8. Phasing check.
9. Current injection tests on each circuit.

C. In the event of an equipment fault, notify the Engineer immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor, Engineer, Owner and the equipment manufacturers factory service representative. Repair or replace the equipment as directed by the Engineer and Owner prior to placing the equipment back into service.

3.4 ADJUSTMENT

A. The switchgear manufacturer shall provide the services of a factory trained service representative(s) for the time period specified in Section 16050. The first trip shall be coordinated with the field testing. The second trip shall include any necessary follow-up or punch list work and technical instruction for the Owner's designated personnel. The manufacturer's service representative(s) shall demonstrate all operational features of the installed switchgear.

B. The switchgear manufacturer's factory service representatives shall make the following test and adjustments:

1. Calibrate and test all circuit breaker trip devices, protective relays and controls per the final version of the Coordination Study specified in Section 16050.
2. Adjust and lubricate circuit breaker operating mechanisms and contacts.

3.5 CLEANING

A. Remove all rubbish and debris from inside and around the switchgear. Remove dirt, dust, or concrete spatter from the interior and exterior of the equipment using brushes, vacuum cleaner, or clean, lint-free rags. Do not use compressed air.

END OF SECTION

SECTION 16108 - MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as hereinafter specified and as shown on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Disconnect Switches:

1. Fusible and non-fusible disconnect switches shall be heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3-pole with full cover interlock. All current carrying parts shall be copper.
2. Enclosure type shall be NEMA 4X, stainless steel with copper lugs except as otherwise shown on the Drawings.
3. Switches shall be horsepower rated as manufactured by the Square D Co., or approved equal.
4. Control wiring shall not pass through any disconnect enclosure. A stainless steel junction box shall be provided, and utilized to separate power and control wiring prior to the disconnect enclosure.
5. Each disconnect shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served.

B. Manual Motor Starters:

1. Manual motor starters shall be furnished and installed for single-phase motors. Manual starters shall be non-reversing, reversing or two speed type as shown on the Drawings. Built-in control stations shall be furnished where shown on the Drawings.
2. Enclosure type shall be NEMA 12 except as shown on the Drawings.
3. NEMA Type 4 enclosures shall be stainless steel.
4. Manual motor starters shall be as manufactured by the Square D Co., or approved equal.

C. Magnetic Motor Starters:

1. Motor starters shall be 2 or 3-pole, 1 or 3-phase as required, 60 Hz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.
2. Two speed starters shall be for single or two winding motors as shown on the Drawings.
3. Each motor starter shall have a 120 volt operating coil, and control power transformer. Three phase starters shall have three overload relays.

Auxiliary contacts shall be provided as shown on the Drawings or required.

4. Overload relays shall be non-adjustable, ambient compensated and manually resettable.
5. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with fuses.
6. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.
7. Enclosure type shall be NEMA 1 except as shown on the Drawings.
8. NEMA Type 4 enclosures shall be stainless steel.
9. Magnetic motor starter shall be as manufactured by the Square D Co. or approved equal.

D. Combination Magnetic Motor Starters:

1. Motor starters shall be a combination motor circuit protector and 3-pole, 60 Hz, 600 volt, magnetically operated, full voltage non-reversing contactor except as otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.
2. Two speed starters shall be for single or two winding motors as shown on the Drawings.
3. Each motor starter shall have a 120 volt operating coil and control power transformer. Three phase starters shall have three overload relays. Auxiliary contacts shall be provided as shown on the Drawings or as required.
4. Overload relays shall be non-adjustable, ambient compensated and manually resettable.
5. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.
6. Enclosure type shall be NEMA 12 except as shown on the Drawings.
7. NEMA Type 4 enclosures shall be stainless steel.
8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be furnished with bolt-on current limiting fuses.
9. Combination magnetic motor starters shall be as manufactured by the Square D Co. or approved equal.

E. Control Stations:

1. Control stations shall be NEMA 4X stainless steel heavy-duty type with full size operators when located outdoors, in "NEMA 4" locations, or in "Corrosive" areas.
2. Control stations shall be Class 9001 manufactured by the Square D Co. or approved equal.
3. Pilot lights shall be complete with glass jewels and 150 volt lamps.

F. Dry Type Lighting Transformers:

1. Transformers shall be dry type, two-winding with KVA and voltage ratings as shown on the Drawings.

2. Four full capacity taps shall be furnished, two 2-1/2% above and two 2-1/2% below rated primary voltage.
3. Transformers shall be built in accordance with ANSI C89 and NEMA ST1-4 with a maximum insulation temperature rise of 115 C.
4. Transformers shall be manufactured by the General Electric Co., or Square D (SORGEL).

G. Control Relays:

1. Control relays shall be heavy duty machine tool type, with 10 ampere, 600 volt, convertible contacts. Time delay relays shall be pneumatic, adjustable 1/5 to 180 seconds.
2. Relays shall be CR2810 and CR2820 as manufactured by the General Electric Co. or approved equal.

H. Unless otherwise noted, all NEMA 4 enclosures shall be stainless steel. NEMA 4X push buttons and pilot lights shall be provided in all weatherproof control panels.

I. Line Thermostats:

1. Line voltage thermostats shall be rated 120 volt, 10 amp, and shall be Mercoid-861, Honeywell, or approved equal.
2. Furnish 1-stage for cooling or heating as indicated on the Drawings.

J. Noise Isolation Transformers (Transformer TR1):

1. Transformers shall be dry type, two-winding with KVA and voltage ratings, single or three phase as shown on the Drawings.
2. A minimum of 4 full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.
3. Electrostatic shield and "spike" suppression shall be provided.
4. Maximum temperature rise shall be 115 C.
5. Transformers shall be General Electric Company's "Guard II", Topaz "Ultra-Isolator" or approved equal.

END OF SECTION

SECTION 16110 - RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

1.2 APPLICATIONS

A. Except where otherwise shown on the Drawings, or hereinafter specified, all exposed raceways shall be in aluminum conduit. PVC conduit shall be used underground for power conductors. PVC coated aluminum conduit shall be used for underground instrumentation conduits (Those carrying 4-20 mA signal wire).

B. Aluminum conduit shall be used in administrative areas, laboratories, lunch rooms and similar dry, clean areas.

C. Schedule 80 PVC conduit shall be used underground for power conductors where concrete encasement is not called for. Instrumentation conduits installed underground shall be PVC coated aluminum. Where Schedule 80 PVC is used, all elbows and risers to above grade shall be PVC coated aluminum. All elbows above grade shall be suitably grounded. Conduit spaces shall be provided for underground conduit installation.

D. PVC schedule 80 conduit shall be used in chemical areas.

E. All conduit of a given type shall be the product of one manufacturer.

F. All switch, outlet and control station boxes and fittings shall be aluminum or stainless steel.

G. Concealed switch, outlet and control station boxes in NEMA 1 areas shall be aluminum.

H. Terminal boxes, junction boxes, pull boxes, etc., installed outdoors shall be NEMA 4X stainless steel. All boxes installed indoors may be aluminum or PVC.

I. Combination expansion-deflection fittings shall be used where exposed or embedded conduits cross structure expansion joints.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rigid Metal Conduit

1. Rigid metal conduit shall be for use under the provisions of NEC Article 346.

2. Rigid aluminum conduit shall be 6063 alloy and shall be as manufactured by New Jersey Aluminum Corp., AFC Co., VAW of America, Inc., or approved equal.
3. PVC coated aluminum conduit shall have a 1/50-in thick, polyvinyl chloride coating permanently bonded to the aluminum conduit and an internal phenolic coating, and shall be plasti-bond 2" as manufactured by Robroy Industries, Triangle PWC Inc., Perma-Cote Industries, or approved equal.

B. Rigid Nonmetallic Conduit

1. Rigid nonmetallic conduit shall be for use under the provisions of NEC Article 347.
2. PVC conduit shall be rigid polyvinyl chloride schedule 80 as manufactured by Carlon, An Indian Head Co., Kraloy Products Co., Inc., Highland Plastics Inc., or approved equal.

C. Liquidtight Flexible Conduit, Couplings and Fittings

1. Liquidtight flexible conduit shall be for use under the provisions of NEC Article 351A.
2. Liquidtight flexible conduit shall be Carflex by Carlon, or approved equal.
3. Fittings used with liquidtight flexible conduit shall be nylon.
4. Fittings installed on tanks, filter area, chemical rooms and other outdoor process areas shall be aluminum.

D. Flexible Couplings, Non-metallic

1. Flexible non-metallic couplings shall be as manufactured by the Crouse-Hinds Co., Appleton Electric Co., Killark Electric Manufacturing Co., or approved equal.

E. Boxes and Fittings:

1. PVC and stainless steel switch and outlet boxes shall be manufactured by Carlon, Appleton, or approved equal.
2. Nema 1 terminal boxes, junction boxes, pull boxes etc., may be fiberglass (FRP) or stainless steel. Boxes shall be as manufactured by Hoffman Engineering Co., Stahlin, or approved equal. NEMA 4 boxes located outdoors shall be 316 stainless steel.
3. Cast aluminum boxes and fittings shall be copper-free aluminum with cast aluminum covers and corrosion-proof screws as manufactured by the Killark Electric Co., Crouse-Hinds Co., Appleton Electric Co., or approved equal.
4. Conduit hubs shall be as manufactured by Meyers Electric Products, Inc., Raco Div., Appleton Electric Co., or approved equal. Conduit hubs shall be provided for all outdoor conduit terminations.
5. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. Co., or approved equal.
6. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or approved equal.

7. Telephone fittings for floor boxes shall have rubber grommeted holes, Walker Catalog No. 501AL or approved equal by Hubbell, Thomas & Betts or approved equal.
8. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK, Spring City Electrical Manufacturing Co., Type WDP, or approved equal.
9. Conduit wall seals for cored holes shall be Type CSML as manufactured by the O.Z./Gedney Co., or approved equal.
10. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co., or approved equal.
11. Conduit sealing bushings shall be O.Z./Gedney Type CSB or approved equal.

G. Terminal Cabinets:

1. Interiors shall be so designed that control relays and terminal blocks can be replaced or added without disturbing adjacent units. Each cabinet shall be furnished with a minimum of 100 spare terminals.
2. All interiors shall be completely factory assembled with control relays, terminal blocks, insulating barriers, etc. All 120 volt ac and dc terminal blocks shall be isolated from each other by insulating barriers or installed in separate enclosures.
3. All wiring within the cabinets shall be grouped together in harnesses and secured to the structure.
4. All shielded cables shall terminate in separate cabinets. A third terminal shall be provided for each twisted shielded pair and the shield for each connected thereto, unless otherwise noted on manufacturer's shop drawings.
5. Terminal blocks shall be tubular screw type with pressure plates and shall be rated 600 volts. Terminal blocks shall be Allen Bradley Catalog Number 1492-CA1 or approved equal.
6. Indoor boxes shall be made from 14 gauge galvanized steel and shall be of sufficient size to provide a minimum of 4 inches of wiring space on all sides and between adjacent terminal blocks. A minimum 2 inch space shall be provided between control relays. A minimum of four mounting studs shall be provided on each cabinet. Cabinets shall be furnished without knockouts. Holes for raceways shall be drilled on the job.
7. A single hinged door shall cover the front of each terminal cabinet. Doors shall have a neoprene gasket, vault type handle, three point catch and lock. Two keys shall be supplied for each lock. All locks shall be keyed alike. A terminal block schedule shall be provided with each terminal point numbered and identified (typewritten) as to function. Spares shall be indicated in erasable pencil.
8. All exterior and interior steel surfaces of the cabinets shall be properly cleaned and finished with gray over a rust-inhibiting phosphatized coating conforming to ANSI A55.1. The finish paint shall be of a type to which field applied paint will adhere.
9. Cabinets shall be Hoffman Engineering Company with latch kit hardware or approved to be an equal product. All terminal cabinets mounted

outdoors shall be NEMA 4 304 stainless steel with quick operating latches.

10. A laminated chart showing control and instrumentation identification pertaining to location and function shall be provided for each terminal cabinet. The CONTRACTOR is responsible for obtaining all control diagrams and coordinating the wiring of all equipment. The chart inside each terminal box shall depict each endpoint designations of all control cable.
11. Instrumentation signal wiring shall be looped in the PLC cabinets.

H. Conduit Mounting Equipment: Stainless steel channel and stainless steel hardware shall be used in all areas indoors or outdoors.

I. Lighting Channel Support System:

1. Lighting channel support systems shall be installed complete with all hanger fittings, threaded rod hangers, beam clamps, fixture hangers and appurtenances.
2. Channel and appurtenances shall be stainless steel with stainless steel mounting hardware. Maximum deflection shall not exceed 1/200 of the span.
3. Channel support system shall be as manufactured by Unistrut Corp. or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. No conduit smaller than 3/4-inch electrical trade size shall be used, nor shall any have more than four 90 degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size in floor slabs shall be 3/4-inch.

B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. The ends of all conduits shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

D. Conduit supports shall be spaced at intervals as required to obtain rigid construction, but in no case more than as required by the NEC.

E. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-inch diameter. Material type shall be as specified in Section 2.

F. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

G. All conduits on exposed work shall be run at right angles to and parallel with the surrounding walls and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true. Conduits not installed in this fashion shall be replaced entirely at the Contractor's expense with no cost to the Owner.

H. No unbroken run shall exceed 300 feet in length. This length shall be reduced by 75 feet for each 90 degree elbow.

I. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

J. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.

K. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.

L. Liquidtight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is present.

M. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.

N. Conduit stub outs for future construction shall be provided with threaded PVC end caps at each end.

O. Aluminum conduit entering manholes and below grade pull boxes shall be terminated with grounding type bushings and connected to a 5/8" x 10" copperweld rod with a #6 bare copper wire.

P. Underground 120 volt circuits (Schedule 80 PVC) shall be installed directly to the respective motor control centers, lighting panels, etc. Stainless steel pull boxes shall be wall mounted on structures to eliminate excessive bends. With prior approval, below grade pull boxes, equal to Brooks #2424 (minimum), with hot dip galvanized covers and frames, may be used. Splices shall not be made in above or below grade pull boxes without prior approval.

Q. A 2-inch concrete conduit housekeeping pad shall be required for all exposed conduit stub-ups. This applies to ALL exposed conduits installed indoors or outdoors.

END OF SECTION

SECTION 16120 - WIRES AND CABLES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified.

1.2 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted for approval. Each sample shall have the size, type of insulation, UL listing and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Engineer with the wire actually installed. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

1.3 APPLICATIONS

A. Wire for lighting and receptacle circuits above grade shall be type THWN.

B. Wire for all power motor circuits and below grade lighting and receptacle circuits shall be type THWN-2, stranded.

C. Single conductor wire for control, indication and metering shall be type THWN-2 No. 14 AWG stranded.

D. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

E. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

1.4 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn stranded copper conductors.

2.2 600 VOLT WIRE AND CABLE

A. Type THWN-2 shall be as manufactured by the Southwire Co., General Cable Co., Rome Cable or approved equal.

2.3 INSTRUMENTATION AND CONTROL CABLE

A. Process instrumentation wire shall be twisted pair, 600V, cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP" as manufactured by Beldon, Alpha, American Insulated or approved equal. Multi-conductor cables shall be supplied with individually shielded twisted pairs.

B. Multi-conductor control cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, type "XLP" as manufactured by Beldon, Alpha, Carol Cable, American Insulated Wire Co., or approved equal.

2.4 TERMINATIONS AND SPLICES

A. Power Conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with 3M brand heat shrink boot or epoxy filling.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors per termination. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors. 3M brand heat shrink boots shall be utilized for all outdoor splices.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations permitted shall be typical of control conductors. Splices are allowed at instrumentation terminal boxes only.

D. Except where otherwise approved by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid aluminum conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at the transmitter end only, unless otherwise directed by supplier of the instrumentation equipment.

F. Wire and cable connections to terminals and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

H. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

I. All control and instrumentation circuits and wiring shall be clearly and permanently numbered and labeled at each end so as to identify the location of the opposite end and the function of the circuit. Individual wires in a multi-wire circuit shall be identified with wire numbers. Labeling shall be in place prior to turnover of any equipment, system or sub-system to Owner.

3.2 TESTS

A. All 600-volt wire insulation shall be tested with a meg-ohmmeter after installation. Tests shall be made at not less than 1,000 VDC. See 16050 for additional testing requirements.

B. All service conductors shall be tested as in paragraph A above. These tests shall be witnessed by the Engineer. A written report shall be submitted to the Engineer for review.

END OF SECTION

SECTION 16150 - MOTORS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

1.2 QUALIFICATIONS

A. Motor shall be sufficient size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.3 SUBMITTALS

A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.

B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

C. Provide equipment warranty in accordance with Section 01780: Warranties.

PART 2 - PRODUCTS

2.1 RATING

A. Unless otherwise noted, all motors shall be of the low voltage type. All motors ½ through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 300 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below ½ horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

2.2 THREE PHASE INDUCTION MOTORS

A. All motors 125 horsepower and larger, not VFD operated, shall be furnished with power factor correction capacitors. The motor control center manufacturer shall provide suitable capacitors for mounting in the motor control center. The motor supplier shall confirm that the capacitors provided are suitable to raise the power factor to 95% minimum. Power factor correction capacitors shall be provided only for the high-speed winding on 2-speed motors.

B. The operating power factor of the motors shall range from 93% to 95% at full load and 95% to 98% when partially loaded. The capacitor current shall not exceed the motor no-load magnetizing current.

C. Capacitors shall be oil insulated or dry type with integral fuse protection and discharge resistor. The insulating medium shall be nonflammable and meet the U.S. Environmental Protection Agency Standards.

D. Motors 25 HP and larger shall have a 120-volt space heater for moisture control.

E. Unless specifically noted in other sections of these Specifications, all motors shall have an efficiency as indicated in the table below. Motors shall be "premium efficiency" type.

TABLE 1

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	2-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102

F. Motors operating with variable frequency drives shall indicate on the nameplate that they are suitable for their intended applications (Inverter duty).

2.3 CONSTRUCTION

A. General:

1. All dripproof and weather protected Type I motors shall have epoxy encapsulated windings. Totally enclosed motors shall not be encapsulated. Motors not readily available with encapsulated windings may be standard type. Motors exposed to the outside atmosphere shall be totally enclosed fan cooled (TEFC) unless otherwise specified.

2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage induction type, NEMA design B. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA

standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.
3. Motors shall be totally enclosed fan-cooled construction with 1.15 service factor unless otherwise noted. Indoor motors shall be ODP unless otherwise noted.
4. Outdoor motors shall be mill and chemical duty suitable for operation in moist air with hydrogen sulphide gas present.
5. The output shaft shall be suitable for direct connection or belt drive as required.
6. Motors shall have a Class B nonhygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.
7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.
8. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.
9. All machine surfaces shall be coated with rust inhibitor for easy disassembly.
10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.
11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.
13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or approved equal.
14. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel, designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.
    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.
    c. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.
    d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large

reservoir providing 10 years' normal operation without relubrication.

15. Integral Horsepower:

a. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be gound and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be copper or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed antifriction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin.

C. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open dripproof, or totally enclosed fan cooled as called for on the Drawings, with temperature rise in accordance with NEMA Standards for Class B insulation.
2. Totally enclosed fan cooled motors shall be designed for severe-duty.
3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protective plating.
4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motor Connections: All motors shall be connected to the conduit system by means of a short section of flexible conduit, 18 inch minimum and 60 inches maximum, unless otherwise indicated. For all motor connections, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

B. Connection to motor leads shall be compression type with 3M brand heat shrink boot.

3.2 TESTS AND CHECKS

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The following table gives minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one minute of megger test run.

TABLE 2

Degree Winding Temperature		Voltage		
F	C	115V	230V	460V
37	3.9	60	108	210
50	10	32	60	120
68	20	13	26	50
86	30	5.6	11	21
104	45	2.4	4.5	8.8
122	50	1	2	3.7
140	60	.5	.85	1.6

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

END OF SECTION

SECTION 16160 - PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor materials, equipment and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

PART 2 - PRODUCTS

2.1 RATING

A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2.2 STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

2.3 CONSTRUCTION (NEMA 1)

A. Interiors:

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the antiturn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.
2. interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
4. A nameplate shall be provided listing panel type, number of circuit breakers and ratings.

B. Buses:

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.
4. Buses for 480V panelboards shall be rated for 65,000 amperes RMS symmetrical. Buses for 120/208V light panels shall be rated 10,000 amperes RMS symmetrical.

C. Boxes:

1. Recessed boxes shall be made from galvanized code gauge steel without knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.
2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in paragraph D4.
3. At least 4 interior mounting studs shall be provided.
4. All conduit entrances shall be field punched.

D. Trim:

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.
2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-inches in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.
3. The trims shall be fabricated from code gauge sheet steel.
4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.
5. Trims for flush panels shall overlap the box by at least 3/4-inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer:

1. 120/240V, single phase, 3-wire, and 120/208V 3-phase, 4-wire panelboards shall be General Electric Company Type NLAB, Square D Co. Type NQOB, or approved equal.
2. 480V, 3-phase, 3-wire panelboards shall be General Electric Company Type CCB, Square D Co., I-Line, or approved equal.

2.4 CONSTRUCTION (NEMA 4)

A. Interiors and Buses: Interiors and buses shall be as herein before specified for NEMA 1 construction.

B. Boxes and Covers:

1. Boxes and covers shall be made from stainless-steel with natural finish.
2. Boxes and covers shall be bolted together and gasketed.
3. Conduit openings shall be tapped.

C. Manufacturer: NEMA 4 panelboards shall be type DVP or DHP as required by voltage application; manufactured by the Crouse-Hinds Company or approved equal.

2.5 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 - amperes, RMS symmetrical.

D. Three pole breakers used in 480V panelboards shall have an interrupting capacity of not less than 65,000 - amperes RMS symmetrical.

E. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.

B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6-feet 0-inch above the floor, properly aligned and adequately supported independently of the connecting raceways.

C. All wiring in panelboards shall be neatly formed, grouped, laced, and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the card holder inside the front cover.

END OF SECTION

SECTION 16216 - DIESEL ENGINE DRIVEN GENERATOR

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The CONTRACTOR shall furnish, all labor, materials, and equipment and install, place in operation, and field test one skid mounted diesel engine driven generator unit and required supporting systems as shown on the Drawings and specified herein.

B. The unit shall have a continuous standby power rating (site rated) of not less than 2500 KVA 2000 KW at 80 percent lagging power factor with 3 phase, 60 Hertz, 480 volt, 4 wire, alternating current generator, complete with excitation system, controls, steel sub-base and all essential and desirable appurtenances. The unit shall have a prime rating of not less than 1825 KW.

C. The unit shall be arranged for automatic starting and stopping and load transfer upon failure of the normal source of power. Parallel operation with Power Company is not required.

D. All equipment and controls specified in this Section shall be new and be considered part of the engine generator package; the engine generator MANUFACTURER, or his licensee shall be responsible for furnishing the package in its entirety as specified herein. Various components of the package, including wiring and interconnected piping shall be installed by others. However, the engine generator package shall be complete in all respects and shall include all equipment and controls necessary for a fully operational alternative power supply.

E. The equipment to be furnished under this Section includes; but shall not necessarily be limited to the following:

1. Main line circuit breakers and protective relays.
2. All required duct for an engine driven radiator cooled unit.
3. Entire exhaust system.
4. Fuel system piping, tanks and appurtenances.
5. Skid mounted, factory-piping, wiring and valves.
6. Flexible connectors and/or expansion joints for field piping.
7. Automatic control valves.
8. Pre-wired free standing floor mounted control panels with engine instrumentation for gauges, controls and alarms and main circuit breakers.
9. Engine mounted electric starters with battery and battery charger.
10. Spring type vibro isolators.
11. Spare parts and special tools.
12. Services of a MANUFACTURER's representative.

1.2 RELATED WORK

A. The concrete engine foundation is included in Division 3.

B. Fuel handling equipment storage tanks and piping containment systems are included in Section 13413.

C. Field electric wiring and connections are included in Division 16.

D. An aboveground main fuel oil storage tank complete with all required accessories, and underground fuel oil supply and return piping, brought to the location indicated on the Drawings within the Generator Room, is included in Division 13413.

1.3 SUBMITTALS

A. Submit shop drawings and product data shall be submitted, in accordance with Section 01300 and shall include the following:

1. Shop drawings, catalog cuts, internal wiring schematics and other materials required to completely describe the systems and equipment being furnished.
2. Identification, description and dimensions for each separately installed sub-assembly or piece of equipment and associated piping and electrical connection schematics.
3. Foundation drawings, indicating size and location of anchor bolts.
4. Performance specifications of all items of equipment.
5. Detailed description of jacket water treatment materials and procedures.
6. Control panel layout drawings showing interior and exterior views, dimensions, paint finish specifications and component bill of materials.
7. Complete electrical, instrumentation, control and wiring diagrams in sufficient detail to allow installation of instrumentation and controls and electrical components. Specifically, the following is required:

    a. Complete instrumentation and control schematics, presented in conformance with Instrument Society of America Bulletin S5.1, latest edition and NFPA 79, latest edition.
    b. Complete electrical circuit schematics, including all generator control, alarms, and power to motors, accessories, instruments, etc. Schematics shall include all termination points in each control panel. All wiring shall be identified by numbers and every termination point shall be assigned a number. Termination point number (including wire number) shall appear on the schematics for each wiring termination shown.
    c. Complete external electrical interconnection diagrams for wiring between control panels, switchgear and engine terminal boxes.

8. Complete Operations and Maintenance Manuals, as specified in Section 01700, covering all equipment furnished, annotated to reference only the specific model numbers supplied. Include parts lists and parts prices current to the date of submittal; include information relevant to parts supply and ordering. It is essential that this information be received prior to the startup and testing of the engine/generator unit.

B. Design Data

1. Submit design data for engine, generator, and accessories in format indicated in Paragraphs B2 through B13 (for rated kw capacity).
2. Engine Data

    a. Manufacturer
    b. Model
    c. Number and arrangement of cylinders
    d. RPM
    e. Bore x stroke
    f. Maximum power at rated RPM
    g. BMEP at rated kw (including any parasitic loads and generator efficiency)
    h. Piston speed, feet per minute
    i. Make and model of governor

3. Generator Data

   a. Manufacturer
   b. Model
   c. Rated KVA
   d. Rated KW
   e. Voltage
   f. Temperature rise above 40 degrees C ambient

      1) Stator by thermometer ___ degrees C
      2) Field by resistance ___ degrees C
      3) Class of insulation ___ degrees C

4. Generator efficiency including excitation losses and at 80 percent PF

   a. Full load ___ percent
   b. Three-quarters load ___ percent
   c. Half load ___ percent

5. Guaranteed fuel consumption rate (at generator terminals/138,000 BTU/gallon)

   a. Full load, gal/hr _____
   b. Three-quarters load, gal/hr _____
   c. Half load, gal/hr _____

6. Generator unit and accessories

   a. Weight of skid mounted unit _____ lbs.
   b. Overall length _____ inches
   c. Overall width _____ inches
   d. Overall height _____ inches
   e. Exhaust pipe size _____ inches

7. Exhaust gas emissions data, maximum values at loads varying from full to 1/4 load:

   Temperature_____ degrees F
   Flow _____ ACFM (mass and volume)
   Carbon Monoxide (CO) _____ grams/BHP-hr
   Nitrogen Oxides (NOx) _____ grams/BHP-hr
   Hydrocarbons (HC) _____ grams/BHP-hr

   * Sulfur Dioxide (SO2) _____ grams/BHP-hr
   * Based on ___ percent sulfur content by weight in the fuel.

8. CFM of air required for combustion and ventilation based upon inlet air temperature of 40 degrees C: ___ CFM.
9. Heat radiated to room by engine and generator: _____ BTU/min.
10. Heat rejected to jacket water including lubricating oil and intercooler (if required) ___ BTU/min.
11. Height from bottom of skid required for removing piston with connecting rod; (also for removing cylinder liner): ___-ft.
12. The unit guaranteed to be adequate for motor starting as required by Paragraph 1.06C of this Specification.
13. Radiator (engine driven) fan cooling air volume (CFM) and required BHP: _____ BHP

C. Test Reports: Furnish eight (8) copies of the manufacturer's certified shop test record of the complete engine driven generator unit. The final test record shall confirm the generator set performance required in Paragraph 1.06.

1.4 REFERENCE STANDARDS

A. Design, manufacturing and assembly of elements of the equipment herein specified shall be in accordance with but not limited to published standards of the following, as applicable:

American Gear Manufacturers Association (AGMA)
American Institute of Steel Construction (AISC)
American Iron and Steel Institute (AISI)
American Society of Mechanical Engineers (ASME)
American National Standards Institute (ANSI)
American Society for Testing Materials (ASTM)
American Welding Society (AWS)
Anti-Friction Bearing Manufacturers Association (AFBMA)
Institute of Electrical and Electronics Engineers (IEEE)
National Electrical Code (NEC)
National Electrical Manufacturers Association (NEMA)
Occupational Safety and Health Administration (OSHA)
Steel Structures Painting Council (SSPC)
Underwriters Laboratories, Inc. (UL)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 QUALITY ASSURANCE

A. The engine-generator set shall be the standard product, as modified by these specifications, of a MANUFACTURER regularly engaged in the production of this type of equipment and which maintains a permanent service organization and supply of spare parts in place at the time of the bid within 150 miles of the project site. The unit to be furnished shall be built from components which have proven compatibility, reliability and are coordinated to operate as a unit. To qualify as a MANUFACTURER, the engine must be the principal item manufactured and the completed engine generator set shall be supplied by that MANUFACTURER's authorized dealer only. The dealer shall have a minimum of ten (10) years experience in the field of power generation.

B. The CONTRACTOR shall require that the standby generator MANUFACTURER coordinate his design with the supplier of the variable frequency drives, specified in Division 1, to assure that sufficient generator reactance is provided to limit the line harmonics to acceptable levels as specified in IEEE Standard 519,1992 and to assure that the generator voltage control system will provide stable operation in the presence of such harmonics.

C. The unit shall be of such physical dimensions to fit into the space provided as indicated on the Drawings.

D. All mechanical equipment shall be designed and built for 24 hour continuous service at any and all points within the specified range of operation without overheating or excessive vibration or strain, and require only that degree of maintenance generally accepted as peculiar to the specific type of equipment required. All parts and components of all units shall be designed and built for interchangeability so that replacement parts may be installed without any additional fitting or machining.

E. Components of mechanical and electrical equipment shall be the products of MANUFACTURERs who can produce evidence of their ability to promptly furnish any and all interchangeable replacement parts as may be needed at any time within the expected life of the equipment.

F. The CONTRACTOR shall submit information on torsional forces on the engine generator and upon request, any additional information that the ENGINEER may deem necessary to determine the ability of the MANUFACTURER to produce the specified equipment.

G. The MANUFACTURER shall have suitable testing facilities adequate for performing the shop tests and inspections specified herein. The CONTRACTOR shall submit a description of the MANUFACTURER's testing facilities. The descriptive matter shall contain illustrative photographs, drawings and such other matter as may be requested.

H. Services of MANUFACTURER's Representative:

1. Provide services of factory-trained service technician, specifically trained on type of equipment specified. Submit qualifications of service technician for approval. Man-day requirements listed are exclusive of travel time and do not relieve CONTRACTOR of obligation to provide sufficient service to place equipment in satisfactory operation.
2. Installation: To assist in location of anchor bolts; setting, leveling and field erection; coordination of piping, electrical, miscellaneous utility connections: 4 man-days.
3. Start-up, testing and calibration: 5 man-days.
4. Operation and maintenance instruction: 5 man-days.
5. Service inspections during first year of actual operation, for use at OWNER's request, and exclusive of repair, malfunction, or other troubleshooting service calls: 3 man-days (not anticipated as consecutive).

1.6 UNIT PERFORMANCE

A. The voltage regulation shall be within plus or minus one percent from zero load to full-rated load. Upon application or removal of full-rated load in one step, the transient voltage, and recovery to steady state operation shall be within five (5) seconds.

B. Stable or steady state operation is defined as operation with the frequency variation not exceeding plus or minus 0.22 percent (0.15 Hertz) and voltage variation plus or minus one percent of their mean value for constant load from zero load to full rated load. A rheostat shall provide a minimum of plus or minus five percent voltage adjustment from rated voltage.

C. The engine driven generator shall be guaranteed to be adequate for starting a 900 HP non linear motor load when already carrying a load of 1000 KW.

D. The generator MANUFACTURER shall coordinate with the MANUFACTURER of the variable frequency drives specified in Section 16370 to provide generator reactance data for harmonic analysis and shall insure that the generator voltage control system will provide stable operation in the presence of such harmonics.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

B. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

C. All mechanical and electrical equipment shall be coated, wrapped and otherwise protected from rain, drippings of any sort, dust, dirt, mud, flood and condensed water vapor during shipment and while installed in place during construction. The protective coverings shall remain in place until the work areas are substantially free of all construction dust and debris. Full details of proposed protective measures shall be submitted for approval to the ENGINEER prior to shipment. Generator space heater shall be energized at all times during storage.

D. All units shall be properly packaged for ocean shipment and especially treated for long periods of storage before use in a hot humid, temperate, frigid climate.

1.8 PROJECT/SITE REQUIREMENTS

A. The engine generator is to be installed as an indoor unit. Automatic temperature controls will operate to limit the maximum summertime temperature in the area of the generators, considering full-load engine generator heat radiation, to 40 degrees C (104 F). All equipment furnished under this Section shall be designed for an ambient temperature of 40 degrees C.

1.9 MAINTENANCE

A. Maintenance Service: Provide to the OWNER, at time of acceptance of the unit(s), a written one year MANUFACTURER's standard service contract for the diesel engine generator and essential support systems, commencing on the date of acceptance of the unit. Contract shall include one preventive maintenance inspection of the installation prior to expiration of the warranty period to assure the safe and dependable operation of the system. The preventive maintenance inspection shall be in addition to the site visits specified in paragraph 1.05 H.5 above. This service contract does not supersede or replace the MANUFACTURER's standard one year equipment warranty.

B. Provide one set of all special tools that are required for the normal operation and maintenance of the engine driven generator unit.

C. Provide the following spare parts per unit:

1. Six air filter elements.
2. Six lube oil filter elements.
3. Six fuel oil filter elements.
4. One jacket water pump.
5. One engine jacket water thermostatic valve.
6. One set of gaskets and/or overhaul kit required for routine maintenance of the engine:

    a) Cylinder head gaskets
    b) Oil pan gaskets
    c) Water pump gaskets
    d) Exhaust manifold gaskets
    e) Thermostat housing gaskets

7. One set of hoses and belts including one of each different size and type.
8. Three complete replacement sets of fuses of each different size and type.
9. One complete change of lube oil plus one gallon of make-up lube oil supplied in unopened containers.
10. One complete change of ethylene glycol anti-freeze solution to provide a 50 percent solution in the engine cooling system supplied in unopened

containers.

11. One anti-freeze test hydrometer.
12. Two pistons complete with ring, piston pin and bushing.
13. One set of compression and oil control rings for each piston.
14. Two cylinder liners complete with all required gaskets, sealing rings and fittings.
15. One complete set of main and crank pin bearing inserts including bolts and nuts for each size bearing.
16. Twenty-four pilot lamps of each type and voltage.
17. One hundred percent replacement on lens caps, all colors.
18. Ten percent replacement on plug-in relays and diode boards (minimum of two each).
19. One voltage regulator.
20. One rotating rectifier.
21. One generator bearing.

D. The spare parts and maintenance tools shall be packed in containers, permanently labeled by word and part number for easy identification of the items and with the words "For Use Only for the Diesel Engine Generator Unit" and properly packed for an extended period of storage before use.

1.10 APPROVED SUPPLIERS

A. Based on the County's existing installed base of Caterpillar gen/sets, only Caterpillar products with ASCO controls shall be considered.

PART 2 - PRODUCTS

2.1 GENERAL

A. The engine-generator set shall be a factory assembled unit, specifically designed and equipped for operation on No.2 diesel fuel oil, and shall be Caterpillar 3516B. The engine and generator shall be directly connected with a semi-flexible steel coupling, shall be free from injurious torsional or other vibration and shall be vibro-mounted with a heavy steel sub-base. The diesel engine shall be vertical in-line, or V-type, single block, not over sixteen cylinders, four stroke cycle, turbo charged with intercooler using engine jacket water, full diesel, mechanical injection, arranged for direct connection to an alternating current generator. The unit shall operate at a rotative speed of not more than 1800 rpm and shall develop its full KW rating including radiator fan power, if so equipped at a BMEP not to exceed the following:

1. Four stroke cycle naturally aspirated 105 PSI.
2. Four stroke cycle turbo charged 172 PSI.
3. Four stroke cycle turbo charged with aftercooler 215 PSI using engine jacket water for aftercooler.
4. The piston speed shall not exceed 2241 FPM.
5. Units offered at ratings in excess of their published ratings are not acceptable and will not be approved.

B. The engine shall be rigid, neat in appearance and shall allow easy access to the various parts for maintenance purposes. The bed plate and frame shall be of heavy construction. All parts shall be properly enclosed to prevent the throwing or dripping of oil.

C. The engine-generator set shall be pre-piped and pre-wired insofar as possible. Separate pre-wired terminal boxes shall be provided on the engine-generator skid for A.C. and D.C. wiring.

D. The rating of the generator set shall not exceed the MANUFACTURER's published standby rating. The gross engine horsepower required to produce the standby rating shall not exceed the MANUFACTURER's published continuous duty rating by more than 135 percent. Continuous duty rating shall be as defined by BS649 or DIN6270 but in no case shall it exceed the MANUFACTURER's published continuous duty rating for the engine as used in continuous pump drive applications. The gross engine horsepower described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper condition while operating at rated load and at a rotative speed not to exceed 1800 rpm.

2.2 ENGINE

A. General

1. The engine shall be capable of withstanding a 10 percent overload for two hours out of every 24 hours without harmful detonation, overheating or other evidence of distress.
2. The complete engine-generator unit shall be free from harmful torsional or other vibration throughout the entire operation range of speed and load.

2.3 EQUIPMENT

A. Governor

1. Governor shall be Woodward Type EGB, or equal, electro-hydraulic isochronous governor, with external manual adjustment for speed droop, speed setting and load limit and with self-contained oil supply. Speed control shall be Woodward No. 2301, or equal, mounted in the generator control panel.
2. Furnish also a separate overspeed shutdown device which shall, in case of predetermined overspeed or the operation of various protective devices as later specified, instantly stop the engine without the fuel injection system losing its prime.

B. Supporting Structure: The diesel engine-generator shall be directly bolted, doweled, and aligned on a rigid, fabricated steel base, suitably sized to maintain the correct alignment, supported by Korfund or equal heavy duty spring type vibro isolators, anchored to the level surface of a concrete pad.

2.4 SYSTEMS

A. Fuel Oil System

1. Furnish a heavy gauge 275 gallon capacity day service tank installed within an enclosed rupture containment basin, 150 percent capacity of the specified day tank, complete with a float switch to activate an alarm/shutdown of the motor driven fuel oil pump.

2. The day service tank shall be a Simplex Model SFT, or equal, complete with a 120 volt, single phase, 1/3 HP motor driven, 6 gpm bronze gear fuel oil pump, fuel level gauge, heavy duty float switch to automatically maintain the proper fuel level, four 1-inch sized for a flow not less than 150 percent of the motor driven fuel supply pump, a removable top cover, a rotary manually operated priming pump with check valve, a solenoid operated fuel valve with manually operated bypass, a critical low fuel alarm/engine shutdown float switch with separate float at switch for remote annunciation,

and a manually operated fuel shutoff valve all as shown on the drawings.

3. The motor driven fuel supply pump shall discharge through a series filtration system, consisting of a 10 micron particle removal cartridge, followed by a water separation cartridge, into the day service tank. A 2-inch diameter differential pressure gauge with 0-15 psig scale and adjustable alarm switch shall be installed across the filters. Suitably sized isolating valves, pipe and fittings shall be provided for bypassing the filters when replacing filter cartridges during the operation of the engine. A relief valve, set to open at 14 psig shall be furnished and installed upstream of the filters and arranged to discharge into the day service fuel tank as shown on the drawings. The twin element cartridge housing shall be Cuno Model 1B1-40292-11, or equal, with a Cuno Model C78C8, or equal, Micro-Klean cartridge nominal 10 micron particle and a Aquacon Model AC21005, or equal, cartridge for water separation.

4. The day tank shall be epoxy coated inside, rust-proofed and finish painted outside medium gray or color of OWNER's choice, with removable gasketed inspection plate, all plumbing and wiring preconnected; UL listed label with all appurtenances to provide a complete system and as further described on the Drawings.

5. An engine driven fuel pump, taking its suction from the day tank shall deliver the fuel oil to the engine injection system through a duplex oil filter of the replaceable element type. The excess fuel supplied to the engine shall be returned to the 10,000 gallon main fuel tank.

6. The fuel piping between the day service tank and the engine shall be as specified in Section 15600 and of a size recommended by the engine manufacturer and shall include flexible hose connections in both the supply and return piping. A Preferred or equal 1-inch size Fusomatic valve shall be installed in the engine suction supply line between the day tank and the diesel engine.

7. All parts of the fuel system shall meet the approval of, and be installed in complete compliance with, all applicable local, state and federal codes, laws and regulations.

B. Electric (Battery) Starting System

1. Starting shall be accomplished by an engine mounted, solenoid shift electric starter, capable of withstanding four consecutive continuous cranking periods of 15 seconds duration each separated by 15 seconds rest periods before shutting down completely and sounding the alarm.

2. The starting battery(ies) shall be low maintenance, long life, lead calcium type, especially designed for diesel engine cranking service, and of a capacity as recommended by the battery MANUFACTURER for cranking the engine being furnished, for the necessary break-away current as required and the spinning current for four consecutive starts of 15 seconds of cranking on each start, without being recharged, with a battery temperature of 45 degrees F and with the SAE 30 oil in the engine maintained at 60 degrees F. The battery(ies) shall be manufactured by CTD Power Systems, chloride, or equal. An insulated protective covering, battery rack and suitable cables shall be provided.

3. Cell containers shall be sealed, translucent, shock absorbing, heat resistant plastic with electrolyte level marks and spray proof, flame arresting type vents. Battery shall be furnished with all connectors and hardware, lifting

device, electrolyte terminal plates, cables, grease, hydrometer and brushes for cleaning posts and connectors.

4. A floor mounted structural steel battery rack shall be furnished specifically designed for battery service. The rack shall be finished with an acid and fire resistant epoxy coating and non-metallic rain covers.

5. Battery charger shall be a UL listed, fully automatic, filtered, float-type, charger suitable for wall or rack mounting. Input voltage shall be 120 volts A.C., single phase, 60 Hz. The D.C. output shall be a minimum 10 amp, regulated to within one percent with plus or minus ten percent fluctuations of output voltage and shall be current limited to 120 per cent of rated output. Accessories shall include D.C. ammeter and voltmeter (panel type; 2 percent accuracy), adjustable float and equalize controls and toggle switch, A.C. and D.C. circuit breakers, A.C. power failure alarm relay, low D.D. voltage alarm relay and D.C. ground fault relay. The charger shall be Chloride Model SCR-F; LaMarche Model A11 or equal.

C. Air Intake System

1. The engine shall be equipped with suitably sized dry type air intake filter(s) to protect working parts of the engine from dirt and grit with replaceable type filter element. In-line air inlet silencers shall be provided between the turbo charger and the air inlet filter. A crankcase breather shall be included.
2. The air intake system shall be equipped with an air damper safety shutoff system.

D. Lubrication System

1. The engine shall be provided with a full pressure lubricating oil system arranged to cool the pistons and to distribute oil to all moving parts of the engine including the turbo charger bearings and including full flow filter of the replaceable element type and a suitably sized shell and tube type oil cooler and an AMOT or equal automatic temperature regulator. An engine driven lubricating oil circulating pump shall be provided for the engine. This pump shall be of the positive displacement type, and shall have ample capacity to circulate the amount of lubricating oil and cooling oil required by the engine and turbo charger. The engine shall be provided with a sump type crankcase arrangement of sufficient capacity to suit the requirements of the engine.
2. Furnish a motor driven prelube pump which shall be automatically deactivated when the engine is started.
3. The engine shall be furnished with a Kenco or equal float operated oil level controller with engine mounted integral oil storage tank. It shall be installed in such a position that it will maintain a constant crankcase oil level as recommended by the engine MANUFACTURER and visually indicate the oil level.

E. Engine Cooling System

1. The unit shall be radiator cooled with a blower or pusher type fan mechanically driven by the engine. Fan and belts shall be completely guarded in accordance with OSHA regulations. The cooling system shall be adequate for cooling the unit at full rated load and, for installation in a climate where freezing temperatures are encountered, shall be adequate for proper cooling in summer with a 50 percent ethylene glycol anti-freeze solution in the radiator, and with an ambient temperature of 100 degrees F. A pressurized radiator cap, if used, shall be rated for not more than 6 psi

on the cooling system. Furnish and install a suitable air discharge duct from the face of the radiator to the wall. For installation in tropical climates, the cooling system shall be adequate for properly cooling the unit at full rated kw capacity and with an ambient temperature of 120 degrees F. Louvers or openings shall be properly screened to prevent the entry of rodents, insects or birds.

a. Attached engine driven, centrifugal jacket water pump equipped with a mechanical seal and capable of circulating the required amount of jacket water through the remote located radiator and required additional piping, to be suitably sized and furnished by engine manufacturer.

b. A suitably sized full flow lubricating oil cooler.

c. Provide AMOT or equal automatic temperature regulators for the engine jacket water and lubricating oil which shall maintain pre-set temperature without restricting the rates of flow through the engine.

d. The engine thermostat shall be "AMOT" or equal which shall automatically maintain jacket water temperature at predetermined values without restricting the rate of flow through the engine.

e. The temperature regulators, expansion tank and other cooling system components shall, as far as practical, be mounted on the engine or unit sub-base and factory piped. All external connections to the engine shall be made with flexible metal hose suitable for the pressure and temperatures involved. All pipe sizes shall be as recommended by the engine MANUFACTURER.

2. Provide suitable jacket water treatment for the prevention of both scale formation and corrosion in the engine water jackets and cooling system components which are in contact with the engine jacket water. This treatment shall be added to the cooling system prior to running the field acceptance test. The treatment shall be NALCOOL 2000 as supplied by and applied in strict accordance with the recommendations of the NALCO Chemical Company, 6233 West 65th Street, Chicago, IL 60638, or equal.

   Before adding the recommended treatment, the engine jacket water system shall be thoroughly cleaned and conditioned, using NALCO 2015 Twin Pac, two step engine cooling system cleaning treatment, or equal, strictly in accordance with the MANUFACTURER's instructions and using particular care to thoroughly flush and remove the soda ash immediately after 15 minutes of idling engine operation.

F. Exhaust System

1. A high degree exhaust silencer, Maxim Model M51, Donaldson Model DRU, or equal, for critical residential (hospital) type silencing, shall be installed. The exhaust pipe shall be Type 302 with wall thickness of 0.250-in, stainless steel with flanged fittings and of the size recommended by the engine manufacturer. Suitable stainless steel bellows expansion joints shall be provided and installed where required to provide for expansion of the pipe caused by a 1000 degree F temperature change. The exhaust line shall be connected to the engine by a suitable section of flexible stainless steel metal exhaust hose as recommended by the engine manufacturer as suitable for the maximum temperature condition which may be encountered. All exhaust line elbows shall be long radius. Provision for installation of smoke density monitoring equipment shall be made as indicated on the Drawings.

2. Furnish and install suitable equipment for the engine exhaust to attenuate the sum of the octave bank levels converted to A-weighted sound pressure levels to not be in excess of 75 dBA at a distance of 50 feet in any direction from the point of discharge to the atmosphere.

3. For the exhaust there shall be included the attenuation curve for the silencing equipment as offered to accomplish the required results of this installation.

4. Octave band sound pressure level readings shall be taken and recorded at the time of the onsite field test and to be acceptable must be within the limits permitted by this Specification.

5. If changes are necessary to accomplish the required exhaust silencing, the CONTRACTOR shall furnish a revised exhaust arrangement drawing which must be approved by the ENGINEER.

6. The entire exhaust system shall be installed in the field, except the flexible section, but including the exhaust silencer and shall be covered with insulation of a non-combustible type and jacketed with an aluminum jacket. The insulation shall be 4-in thick, Fibrex FBX-MF 1200 pipe insulation, or equal, held in place with stainless steel banding and covered with a 0.016 or 0.020-in aluminum jacket, secured with screws and jacketing lapped a minimum of 3-in. The aluminum jacket shall be separately applied at the job site. Fittings and flanges shall be insulated with MF pipe covering material cut to fit. No asbestos or asbestos bearing products be used. Flexible sections of the exhaust systems shall be protected by a suitable metal guard to prevent personal injury from a burn if in contact with bare flesh. Include all required steel support framing and hanger bands for mounting of the silencer to the overhead concrete structure.

7. Furnish and install the complete exhaust system, including silencer, flanged piping with a single (sleeve) stainless steel thimble through wall designed to accommodate the required 4-in thick insulation and the complete supporting system. The exhaust pipe shall be directed vertically by means of long radius elbow, terminating with a 316 stainless steel counterbalance raincap with bronze bushings equal to Rain Fighter Systems Inc., Shreveport, LA.

8. A suitable drain with valve shall be installed at the low point of the exhaust line. The thimble sleeves shall be sealed with an approved compound. The entire installation shall meet with the ENGINEER's approval.

9. It is the intent of this specification to provide complete compliance with all applicable local, State and Federal codes, laws and regulations.

G. Miscellaneous Equipment and Requirements

1. Heaters

   a. Automatic thermostatically controlled heaters, rated 6 KW 480 volt, single phase, shall be provided to maintain not less than 90 degrees F temperature with an ambient temperature of 40 degrees F (4.5 degrees C) for the engine jacket water and engine lubricating oil system(s).
   b. All heaters shall be automatically deactivated when the engine generator unit is in operation.

2. Field Piping: All required field piping except for engine fuel, exhaust and air starting piping shall be seamless copper, Type L and sizes as recommended by the engine manufacturer and shall have approved fittings with soldered joints. Flanges or unions shall be provided as required to make disassembly for repairs easy. All connections to the engine shall be made with flexible metal hose of an approved type. Fuel, exhaust and air starting piping shall be as specified earlier in this Section.
3. Hearing Protection: Two circumboreal hearing protection devices MSA Noisefoe Mark IV ear muffs or equal shall be furnished for the protection of operating personnel. Provide with high impact plastic window type cabinet, suitable for wall mounting.
4. Flexible all-metal connectors for all field-piped connections to the engine.

2.5 ENGINE INSTRUMENTATION AND CONTROLS

A. Generator Control Panels (G2A and G3)

1. Furnish and install free-standing generator control panels with one section each of a size not greater than 38-in wide by 66-in deep and 90-in high for the controls and generator breakers. Each generator control panel (G2A and G3) shall be connected to the switchgear as shown on the Drawings. G2A shall operate the existing Generator No. 2 and G3 shall operate Generator No. 3 furnished herein. All controls required to interface with existing Generator No. 2 and it respective controls shall be provided as required.

2. The operation and controls including the PLCs are to match the existing generator control panels (G1 and G2) except where specified otherwise herein.

3. The face of the panel shall include meters, controls and indicators as specified, each with descriptive lamicoid nameplates. The back of the panel shall have metal cabinet door(s) with continuous hinge and a cabinet type locking latch (ANSI 61). The general arrangement of the panels shall be similar to the existing generator control panels.

4. The generator control panel shall be fabricated from code gauge sheet steel. All cutting, fitting and welding shall be neat, and all edges shall be ground smooth. The panel interior shall be painted white. The panel exterior shall be cleaned and primed and given a final finish coat of light grey polyurethane.

5. 120/240 volt circuits for engine heaters, etc, will be brought to the A.C. wiring terminal box on the engine skid. Motor starters, contactor, or relays shall be provided as required for the control of this equipment. Local disconnects shall be provided in accordance with the NEC.

6. The engine starting controls and alarms shall be powered by the 24 volt D.C. batteries specified herein.

7. Equipment controlled by the generator control panel shall include, but not be limited to:

   a. Jacket water heater.
   b. Generator space heater.
   c. Cooling water supply valves.

8. Controls switches shall be 600 volt, 20 ampere, multi-stage rotary type with black handles. Each switch shall have a fixed modern pistol grip handle

with an engraved black plastic escutcheon plate. Switches shall be General Electric Type SB-1 or Westinghouse Type W2 or equal.

9. All indicating instruments shall be of the (4-1/2-in) square, concentric scale type, with white scales, black markings and black pointers or indicators. Accuracy shall be one percent.

10. Control relays and timers shall be heavy duty plug-in socket type with a transparent dust cover. The relays shall be equipped with an indicating light to indicate when its coil is energized. The relays shall have 10 ampere minimum unless otherwise specified, 120/230 volt A.C. contacts. The mechanical life of the relay shall be 10,000 operations minimum.

11. The generator control panel shall have an engine start alarm circuit which energizes an engine mounted horn. An automatic signal to start engine shall energize an engine start time (5 seconds minimum) and this alarm shall sound until the unit starts, after which it shall automatically be silenced.

12. All panel equipment shall be mounted and wired on or within the cabinet. All wiring within the panel shall be grouped together with harnesses or ducts and secured to the structure. All wiring shall be numbered in accordance with the numbering system used on the wiring/connection diagrams. Wiring and connection diagrams shall be submitted as part of the shop drawings for approval of the ENGINEER.

13. Terminal blocks shall be grouped in the instrument and control compartment for easy accessibility unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

14. Panel wiring shall be stranded copper conductor, 600 volt class, insulation and jacketed, General Electric Type SIS, or equal. Minimum size shall be No. 14 AWG for A.C. power wiring and No. 16 AWG for D.C. control wiring. Wire for voltage regulator power and field circuits shall be shielded. All wiring shall be numbered at both ends with type written heat shrinkable markers.

B. Generator Control Panel Functions

1. The General Control Panel (GCP) shall include all controls for initiating automatic engine start-up and shutdown, including all controls for related auxiliary systems. The panel shall also include controls of components necessary to keep the engine in a ready condition for automatic operation.

   a. The cranking limiter shall disconnect the starting motor(s) from the batteries after completing a total of four fifteen-second cranking periods separated by four fifteen-second rest periods before shutting down completely and sounding the alarm.
   b. An adjustable 0-30 minute cool-down timer shall be provided.

2. The following devices shall be mounted on the panel:

   a. Master control switch - three position "OFF-LOCAL-AUTO REMOTE" switch that controls D.C. power and start-stop command location. In the "LOCAL" position, the operator may start and stop the generator set at the engine generator control cabinet. In the "AUTO REMOTE" position, the unit start and stop

sequence shall be controlled from a contact in the 480 volt switchgear specified under Section 16106.

b. Emergency stop switch - two position (push to stop) mushroom head switch. Controls hard-wired contacts to initiate a controlled immediate stop of the engine.
c. Elapsed time meter - 0-99999.9 hours.
d. Engine speed meter, RPM, digital display.
e. Voltage raise/lower switch - three positions "LOWER-OFF-RAISE" spring return to center switch.
f. Engine running status light indicates that the engine is running.
g. For G2A, provide a keyed selector switch designated as "SELECTOR SWITCH: GEN 2 - GEN 3".
h. For G2A, provide a keyed selector switch designated as "SELECTOR SWITCH LOAD CURTAILMENT: AUTO - MANUAL".

3. An alarm annunciator system shall be mounted on the panel consisting of the following:

a. Twenty-four point, triple window type alarm annunciator, with D.C. power supply, by Rochester Instrument Systems; Ronan or equal. Provide 16 YELLOW indicators for warnings and 8 RED indicators for shutdowns.
b. Annunciator horn - 24 VDC Sonalert, or equal, with time delay horn cutout relay to prevent battery drain.
c. Test pushbutton - tests all annunciator and status lights.
d. Silence/Acknowledge pushbutton - operation changes flashing first out point to steady on and silences annunciator horn.
e. Alarm indication shall be provided for the following points:

Condition	Warning (Yellow)	Shutdown (Red)
Generator Breaker Tripped	X	
Emergency Stop		X
Fail to Start		X
Battery Charger Malfunction	X	
High Lube Oil Temperature	X	X
Low Lube Oil Pressure	X	X
Engine Overspeed		X
High Jacket Water Temperature	X	X
Low Jacket Water Temperature	X	
Low Jacket Water Coolant Level	X	
Low Cooling Water Flow	X	
Low Fuel Shutdown		X

f. All engine warning conditions shall be grouped to provide a common alarm to the station instrument panel. All shutdown alarms shall be grouped to provide a common alarm to the station instrument panel. Provision shall be made for a remote emergency stop button in the generator room.

C. Generator Main Breakers and Protective Relays. Each generator control panel shall be provided with a generator circuit breaker containing, but not necessarily limited to, the following:

1. One - 3-phase differential current relay.
2. One - ground fault relay with test panel.
3. One - undervoltage relay and one - frequency relay.
4. One - AC ammeter, overload meter relay.

5. One - AC power factor meter, 3-phase indicating.
6. One - AC wattmeter, 3-phase indicating with transducer and 4-20 mA transmitter.
7. One - ammeter phase selector switch, 3 position.
8. One - voltmeter and phase selector switch, 4 position with transducer and 4-20 mA transmitter for phase A-B only.
9. One - reverse power relay.
10. One - manual close/trip control switch, with pistol grip handle. The switch shall provide a manual trip signal without interlocks. The closed position shall be limited as follows:

    a. Operate the breaker in the test position without interlocks.
    b. Close breaker when the generator is running at rated voltage and frequency, provided both the switchgear and generator selector switches are in the manual position, Main circuit breakers and tie circuit breaker interlocks are permissive. See switchgear elementary diagram.

11. The generator circuit breaker control switch shall be located in the generator circuit breaker cubicle and shall have positive indicating lights to indicate breaker position.
12. One-circuit breaker, 3 pole, single throw, electrically operated from the station switchgear 48 volt, direct current batteries. The breaker shall be of the insulated case type, including shunt trip coil closing with continuous current rating of 3,000 amperes and interrupting capacity of 65,000 amperes asymmetrical at 480 volts and shall be same type, frame size and MANUFACTURER as the station switchgear main and tie breakers supplied in section 16450.
13. One-set of solderless lugs on breaker for customer's generator cable connections.
14. One-set of 3 phase 3000 amp main bus bars (tin plated copper), having adequate short circuit bracing and fully insulated.
15. One-set of 3 phase solderless lugs for connecting generator breaker to main bus. Lugs shall be located in a separate compartment, with screw-on cover, and marked "DANGER, 480 VOLTS WITH GENERATOR ON OR OFF."
16. Automatic voltage regulator and associated devices including transformers, adjusting rheostats and switches.
17. All necessary current and potential transformers for instrumentation and relays.
18. One-terminal block for remote wiring to indicate circuit breaker position, unit failure and run condition of each engine and generator.
19. One-phase sequence voltage relay.
20. One-frequency meter.
21. Auxiliary contacts shall be provided and the circuit breaker interlocked with the station switchgear as indicated on the elementary control diagrams.

D. Engine Instrument Panel

1. The engine manufacturer shall provide jacket water, fuel and lube oil pressure gauges, jacket water and lube oil temperature gauges, and combustion air filter manometer mounted on a common vibration isolated panel as part of the engine skid.
2. Gages shall be as manufactured by Frank W. Murphy Manufacturing Company or equal. The gauges shall have a sealed case pulsation dampener and shall be a minimum of 2-inches in diameter. The scale range shall be as required for the particular application.
3. A digital-type multiple circuit exhaust pyrometer shall be furnished and mounted with the gages to measure the exhaust temperature from each

cylinder and the combined exhaust temperature. The pyrometer shall be mounted on the engine instrument panel and back connected with terminal connections to a thermocouple on each individual cylinder and combined exhaust connection, plus at least one spare connector point. The Fahrenheit temperature scale shall read from 0 to 1200 degrees.

4. Temperature gages, with graduations appropriate to the service, shall be installed on the raw cooling water inlet and outlet piping as shown on the Drawings.
5. Pressure and temperature switches shall be Honeywell; United Electric or equal, with adjustable range and differential. Switches shall be located as required to accommodate the control functions previously specified.
6. Engine coolant level switch shall be Murphy Model L-150 or equal.

2.6 GENERATOR AND EXCITATION SYSTEM

A. The generator shall be of the drip-proof, guarded, bracket type, especially designed for connection to the specified engine and shall be for 3-phase, 60-Hertz, 4-wire, 480-volt operation and shall be "Y" connected. The generator shall be mechanically and torsionally matched to the engine driver and shall be designed to withstand inherent pulsating torques of the engine.

B. The generator shall be as manufactured by Caterpillar, and shall have a forged or cast alloy steel flanged shaft for direct connection through a suitable flywheel type coupling to the engine, or with suitable adapter and disc coupling; and shall be of the single bearing type with anti-friction bearing. Full load efficiency of the combined generator, exciter and regulator shall be not less than 93 percent.

C. The generator windings, insulation and excitation system shall be braced to withstand any possible short-circuit stresses and shall be designed to withstand any overheating or stresses caused by harmonics generated by the variable frequency drives. The excitation and voltage control system shall sustain at least 300 percent rated generated current for ten seconds when a 3 phase symmetrical short-circuit is applied at the generator terminals. The unit shall be "Radio Interference Proof" (RIP) and the "Telephone Influence Factor" (TIF) shall be within the limits of Section 9, ANSI C50.12.

D. The generator shall utilize a brushless, rotating field, Permanent Magnetic Generator (PMG) type excitation system with an electronic closed loop voltage regulator. The exciter rotor and field windings shall have Class F insulation, rated for Class B temperature rise.

E. The generator armature and field windings shall have Class F vacuum/pressure impregnated (VPI) epoxy insulation, limited to Class B temperature rise.

F. The generator stator core shall be built up of low carbon steel laminating precision punched, deburred and individually insulated. Stator coils shall be all copper, random or form wound and inserted in insulated core slots. Wound core shall be repeatedly treated a minimum of three times with thermosetting synthetic varnish and backed for maximum moisture resistance, high dielectric strength and high bonding qualities. Armature lamination followers and frame ribs shall be welded integral with frame.

G. The generator shall be furnished with 120 Volt anti-condensation space heaters, to hold a minimum temperature of 90 degrees F. Stator RTD's and bearing RTD's shall be provided to monitor temperature.

H. Generator rotor poles shall be built up of individually insulated steel punchings. Poles shall be wound and bonded with high strength varnish, then baked. Cage

connections shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be dovetailed and keyed to rotor shaft. The rotor shall be dynamically balanced for all speeds up to 125 percent of rated speed per NEMA specifications. The entire rotor assembly shall be 100 percent epoxy resin vacuum pressure impregnated, then baked.

I. A cooling fan shall be mounted on the rotor to draw air from exciter end, over rotor poles and through louvered openings in drive end.

J. The generator shall have an oil lubricated anti-friction bearing. The designed bearing life, based on B-10 curve of the Anti-Friction Bearing Manufacturers' Association, shall not be less than 40,000 hours.

K. Voltage regulator shall be hermetically sealed, silicon controlled rectifier type and shall employ a zener reference and three phase sensing. The voltage regulator shall provide automatic protection of the entire unit on 3 phase short-circuits. The voltage regulator shall include automatic overexcitation and underfrequency protection. Input isolation transformers and filters shall be provided to minimize disturbances caused by line harmonics. Exciter shall be fast response type with a rotating rectifier and surge suppresser, 3 phase, full-wave bridge. It shall feature low time constant design to minimize voltage transients under severe load changes.

L. Voltage regulation shall be within plus or minus 1 percent of rated voltage from no load to full load. Steady-state modulation shall not exceed plus or minus ½ percent. Instantaneous voltage dip shall not exceed 20 percent of rated voltage when full load at rated power factor is applied. Recovery of stable operation shall occur within one second.

M. The voltage regulator and associated equipment shall be mounted in the generator terminal box.

N. Generator stator leads shall be connected to copper bus bars in an oversize terminal box with differential and ground fault protection current transformers. The terminal box shall be sized to easily receive 9-4" conduits and allow the termination of 8-500 MCM cables per phase without sharp bends.

2.7 SURFACE PREPARATION AND SHOP PAINTING

A. The engine generator set and associated equipment shall be shop primed and finished coated in accordance with the MANUFACTURER's standard practice prior to shipment. Color shall be selected by the ENGINEER and an adequate supply of touch-up paint shall be supplied by the MANUFACTURER.

2.8 SHOP TEST

A. A complete engine generator unit and the generator main breakers and control panels shall be shop tested prior to shipment. Four copies of the complete certified test record shall be submitted to the ENGINEER within 30 days after the completed test.

B. These tests for the unit shall be sufficient to assure that the unit will operate successfully and meet all specified operational requirements. The MANUFACTURER shall furnish all necessary instruments, filters, starting air, fuel gas, cooling water, electric power and load banks for the test.

C. The shop test shall consist of, but not be limited to, four continuous hours of operation. Voltage and frequency regulation and transient response shall be tested and recorded to show full compliance with this specification. During the

shop test, readings shall be taken and recorded every thirty minutes for each of the following:

1. Time
2. Ambient temperature
3. Volts for each phase
4. Load:

    a. Amps for each phase
    b. KW
    c. Power factor
    d. Frequency
    e. Engine jacket water temperature
    f. Cooling water temperature (in and out)
    g. Intake manifold pressure
    h. Lubricating oil pressure
    i. Crankcase pressure
    j. Lube oil temperature
    k. Intake manifold temperature
    l. Exhaust gas temperature
    m. Raw water cooling flow (required only for heat exchanger systems)
    n. Gallons of fuel consumed per hour

D. The generator shall be shop tested in accordance with IEEE Standard 115. Testing shall include the following:

1. Cold resistance of all windings
2. Insulation resistance of all windings
3. Polarity of field coils
4. High potential on all windings
5. Open circuit saturation
6. Air gap measurement
7. Regulation (with regulator)
8. Transient voltage dip and response
9. Voltage and current balance

E. The procedure for the shop test of the diesel engine shall cover the engine MANUFACTURER's standard practice and shall also include at least, but not be limited, to the following:

1. Prior to all starts during initial tests and all starts after new running parts have been installed, the engine shall be connected to a separately driven lubricating oil pump and filtered oil circulated through all of the engine channels. The engine shall be thoroughly inspected for oil leaks prior to shipment, paying particular attention to leaks around the shims of bearing shells in engines where shims are used.
2. The engine shall be prelubricated for a sufficient period of time to insure adequate lubrication. Caution shall be taken to avoid the accumulation of oil in the combustion chambers.
3. Engine and generator alignment shall be checked and generator air gap measured prior to the test.

F. Provision shall be made for bypass filtering and full-flow straining of the lubricating oil during the test. The strainer shall be so constructed that it will not pass particles over 0.003-in.

1. The engine shall be tested with the governor intended for permanent use on the engine. New, clean lubricating oil shall be used in the governor.

2. An air filter or cleaner shall be used for the supply of combustion air during all testing.
3. All starting air lines shall be fitted with water traps and lubricators.
4. The engine shall be given a suitable wearing-in run before the witnessed shop test as recommended by the MANUFACTURER. Before recording any readings, all operating temperatures and pressures shall have become stabilized.
5. All alarm, shutdown, and control functions shall be demonstrated. Transient response shall be measured to indicate compliance with the performance specifications.

G. After completion of all testing, the following is required:

1. The load limit shall be sealed. The seal shall be applied, using a seal press which embosses the MANUFACTURER's initials on the lead seal.
2. All entrapped water shall be drained, and proper protection applied to prevent the entry of water during shipment or a long period in storage while waiting for installation.
3. The engine shall be given proper treatment for its protection for extended storage at the job site while waiting for completion of installation.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with other trades, equipment and systems to the fullest extent possible.

3.2 INSTALLATION

A. Provide services of a qualified field representative to check the installation of the generator unit to ensure a proper installation.

B. The complete generator unit shall be mounted on a welded steel subbase of sufficient rigidity and strength to maintain alignment of the unit. The base shall be suitable for, and there shall be included, spring type vibro-isolators for mounting the unit on a level surface of a concrete pad. The spring type vibro-isolators shall be supplied by the generator unit MANUFACTURER.

3.3 EQUIPMENT START-UP

A. Operate unit to demonstrate ability to operate continuously without vibration, jamming, leakage or overheating and to perform specified functions, after installation and after MANUFACTURER's representative check of installed equipment.

B. Comply with MANUFACTURER's operating and maintenance instructions during start-up and operation.

C. Promptly correct improper installation of equipment.

D. Cooperate with supplier of equipment at time of start-up and in making of all final adjustments necessary to place equipment in satisfactory working order. Start-up shall not commence without the presence of the MANUFACTURER's representative.

3.4 FIELD TEST

A. Upon completion of the installation and as soon as conditions permit, the emergency power supply system including the engine driven generator, electrical circuits, controls, transfer switch and other devices shall be tested in the presence of the ENGINEER by the CONTRACTOR and the service representative for the MANUFACTURER of the engine driven generator unit to assure that the system functions as specified.

1. Prior to scheduling the test, the CONTRACTOR shall notify the ENGINEER in writing that all requirements and provisions of the Contract Documents have been fulfilled, that all apparatus shall be clean, properly adjusted and ready for operation and that the Instruction Manuals, parts lists and record drawings described in Paragraph 1.03, have been submitted.
2. The MANUFACTURERs' representatives shall make such changes in wiring or connections and such adjustments, repairs or replacements necessary to make the circuit, device or control system function as specified and otherwise comply with the Contract Documents.

B. The test shall consist of eight hours of continuous operation of the unit at full rated load using a portable resistive load bank. During the test, the same readings as outlined under Shop Test Paragraph 2.08C, shall be taken and recorded at 30 minute intervals.

C. As part of the field test, each of the automatic shutdown devices shall be tested and the respective values recorded at which the devices will stop the engine. Any adjustments required shall be made in the devices to make the operating values correspond to those recommended by the engine MANUFACTURER and as recorded during the stop test.

D. After the eight hour test has been completed, additional testing shall be performed to demonstrate the emergency power supply system's ability to meet the automatic starting, load transfer and motor starting requirements as specified under Paragraph 1.01C and 1.06C.

E. The CONTRACTOR shall provide a person qualified to conduct sound level testing to take and record octave band sound pressure level readings with the portable resistive load shut off and operating the engine driven generator using the station load available at the time the field tests are conducted. These readings shall be within the limits permitted by this specification.

F. Piping shall be tested in strict accordance with the MANUFACTURERs testing requirements. For each double wall fuel oil line entering the building, provide a pressure test port with threaded plug in the double wall piping termination fitting. Piping shall be subjected to an air test of 10 psig maximum.

G. If the emergency power supply system fails to fulfill the performance requirements of this specification, corrective action shall be taken and the system retested to assure full compliance. All expenses associated with the field tests, including any corrective action, shall be borne to the CONTRACTOR.

END OF SECTION

SECTION 16370 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install variable frequency drives as shown on the Drawings and as specified herein.

B. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment furnished. They are, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the variable frequency drives herein specified.

1.2 DESCRIPTION OF SYSTEM

A. The variable frequency drives specified hereinafter will be furnished under this specification. It is the intention of these specifications that the pump manufacturer under Division 11 coordinate the supply of the variable frequency drives with the balance of their equipment so as to provide system coordination.

B. The variable frequency drives will operate motors as specified in Division 11 and Division 16. The drives furnished herein under shall be totally compatible and adequately sized with both the Pumps and Motors to be supplied.

1.3 QUALIFICATIONS

A. Variable speed drives shall be of sufficient size for the duty to be performed and shall not exceed their full-rated capacity when the driven equipment is operating as specified. To assure unity of responsibility, all equipment specified in this Section of the specifications shall be furnished and coordinated by the pumping system supplier.

B. The drives covered by these Specifications are intended to be equipment of proven ability as manufactured by reputable manufacturers having long experience in the production of identical units. The equipment furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

C. The variable frequency control shall operate satisfactorily when connected to a bus supplying other solid state power conversion equipment which may be causing up to 10% total harmonic voltage distortion and commutation notches up to 36,500 volt microseconds, or when other variable frequency drives are operated from the same bus.

D. All variable frequency drives shall be furnished by a single manufacturer who shall maintain and staff engineering service and repair shops throughout the United States, including the State of Florida, staffed by personnel trained to do

start up service, emergency service calls, repair work, service contracts and training of customer personnel.

E. Approved Manufacturers: Allen Bradley 1336 Plus, Square D Altivar 66, or Asea Brown Boveri (ABB).

1.4 SUBMITTALS

A. Copies of all materials required to establish compliance with the specifications shall be submitted. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
2. Descriptive literature, bulletins and/or catalogs of the equipment.
3. Data on the characteristics and performance of the variable frequency drives. Data shall include certification that the variable frequency drives are warranted for use with the motors specified in Division 11 and Division 16.
4. Complete drawings shall be furnished for approval before proceeding with manufacture and shall consists of master wiring diagrams, elementary or control schematics including coordination with other electrical control devices operating in conjunction with the variable frequency drive, and suitable outline drawings with sufficient details for locating conduit stub-ups and field wiring. Generic schematics not specific to this project shall not be acceptable.
5. A list of the manufacturer's recommended spare parts with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.

1.5 OPERATING INSTRUCTIONS

A. Three copies of the operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

B. A factory representative who has complete knowledge of proper operation and maintenance shall be provided for one (1) day after completion of all training to instruct representatives of the Owner on proper operation and maintenance.

1.6 TOOLS AND SPARE PARTS

A. The Manufacturer shall furnish a complete list of recommended spare parts necessary for the first five (5) years of operation.

B. The Manufacturer shall include in their bid the following spares:

- Spare 25 HP drive
- Spare 75 HP drive

1.7 PRODUCT HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. All equipment and spare parts must be properly protected against any damage during a prolonged period at the site.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.8 WARRANTY

A. All equipment supplied under this Section shall be warranted by the CONTRACTOR and the equipment manufacturers for a period of one (1) year from final acceptance.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no additional cost to the Owner.

C. The manufacturer's warranty period shall run concurrently with the CONTRACTOR's warranty period. No exception to this provision shall be allowed.

PART 2 - PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall furnish and install complete variable frequency drives as described in this specification and as detailed on the applicable Drawings.

B. The CONTRACTOR shall be responsible for the erection, installation, and start up of the equipment covered by this specification.

C. The variable frequency drives shall be furnished by a vendor who has actively been manufacturing variable frequency drives for a period of at least five (5) years.

D. The variable frequency drives shall be comply with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electric Code.

E. Variable frequency drives shall operate as specified on standby generators or normal power sources.

2.2 CONSTRUCTION

A. Each variable frequency drive shall consist of a 460V, 3 phase rectifier, DC link and variable frequency inverter with features, functions and options as specified. The inverter shall be voltage source design using pulse width modulation (PWM) techniques. Output transistors shall be IGBT type.

B. The variable frequency drives shall be rated for the HP, full load current and rpm of the motor. The variable frequency drives shall be designed to provide continuous speed adjustment of three-phase motors. The variable frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 Hertz.

C. Inverters shall be capable of converting incoming three phase, 460V (+10 to -5%) and 60 Hertz (+/-2) Hertz power to DC bus levels. The DC voltage shall be inverted to an variable frequency output.

D. Controllers shall be rated for an ambient temperature of 0 C to 40 C, an altitude of up to 3,300 feet above sea level and humidity of 0 to 95% non-condensing.

E. Controller enclosures shall be NEMA Type 1 floor-mounted, force ventilated above 50 HP. The inverters shall have complete front accessibility with easily removable assemblies. Models 50 HP and smaller may be wall mounted.

F. The following standard basic control features shall be provided on the inverter:

1. Start, Stop, "Power On" indicating light and speed control potentiometer. Terminations for remote mounted operator control devices shall be furnished.
2. Unidirectional operation, coast to rest upon stop.
3. Variable linear independent timed acceleration.
4. Variable torque performance from 4 to 60 Hertz.
5. All variable frequency drives shall be furnished with AC power line reactors.
6. Frequency stability of ½% for 24 hours with voltage regulation of +2% of maximum rated output voltage.
7. LED status indication for Power On, Run, Inverter Enable, Overcurrent, Overvoltage, Overtemperature, Low Supply, and Phase Loss.
8. 115V AC control power for operator devices.
9. Phase insensitive to input power.
10. Automatic restart upon return of power following a utility outage. Drive shall require manual reset after three (3) attempts in a 60 second period.

G. The following protective features shall be provided on the drive:

1. Input AC circuit breaker with an interlocked, pad lockable handle mechanism and AC input line current limiting fuses for fault current protection of AC to DC converter section and circuit breaker. Minimum short circuit rating.
2. Electronic overcurrent trip for instantaneous overload protection.
3. Undervoltage and phase loss protection of output.

4. Over-frequency protection.
5. Over-temperature protection.
6. Surge protection from input AC line transients.
7. Electrical isolation between the power and logic circuits, as well as between the 115V AC control power and the static digital sequencing.
8. Drive to be capable of withstanding output terminal line short or open circuits without component failure.
9. di/dt and dv/dt protection for converter semiconductors.
10. Loss of speed reference 4-20 mA DC signal when variable frequency drive in auto (Alarm) and drive to operate at last reference speed.
11. Units shall have an English language (no codes) alphanumeric diagnostic display. LED indication of overfrequency, instantaneous overcurrent, DC overvoltage, AC undervoltage/loss-of-phase, emergency stop, overload, overtemperature, inverter pole trip and standby modes shall be provided and door mounted. Additional door mounted status indicating LEDs for self-diagnostic including run, phase loss, micro-processor fault, as well as board mounted LEDs including one for each inverter pole gating signal, each inverter pole status and each logic level VDC used. A comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions is also approved.

H. The following standard independent adjustments shall be provided on the inverter:

1. Minimum speed (1½ to 54 HZ).
2. Maximum speed (40 to 60 HZ).
3. Acceleration time 6 to 60 Sec. (minimum).
4. Deceleration time 6 to 60 Sec. (minimum).
5. Volts per Hertz.
6. Stability adjustment, if required.
7. Voltage boost (100 to 600 percent of nominal V/HZ ratio at 1 HZ tapering to 100 percent at 20 HZ).

I. The following shall be furnished with each controller:

1. Constant speed bypass shall be provided to allow the motor to run across the line in the event of variable frequency shutdown. The transfer from the variable frequency shutdown to the line shall be accomplished manually by means of a selector switch. The bypass circuitry shall be separately enclosed in a common NEMA 1 cabinet.

    a. The bypass cabinet shall include a door-interlocked input circuit breaker, variable frequency drive output contactor, and a full voltage starting contactor (both contactors electrically interlocked), a thermal overload relay to provide motor protection, and a control power transformer. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power "ON" light, motor "ON" variable frequency drive light, and motor "ON LINE" light.

2. Isolated process instrument speed input signal of 4-20 mA DC.
3. Isolated process instrument speed output signal 4-20 mA DC.
4. Relay output auxiliary contacts as shown on the drawings or as required herein, in Division 11 or Division 15.
5. Output load ammeter, voltmeter, and speed output indicating meters.
6. Built-in self diagnostics.
7. Relay output auxiliary contacts as shown on the drawings.
8. Local/Off/Remote and Start/Stop selector switches.
9. Input line reactors.

J. Additional control circuitry as shown on the drawings which include, but are not limited to seal fail, motor temp switch shutdown.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Field wiring shall be in accordance with manufacturer's recommendations. Anchor bolts shall be stainless steel and set in accordance with the manufacturer's recommendations.

3.2 SHOP PAINTING

A. Prior to shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill/scale, rust, grease, dirt, and other foreign matter.

B. Drives shall be shop painted.

3.3 TESTING

A. Tests and Check

1. The drive manufacturer shall test the drive controller with a motor load prior to shipment. The motor shall have equal or greater full load current than the specified motor.
2. A certified copy of all tests and checks performed in the field, complete with meter readings and recordings, where applicable, shall be submitted to the Owner.

B. After the drives have been completely installed, and working under the direction of the Manufacturer, conduct in the presence of the Owner, such tests as necessary to indicate that operation conforms to the Specifications.

3.4 TRAINING

A. The cost of onsite training programs to be conducted by factory employees for Owner's personnel shall be included in the Contract price. The training and instruction shall be directly related to the System being supplied.

B. The training shall include both classroom and hands on instruction. Detailed manuals shall be used to supplement the onsite training. The manuals shall include specific details of equipment supplied and operations specific to the project.

C. The factory representative(s) shall make use of teaching aids, manuals, slide/video presentations, etc. After the training sessions, the manuals and troubleshooting guides shall be delivered to Owner.

D. The onsite training program shall represent a comprehensive program covering all aspects of the variable frequency drive and maintenance of the system.

E. All training schedules shall be coordinated with, and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule.

END OF SECTION

SECTION 16402 - UNDERGROUND SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install a complete underground system of ducts, manholes and handholes all as hereinafter specified and shown on the Drawings.

1.2 RELATED WORK

A. Excavation and backfilling is included in Division 2.

B. All concrete and reinforcing steel shall be included under Division 3.

C. Conduit for ducts shall be as specified under Section 16110.

D. Ground rods and other grounding materials and methods shall be as specified under other Sections of Division 16.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ducts shall be PVC Schedule 80 unless otherwise noted.

B. Ducts for shielded instrumentation circuits shall be PVC coated galvanized rigid steel.

C. Cable racks, supports, pulling-in irons, manhole steps, and hardware shall be galvanized steel manufactured by Cope or approved equal.

D. Precast manholes and handholes shall be heavy duty type, designed for a Class H20 wheel load. Precast manholes and handholes shall be as manufactured by Brooks Products Co., or approved equal.

E. Handhole covers and frames shall be provided as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ducts shall be installed to drain away from buildings; ducts between manholes or handholes shall drain toward the manholes or handholes. Duct slopes shall not be less than 3 inches per 100 feet.

B. Duct banks shall be reinforced as shown on the Drawings.

C. Duct lines shall be laid in trenches on a clean backfill bedding not less than 6 inches thick and well graded.

D. Plastic spacers shall be used to hold ducts in place whether concrete encased or not. Spacers shall provide not less than 7½-inch spacing center-to-center between ducts per NEC, figure 310-1.

E. The minimum cover for duct lines shall be 24 inches unless otherwise permitted by the Engineer.

F. Duct entrances to buildings and structures shall be made with coated rigid aluminum conduit not less than 10 feet long.

G. PVC duct terminations at manholes shall be with PVC end bells. Aluminum conduits shall be terminated with insulated, grounding-type bushings.

H. Where bends in ducts are required, long radius elbows, sweeps and offsets shall be used.

I. All ducts shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions which may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter 1/2 inch less than the inside diameter of the duct.

J. Spare ducts shall be plugged and sealed watertight at all manholes, buildings and structures.

K. Ducts in use shall be sealed watertight at all manholes, buildings and structures.

L. Pulling-in irons shall be installed opposite all duct entrances to manholes, equal to Cope Cat. No. 311-9.

M. Cable racks shall be similar and equal to Cope Cat. 324-T, cut to length for one, two, three or four vertical tiers of cables. Racks shall be mounted with 1/2 inch by 4 inch expansion bolts on manhole walls. Arms similar and equal to Cope Cat. No. 325-T4, 325-T75 and/or 325-T10 for one, two and/or three cables respectively shall be furnished and installed with Cat. No. 326-T22 porcelain insulators for support of cables. Lock clips shall be furnished and installed to secure hooks in position.

N. Cables shall be trained in manholes and supported on racks and hooks at intervals not greater than 3 feet-0 inches and supports shall be installed on each side of all splices. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation. Branch circuit conductors shall not be run in manholes.

O. Coated rigid aluminum conduit shall be used for risers. For PVC runs, a PVC to rigid aluminum conduit adapter shall be used at the lower end of the elbow and the elbow and all exposed conduit shall be of coated rigid aluminum conduit.

P. All risers from underground shall be given a heavy coat of bitumastic paint from a point 1 foot-0-inch below grade to a point not less than 6 inches above grade or surface of slab.

Q. All joints shall be made so as to prevent the passage of concrete inside the conduit to form obstructions or cause cable abrasions.

R. Manhole covers in streets shall finish flush with finished paving and in other areas shall finish 3 inches above crown of adjacent roadway. Floor elevations of manholes shall be so set that the center line of the lowest conduit entering will be not less than 1-foot above the floor and center line of the highest conduit entering will be not less than 1 foot below the roof slab.

S. Concrete monuments shall be provided at each stubbed conduit location. Monuments shall be as shown on the Drawings and shall be installed in the same manner outlined for manhole covers.

T. A #6 bare copper wire (stranded) shall be installed in each 4-inch PVC conduit.

U. A 5/8-inch by 10-foot copperclad ground rod shall be driven in the bottom of each manhole. All bond wires and aluminum conduits shall be bonded to the ground rod.

END OF SECTION

SECTION 16500 - LIGHTING SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contactors, and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

1.2 STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be Underwriters Laboratories labeled.

1.3 RELATED WORK

A. Panelboards shall be as specified under Section 16160.

B. Conduit shall be as specified under Section 16110.

C. Wire shall be as specified under Section 16120.

D. Transformers shall be specified under Section 16108.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Switches:

1. Wall switches shall be of the indicating, toggle action, quiet type. All switches shall conform to Federal Specification W-S-896-D.
2. Wall switches shall be of the following types and manufacturer or approved equal.

    a. Single pole - Leviton No. 1221-2.
    b. Double pole - Leviton No. 1222-2.
    c. Three way - Leviton No. 1223-2.
    d. Four way - Leviton No. 1224-2.
    e. Single pole, key operated - Leviton No. 1221-2L.
    f. Momentary contact, 2 circuit, center off - Leviton No. 1256.

B. Receptacles:

1. Wall receptacles shall be of the following types and manufacturer or approved equal.

a. Duplex, 20A, 125V, 2P, 3W; Leviton No. 5362.
b. Corrosion-resistant, duplex, 20A, 125V, 2P, 3W; Leviton No. 5362CR and Crouse-Hinds WLRD-1 cover.
c. 60A, 480V, 3P, 2W; weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
d. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W; Leviton No. 6899.
e. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. S-26.
g. Single, 20A, 250V, 2P, 3W; Leviton No. 5461.
h. Single, 30A, 125V, 2P, 3W; Leviton No. 5371.
i. Clothes dryer, 30A, 125/250V, 3P, 3W; Leviton No. 5209 and No. 9382-P.

2. Receptacles (Weatherproof/NEMA 4 Areas/Outside)

a. General Requirements: Receptacles in wet locations shall be installed with a hinged outlet cover/enclosure clearly marked "Suitable for Wet Locations While In Use" and "UL Listed". There must be a gasket between the enclosure and the mounting surface, and between the hinged cover and mounting plate/base to assure proper seal. Taymac; Specification Grade.

C. Device Plates:

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.
2. Plates for surface mounted device boxes shall be of the same material as the box. Pressed steel boxes and plates shall not be used.

D. Lighting Fixtures: Lighting fixture types shall be as shown on the "Lighting Fixture Schedule" on the Drawings. The catalog numbers listed are given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be reviewed.

E. Lamps:

1. Fluorescent lamps shall be medium bi-pin and recessed double contact, rapid start, standard cool white all as indicated on the "Fixture Schedule."
2. Fluorescent ballasts shall be Class P, rapid start, high power factor, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on 120 volts or as indicated on the "Fixture Schedule."
3. High pressure sodium ballasts shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as called for in the Lighting Fixture Schedule on the Drawings.

F. Lighting Contactor:

1. Lighting contactor shall be of the electrically operated, mechanically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.
2. Contactors shall be rated for 25A-600 volt contacts and be similar and equal to Automatic Switch Company Bulletin 1255-166 RC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduits shall be supported from the structure.

C. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

D. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

3.2 SPARE LAMPS

A. Spare lamps shall be provide for all fixture types supplied. Quantity shall be 15 percent of total used on project.

3.3 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16921 - 480-VOLT MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish, install and test the motor control centers as hereinafter specified and as shown on the Drawings.

1.2 QUALIFICATIONS

A. The motor control centers shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control centers.

B. All units and sections shall be U.L. labeled when possible. Motor control centers containing service entrance equipment shall be U.L. labeled "Suitable For Use As Service Equipment."

C. The motor control centers shall be the 8000 line as manufactured by the General Electric Co., or Model 6 as manufactured by the Square D Company.

1.3 SUBMITTALS

A. Complete master wiring diagrams and elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the motor control centers and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.

B. Submittals shall include a bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.

C. Where it is not explicitly shown and completely obvious from the outline drawings the following items shall be verified in a written statement accompanying the shop drawings.

1. Type of terminal blocks used and that the removal of plug-in compartments can be performed without disconnecting or removing wires.
2. Silver or tin plating of bus.
3. Insulation and isolation of vertical bus.
4. U.L. approval.

1.4 RELATED WORK

A. Lighting Panels are included in Section 16160.

B. Dry type lighting transformers are included in Section 16108.

PART 2 - PRODUCTS

2.1 RATING

A. The motor control centers shall be designed for 480 volt, 3 phase, 3 wire 60 Hz service and shall have short-circuit rating of not less than 65,000 amperes RMS, symmetrical.

2.2 CONSTRUCTION

A. Structure:

1. The motor control centers shall be a standard metal-enclosed, free-standing, deadfront structure, not more than 90-in in height, and fabricated from formed sheet steel of not less than No. 14 gauge thickness. The enclosure shall be NEMA I. The motor control centers shall consist of vertical sections of equal height and 20 inches deep containing individual plug-in compartments. Compartments shall be isolated from each other by separate horizontal steel plates or by steel plates without openings that are a part of the compartment itself.
2. Plug-in compartments shall totally isolate enclosed equipment. All unused openings to the adjacent vertical wiring space shall be plugged. All openings used for wiring shall have insulating grommets.
3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.
4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.
5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door.
6. The motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.

7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing panel boards shall have a card holder on the inside of the door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.
8. The motor control centers shall provide equipment of type, capacity, trip ratings for the loads shown on the Drawings or otherwise specified.
9. Construction shall be NEMA Class II, Type C. In so far as possible all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.
10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light grey enamel over a rust resistant primer.
11. The insulation level of the complete motor control assembly shall be such that it will meet the field tests required under Paragraph 3.02.

B. Buses:

1. All buses shall be silver on tin-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings, but shall be not less than 600 amperes.
2. Each vertical section shall have a full height vertical bus rated not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.
3. A ¼-inch x 2-inch ground bus shall be furnished the entire length of the motor control centers.
4. Buses shall be braced for 65,000 amperes RMS, symmetrical, short circuit current.
5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.
6. The buses shall be sized for a maximum current density of 1200 amperes per square inch.

C. Wiring:

1. All wiring shall be copper.
2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartments to be withdrawn without having to remove wires from fixed terminal blocks.
3. Power wiring shall be black, control wiring shall be red, wiring energized from sources other than the starter control power transformer shall be yellow.
4. All wiring shall be numbered and referenced to the control diagram furnished inside the enclosure.

D. Signage:

1. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE." Letters shall be not less than 1-inch high, 1/4-inch stroke. Signs shall be laminated plastic, engraved red letters with a white background.
2. All compartments with voltages from sources outside of the compartment, not disconnected by the motor circuit protector, shall have a sign on the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE OF THIS UNIT." Letters shall be black on a high visibility yellow background. Background shall be laminated plastic approximately 3 inches x 5 inches.

2.3 COMPONENTS

A. Combination Motor Starters:

1. All motor starters shall be a combination motor circuit protector and contactor, 3-pole, 60-Hz, 600-volt, magnetically operated, of the types shown on the drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings, but shall be not less than NEMA Size 1.
2. All motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.
3. All motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.
4. Full voltage, non-reversing starters, NEMA size 4 and smaller shall be of plug-in design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed design.
5. Reduced-voltage starters shall be auto-transformer type with closed circuit transition. Auto-transformers shall be dry type with 50, 65 and 80 percent voltage taps. Auto-transformers shall have over-temperature protection. Timing relays shall be pneumatic, adjustable.
6. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.
7. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.
8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

B. Circuit Breakers:

1. Circuit breakers shall be thermal-magnetic, molded case, 480 volt, with not less than 65,000 amperes, RMS interrupting capacity. All circuit breakers with 225 amperes frames and larger shall have interchangeable

trips. Circuit breakers shall have auxiliary disconnect contacts when used with starters having external control circuits.

2. Current limiting breakers (CLB) shall be provided where shown on the single line diagrams.

C. Control Stations: Control stations shall be standard size, heavy-duty, oiltight.

D. Indicating Lights: Indicating lights shall be standard size, heavy duty, oil tight, low voltage transformer operated.

E. Running Time Meters: Running time meters shall be 3-1/2-inch square case; non-resettable, 99,999.9 hour range; Type 236 as manufactured by the General Electric Co., or approved equal.

F. Voltmeters:

1. Voltmeters, ammeters and wattmeters shall be 4-1/4-inch square, 250-degree scale, plus or minus 1-percent accuracy switchboard instruments; General Electric Co.'s. Type AB-40, or approved equal.
2. A four-position selector switch shall be furnished and installed for selection of three phases and off.

G. Instrument Transformers:

1. Instrument transformers shall be indoor, 600-volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards.
2. Relays shall be tagged and referenced to the control diagram furnished inside the enclosure.

H. Surge Protection: Surge protection equipment shall be provided as shown on the Drawings.

I. Control Relays: Control relays shall be heavy-duty, machine tool type with suitably rated convertible contacts. Time delay relays shall be pneumatic, adjustable.

J. Nameplates: Unit nameplates shall be black and white laminated plastic having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall identify equipment controlled or circuit designation as applicable.

K. Power Factor Correction Capacitors:

1. Motors 100 HP and larger shall have power factor correction capacitors connected on the line side of the overload relays. Capacitors shall be furnished with the motors. Two speed motors, high speed only.
2. Mounting compartments shall be provided for capacitors. The compartments shall have a removable mounting panel 18"x30" with 6" clear mounting space. Suitable conductors shall be provided to connect to the capacitor fuse box.

2.4 SPARE PARTS

A. The following spare parts shall be furnished:

1. One (1) box of power fuses of each size furnished.
2. One (1) set of starter contacts for each NEMA size installed.
3. One (1) starter coil for each NEMA size installed.
4. One (1) box of pilot lights.
5. One (1) box of lens for each color used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The motor control center shall be installed on a 2-inch high concrete housekeeping pad.

B. The motor control center housings shall be bolted to angle iron sills imbedded in the concrete on the two longest sides. The sills shall be the full length of the motor control center housing and shall be installed level in all directions.

C. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.

D. The motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.

E. The motor control centers shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by motor control centers manufacturer.

3.2 TESTS AND CHECKS

A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.

1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.
2. A 1,000 VDC megger shall be used for these tests.
3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.
4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.

B. The following shall be done before energizing the motor control centers.

1. Remove all current transformer shunts after completing the secondary circuit.

2. Install overload relay heaters based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.
3. Check all interlocks for proper operation.
4. Vacuum clean all interior equipment.

END OF SECTION

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