**The Enclosed Document Is Provided For Your Convenience.**

# Please Email ALL Questions:

**MailTo:ContractAdministration@TampaGov.net**

**Please Let Us Know If You Plan To Bid**

City of Tampa
Contract Administration Department
306 E. Jackson St. #280A4N
Tampa, FL 33602
(813)274-8456

CITY OF
TAMPA, FLORIDA

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS
PROPOSAL, BID BOND, FORM OF NOTICE OF AWARD,
AGREEMENT, PERFORMANCE BOND AND
SPECIFICATIONS

FOR

## Contract 14-C-00009

# KRAUSE PUMP STATION REHABILITATION

City of Tampa
CONTRACT ADMINISTRATION DEPARTMENT
TAMPA MUNICIPAL OFFICE BUILDING
306 E. JACKSON STREET - 4TH FLOOR NORTH
TAMPA, FLORIDA 33602

JUNE 2014

CITY OF TAMPA
CONTRACT ADMINISTRATION DEPARTMENT
306 E. Jackson Street 280A4N
Tampa, FL 33602

**********

BID NOTICE MEMO

**********

Bids will be received no later than 1:30 p.m. on the indicated Date(s) for the following Project(s):

**********

CONTRACT NO.: 14-C-00009; Krause Pump Station Rehabilitation

BID DATE: July 8, 2014 ESTIMATE: $5,000,000 SCOPE: The project comprises furnishing all labor, materials, and equipment to remove existing pumps, motors and concrete pedestals from pump No.1 – constant speed 300 hp motor, Nos. 2 & 4 – variable speed 105 hp motors and No 3- constant speed 400 hp motor, four (4)-24" discharge valves, piping, pump controls, and existing 4160V electrical equipment; install four (4) 400 HP pumps and immersible motors, discharge and suction valves, piping, concrete pedestal supports, air compressors; install four (4) 480V variable frequency drives, pump controls, annunciator panel, motor control center, electrical switchgear, concrete duct bank system, conduits, wiring, and other electrical equipment needed to convert the pump station from 4160V service to 480V service and new ventilation system. The contract also includes furnishing all labor, materials, and equipment, to install a new 36" flow meter outside the station, temporary bypass pumping with all associated work required for a complete project in accordance with the Contract Documents. PRE-BID CONFERENCE: Tuesday, June 24, 2014, 9:00 a.m., on site at 225 S. Ashley Street, Tampa, FL 33602. Attendance is not mandatory, but recommended.

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Bids will be opened in the 4th Floor Conference Room, Tampa Municipal Office Building, 306 E. Jackson Street, Tampa, Florida 33602. Pre-Bid Conference is held at the same location unless otherwise indicated. Plans and Specifications and Addenda for this work may be examined at, and downloaded from, www.demandstar.com. Backup files are available at http://www.tampagov.net/dept_contract_administration/programs_and_services/construction_project_bidding/index.asp. Subcontracting opportunities may exist for City certified Small Local Business Enterprises (SLBEs). A copy of the current SLBE directory may be obtained at www.Tampagov.net. Phone (813) 274-8456 for assistance. Email Technical Questions to: contractadministration@tampagov.net .

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NOTICE TO BIDDERS
CITY OF TAMPA, FLORIDA
Contract 14-C-00009; Krause Pump Station Rehabilitation

Sealed Proposals will be received by the City of Tampa no later than 1:30 P.M., July 8, 2014, in the 4th Floor Conference Room, Tampa Municipal Office Building, 306 E. Jackson Street, Tampa, Florida, there to be publicly opened and read aloud.

The proposed work is to include, but not be limited to, furnishing all labor, materials, and equipment to remove existing pumps, motors and concrete pedestals from pump No.1 – constant speed 300 hp motor, Nos. 2 & 4 – variable speed 105 hp motors and No 3- constant speed 400 hp motor, four (4)-24" discharge valves, piping, pump controls, and existing 4160V electrical equipment; install four (4) 400 HP pumps and immersible motors, discharge and suction valves, piping, concrete pedestal supports, air compressors; install four (4) 480V variable frequency drives, pump controls, annunciator panel, motor control center, electrical switchgear, concrete duct bank system, conduits, wiring, and other electrical equipment needed to convert the pump station from 4160V service to 480V service and new ventilation system. The contract also includes furnishing all labor, materials, and equipment, to install a new 36" flow meter outside the station, temporary bypass pumping with all associated work required for a complete project in accordance with the Contract Documents.

The Instructions to Bidders, Proposal, Form of Bid Bond, Agreement, Form of Public Construction Bond, Specifications, Plans and other Contract Documents are posted at DemandStar.com. Backup files may be downloaded from http://www.tampagov.net/dept_contract_administration/programs_and_services/construction_project_bidding/index.asp. One set may be available for reference at the office of the Contract Administration Department, Municipal Office Building, Fourth Floor North, City Hall Plaza, Tampa, Florida 33602.

Each Proposal must be submitted on the Proposal form included in the Specifications and must be accompanied by a certified check or cashier's check on a solvent bank or trust company in compliance with Section 255.051, Florida Statutes, made payable to the City of Tampa, in an amount of not less than five per cent of the total bid, or a Bid Bond, of like amount, on the form set forth in the Contract Documents, as a guarantee that, if the Proposal is accepted, the Bidder will execute the Proposed Contract and furnish a Public Construction Bond within twenty (20) days after receipt of Notice of Award of Contract.

The City of Tampa reserves the right to reject any or all Bids and to waive any informalities in the Bid and/or Bid Bond. Acceptance or rejection of Proposals will be made as soon as practicable after the Proposals are received, but the City reserves the right to hold Proposals for ninety (90) days from the date of Opening.

Bid Protest Procedures: Unless subsequently indicated otherwise, in a revised posting on the Department's web page for Construction Project Bidding, the City of Tampa intends to award the referenced project to the lowest bidder listed in the tabulation posted on or about the date of Bid Opening. A bidder aggrieved by this decision may file a protest not later than 4:30 P.M., five (5) business days from the first posting thereof, pursuant to City of Tampa Code Chapter 2, Article V, Division 3, Section 2-282, Procurement Protest Procedures. Protests not conforming therewith shall not be reviewed.

Communication with City Staff

Pursuant to City of Tampa Ordinance 2010-92, during the solicitation period, including any protest and/or appeal, NO CONTACT initiated by bidders or responders with City officers or employees, other than the individuals specified below is permitted:
Director of Contract Administration, David Vaughn
Contracts Management Supervisor, Jim Greiner
Contract Officer, Jody Gray
The City's Legal Department staff
The City's Contract Administration Department staff.
Technical Questions and Requests For Information should be directed to the Department via
ContractAdministration@tampagov.net

"A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a bid on a contract to provide any goods or services to a public entity, may not submit a bid on a contract with a public entity for the construction or repair of a public building or public work, may not submit bids on leases of real property to a public entity, may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity, and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, for CATEGORY TWO for a period of 36 months from the date of being placed on the convicted vendor list." Refer to Section 287.133 Florida Statues.

In accordance with the City of Tampa's Equal Business Opportunity Ordinance, a Goal may have been established for subcontracting with Small Local Business Enterprises, SLBEs, certified by the City. Links to further information and a list of SLBEs are on the Department's Construction Project Bidding Web page. A link to the current complete directory of SLBEs is on the Minority Business Development Office Website.

# INSTRUCTIONS TO BIDDERS
## SECTION 1 - SPECIAL INSTRUCTIONS

I-1.01 GENERAL:

The proposed work is the Krause Pump Station Rehabilitation in the City of Tampa, as required for a complete project, as shown on the plans and detailed in the specifications. The work is located on land owned or controlled by the City of Tampa.

I-1.02 FORM PREPARATION AND PRESENTATION OF PROPOSALS: Replace the second sentence with the following: Submission of the entire specification book is not required.

I-1.03 ADDENDA – Section I-2.03 is replaced with the following: No interpretation of the meaning of the Plans, Specifications, or other Contract Documents will be made to any Bidder orally.

Every request for such interpretation must be in writing, addressed to the City of Tampa, Contract Administration Department, 306 E. Jackson St., 4th Floor, Tampa, Florida 33602 and then emailed to ContractAdministration@tampagov.net. To be given consideration, such request must be received at least seven (7) days prior to the date fixed for the opening of the Proposals. Any and all such interpretations and any supplemental instructions will be in the form of written addenda which, if issued, will be posted on DemandStar.Com and on the Department's web page, with notice given to all prospective bidders at the respective fax numbers or e-mail addresses furnished, for such purposes. Failure of any Bidder to receive any such addenda shall not relieve said Bidder from any obligation under his Proposal as submitted. All addenda so issued shall become part of the Contract Documents.

I-1.04 SIGNATURE OF BIDDERS: Section I-2.07 is replaced with the following:

Proposals must be signed in ink by the Bidder with signature in full. When firm is a Bidder, the Proposal shall be signed in the name of the firm by one or more partners. When a corporation is a bidder the officer signing shall set out the corporate name in full beneath which he shall sign his name and give the title of his office. The Proposal shall also bear the seal of the corporation attested by its secretary.

If the bidder referred to in Section I-2.07 is a corporation, it must submit; upon request, a copy of its filed Articles of Incorporation. In addition, if the bidder was incorporated in another state, it must establish that it is authorized to do business in the State of Florida. If the bidder is using a fictitious name, it must submit upon request, proof of registration of such name with the Clerk of the Circuit Court of the Country where its principal place of business is. Failure to submit what is required is grounds to reject the bid of that bidder.

I-1.05 TIME FOR COMPLETION:

The work shall be arranged to be completed in accordance with a progress schedule approved by the Construction Engineer.

The time for completion of this project, referred in Article 4.01 of the Agreement, shall be 360 consecutive calendar days. The period for performance shall start from the date indicated in the Notice To Proceed.

I-1.06 LIQUIDATED DAMAGES:

The amount of liquidated damages, referred to in Article 4.06 of the Agreement, for completion of this project shall be $500.00 per calendar day.

I-1.07 BASIS OF AWARD OF CONTRACT:

The basis of award referred to in Item I-2.11 of Instructions to Bidders shall be the greatest amount of work, which can be accomplished within the funds available as budgeted. The award may be made on the basis of the total bid, base bid, alternates(s) if any, unit bids if any, or any combination thereof deemed to be in the best interest of the City.

# INSTRUCTIONS TO BIDDERS
# SECTION 1 - SPECIAL INSTRUCTIONS

Unless all bids are rejected, the award will be made within 90 days after opening proposals.

## I-1.08 GROUND BREAKING CEREMONY:

Arrangement may be made by the City in coordination with the Contractor, for construction to commence with a Ground Breaking Ceremony. Details will be discussed at the pre-construction conference.

## I-1.09 INSURANCE:

The insurance required for this project shall be as indicated on Pages beginning with INS-1. Before commencing work, the Contractor shall provide the evidence of the insurance required on a Certificate of Insurance accompanied by evidence of authority to bind the insurance company or companies such as agents license, power of attorney, or letter of authority.

## I-1.10 EQUAL BUSINESS OPPORTUNITY PROGRAM / SLBE / REQUIREMENTS

In accordance with the City of Tampa's Equal Business Opportunity Ordinance, a goal of 21.1% has been established for subcontracting with Small Local Business Enterprises, (SLBEs), certified by the City. The goal is based upon the availability of the firms listed on the Goal Worksheet and as posted in the "SLBEs" link under this Contract's notice on the Department's Construction Project Bidding web page.

BIDDERS MUST SOLICIT ALL SLBEs ON THAT LIST and provide documentation of emails, faxes, phone calls, letters, or other communication with the firms as a first step to demonstrate Good Faith Efforts to achieve the goal. The list is formatted to facilitate e-mail solicitations to the listed firms by copying and pasting e-mail addresses.

Bidders may explore other opportunities for subcontracting with SLBEs by consulting the current directory of all certified SLBEs posted on the Minority Business Development Office web page.

GOOD FAITH EFFORT COMPLIANCE PLAN REQUIRED - When a Goal has been established, the Bidder must submit, with its bid, completed to the fullest extent possible, a Good Faith Effort Compliance Plan using the form GFECP contained herein. Additional documentation is required whenever an SLBE subcontractor's low quote is not utilized. Supplemental information or documentation concerning the Bidder's Compliance Plan may be required prior to award as requested by the City.

DIVERSITY MANAGEMENT INITIATIVE, DMI, DATA REPORTING FORMS REQUIRED - Bidders must submit, with its bid, "DMI-Solicited" forms listing all subcontractors solicited and "DMI-Utilized" forms listing all subcontractors to be utilized. Supplemental forms, documentation, or information may be submitted at bid time or as requested by the City.

After an award, "DMI-Payments" forms are to be submitted with payment requests to report payments to subcontractors.

Bidders may visit the Minority Business Development Office's web page at TampaGov.net for other information about the SLBE program, FAQ's, and the latest SLBE directory of certified firms.

## I-1.11 BID SECURITY:

Surety companies shall have a rating of not less than B+ Class VI as evaluated in the most recently circulated Best Key rating Guide Property-Liability.

INSTRUCTIONS TO BIDDERS
SECTION 1 - SPECIAL INSTRUCTIONS

I-1.12 PUBLIC CONSTRUCTION BOND:

The Bidder who is awarded the Contract will be required to furnish a Public Construction Bond upon the form provided herein, equal to 100 percent of the Contract price, such Bond to be issued and executed by (a) surety company(ies) acceptable to the City of Tampa and licensed to underwrite contracts in the State of Florida. After execution of the Agreement and before commencing work, the Contractor must provide the City a certified copy of the officially recorded Bond.

I-1.13 AGREEMENT
Section 2 – Powers of the City's Representatives
Add the following:
Article 2.05 CITY'S TERMINATION FOR CONVENIENCE:

The City may, at any time, terminate the Contract in whole or in part for the City's convenience and without cause. Termination by the City under this Paragraph shall be by a notice of termination delivered to the Contractor, specify the extent of termination and the effective date.

Upon receipt of a notice of termination, the Contractor shall immediately, in accordance with instructions from the City, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

(a) cease operations as specified in the notice;
(b) place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;
(c) terminate all subcontracts and orders to the extent they relate to the Work terminated;
(d) proceed to complete the performance of Work not terminated; and
(e) take actions that may be necessary, or that the City may direct, for the protection and preservation of the terminated Work.

The amount to be paid to the Contract by the City because of the termination shall consist of:

(a) for costs related to work performed on the terminated portion of the Work prior to the effective date including termination costs relative to subcontracts that are properly chargeable to the terminated portion of the Work.
(b) the reasonable costs of settlement of the Work terminated, including accounting, legal, clerical and other expenses reasonable necessary for the preparation of termination settlement proposals and supporting data; additional costs of termination and settlement of subcontracts excluding amounts of such settlements; and storage, transportation, and other costs incurred which are reasonably necessary for the preservation, protection or disposition of the terminated Work; and
(c) a fair and reasonable profit on the completed Work unless the Contractor would have sustained a loss on the entire Contract had it been completed.

Allowance shall be made for payments previously made to the Contractor for the terminated portion of the Work, and claims which the City has against the Contractor under the Contract, and for the value of materials supplies, equipment or other items that are part of the costs of the Work to be disposed of by the Contractor.

I-1.14 Section 5 – subcontracts and Assignments, Article 5.01, Page A-7, Last Paragraph:
Change "…twenty-five (25) percent… "to fifty-one (51) percent…"

Section 10-Payments, Article .05 Partial Payments, 1st Paragraph, 1st Sentence:
Change "…fair value of the work done, and may apply for…" to "…fair value of the work done, and shall apply for…"

INSTRUCTIONS TO BIDDERS
SECTION 1 - SPECIAL INSTRUCTIONS

I-1.15 Contractors must utilize the U.S. Department of Homeland Security's E-Verify Systems to verify the employment eligibility of all persons employed during the term of the contract to perform employment duties within the State of Florida and all persons, including subcontractors, assigned by the contractor to perform work pursuant to the contract.

I-1.16 GENERAL PROVISIONS; G-2.02 Copies Furnished to Contractor: Replace the first paragraph with the following:

The Contractor shall acquire for its use copies of the plans and specifications as needed. The documents may be downloaded from the City's web site, at
http://www.tampagov.net/dept_contract_administration/programs_and_services/construction_project_bidding/index.asp

I-1.17 PAYMENT DISPUTE RESOLUTION

Any dispute pertaining to pay requests must be presented to the City pursuant to Executive Order 2003-1.

I-1.18 SCRUTINIZED COMPANIES.

For Contracts $1,000,000 and greater, if the City determines the Contractor submitted a false certification under Section 287.135(5) of the Florida Statutes, or if the Contractor has been placed on the Scrutinized Companies with Activities in the Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List, the City shall either terminate the Contract after it has given the Contractor notice and an opportunity to demonstrate the City's determination of false certification was in error pursuant to Section 287.135(5)(a) of the Florida Statutes, or maintain the Contract if the conditions of Section 287.135(4) of the Florida Statutes are met.

I-1.19 FLORIDA'S PUBLIC RECORDS LAW

4.33.3 The City of Tampa is a public agency subject to Chapter 119, Florida Statutes. In accordance with Florida Statutes, 119.0701, if applicable, Contractor shall comply with Florida's Public Records Law. Specifically, the Contractor shall:

1. Keep and maintain public records that ordinarily and necessarily would be required by the City in order to perform the service;

2. Provide the public with access to such public records on the same terms and conditions that the City would provide the records and at a cost that does not exceed that provided in Chapter 119, Florida Statutes, or as otherwise provided by law;

3. Ensure that public records that are exempt or that are confidential and exempt from public record requirements are not disclosed except as authorized by law;

4. Meet all requirements for retaining public records and transfer to the City, at no cost, all public records in possession of the contractor upon termination of the contract and destroy any duplicate public records that are exempt or confidential and exempt. All records stored electronically must be provided to the City in a format that is compatible with the information technology systems of the agency.

4.33.4 The failure of Contractor to comply with the provisions set forth in this Article shall constitute a Default and Breach of this award and the City shall enforce the Default in accordance with the provisions set forth in the DEFAULT/RE-AWARD section of this document.

## SECTION 2
## GENERAL INSTRUCTIONS

I-2.01 BIDDER'S RESPONSIBILITY

Before submitting Proposals, Bidders shall carefully examine the entire site of the proposed work and adjacent premises and the various means of approach and access to the site, and make all necessary investigations to inform themselves thoroughly as to the facilities necessary for delivering, placing and operating the necessary construction equipment, and for delivering and handling materials at the site, and inform themselves thoroughly as to all difficulties involved in the completion of all the work in accordance with the Contract Documents.

Bidders must examine the Plans, Specifications, and other Contract Documents and shall exercise their own judgment as to the nature and amount of the whole of the work to be done, and for the bid prices must assume all risk of variance, by whomsoever made, in any computation or statement of amounts or quantities necessary to complete the work in strict compliance with the Contract Documents.

Elevations of the ground are shown on the Plans and are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation. Bidders shall satisfy themselves as to the correctness of all elevations.

The City may have acquired, for its own use, certain information relating to the character of materials, earth formations, probable profiles of the ground, conditions below ground, and water surfaces to be encountered at the site of the proposed work. This information, if it exists, is on file at the offices of the Department of Public Works and Bidders will be permitted to see and examine this information for whatever value they consider it worth. However, this information is not guaranteed, and Bidders should satisfy themselves by making borings or test pits, or by such other methods as they may prefer, as to the character, location, and amounts of water, peat, clay, sand, quicksand, gravel, boulders, conglomerate, rock, gas or other material to be encountered or work to be performed.

Various underground and overhead structures and utilities are shown on the plans. The location and dimensions of such structures and utilities, where given, are believed to be reasonably correct, but do not purport to be absolutely so. These structures and utilities are plotted on the Plans for the information of the Bidders, but information so given is not to be construed as a representation or assurance that such structures will be found or encountered as plotted, or that such information is complete or accurate.

I-2.02 FORM, PREPARATION AND PRESENTATION OF PROPOSALS

Each Proposal shall be submitted upon the Proposal Form and in accordance with the instructions included herein. The Proposal Form must not be detached herefrom. All blank spaces for bid prices must be filled in, in both words and figures, with the unit or lump sum prices, or both, for which the Proposal is made. The computed total price for each unit price Contract Item shall be determined by multiplying the estimated quantity of the item, as set forth in the Proposal Form, by the corresponding unit price bid for such item. The resulting product shall be entered in the appropriate blank space under the column headed "Computed Total Price for Item". The lump sum price bid for each lump sum price Contract Item shall also be entered in the column headed "Computed Total Price for Item". If a Proposal contains any omissions, erasures, alterations, additions, or items not called for in the itemized Proposal, or contains irregularities of any kind, such may constitute sufficient cause for rejection of the Proposal. In case of any discrepancy in the unit price or amount bid for any item in the Proposal, the price as expressed in written words will govern. In no case is the Agreement Form to be filled out or signed by the Bidder.

In the case of certain jobs bid Lump Sum a "Schedule of Unit Prices" must be filled out as an attachment to the Lump Sum proposal. These prices may be used as a guide for the negotiation of change orders, at the City's option.

The proposal must be signed and certified and be presented on the prescribed form in a sealed envelope on/or before the time and at the place stated in the Notice of Bidders, endorsed with the name of the person, firm or corporation presenting it, the date of presentation, and the title of the work for which the Proposal is made.

Unless the apparent low bidder is now engaged in or has recently completed contract work for the City of Tampa, he, if requested, shall furnish to the City, after the opening of bids and prior to award, a summary statement of record of construction experience over the past three (3) years with proper supporting evidence, and, if required by the City, shall also furnish a list of equipment and other facilities pertinent to and available for the proper execution of the proposed work, and a statement of financial resources to the extent necessary to establish ability to carry on the proposed work. The City may make further investigations as considered necessary with respect to responsibility of the Bidder to whom it appears may be awarded the Contract.

If forwarded by mail, the sealed envelope containing the Proposal, endorsed as directed above, must be enclosed in another envelope addressed as specified in the Notice to Bidders and sent by registered mail.

I-2.03 ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the Plans, Specifications, or other Contract Documents will be made to any Bidder orally.

Every request for such interpretation must be in writing, addressed to the Contract Administration Department, Tampa Municipal Office Building, 4th Floor North, City Hall Plaza, Tampa, Florida 33602. To be given consideration, such request must be received at least seven (7) days prior to the date fixed for the opening of the Proposals. Any and all such interpretations and any supplemental instructions will be in the form of written addenda which, if issued, will be sent by certified mail, with return receipt requested, to all prospective bidders at the respective addresses furnished, for such purposes, not later than three (3) working days prior to the date fixed for the opening of the Proposals, and if requested, a copy will be delivered to the prospective bidder's representative. Failure of any Bidder to receive any such addenda shall not relieve said Bidder from any obligation under his Proposal as submitted. All addenda so issued shall become part of the Contract Documents.

I-2.04 BID SECURITY

Each Proposal must be accompanied by a certified or cashier's check issued by a solvent bank or trust company and payable at sight to the City of Tampa, in compliance with Section 255.051 Florida Statutes, or a Bid Bond upon the form provided herein, in an amount of not less than five percent of the sum of the computed total amount of the Bidder's Proposal as a guarantee that if the Proposal is accepted, the Bidder will execute and fill in the proposed Contract and Public Construction Bond within twenty (20) days after notice of award of the Contract. Certified checks shall have all necessary documentary revenue stamps attached if required by law. Surety on Bid Bonds shall be a duly authorized surety company authorized to do business in the State of Florida, and all such Bonds shall be issued or countersigned by a local resident producing agent, and satisfactory evidence of the authority of the person or persons executing such Bond to Execute the same shall be submitted with the Bond. Bid Bonds shall be issued by a surety company acceptable to the City.

Within ten (10) days after the opening of Proposals, the bid security of all but the three lowest Bidders will be returned. The bid security of the remaining two Bidders whose Proposals are not accepted will be

returned within ten (10) days after the execution of the Contract, or, if no such Contract has been executed, within ninety (90) days after the date of opening Proposals. The bid security of the Bidder whose Proposal is accepted will be returned only after he has duly executed the Contract and furnished the required Public Construction Bond and insurance.

Should it be necessary for the City to retain the bid security and said bid security is in the form of checks, the checks of these Bidders will be returned if replaced by Bid Bonds in an amount equal to the amount of the checks of such Bidders in such form and issued by a surety company acceptable to the City.

A Bidder may withdraw his Proposal before the time fixed for the opening of Proposals, without prejudice to himself, by communicating his purpose, in writing, to the Mayor and City Council, and when his communication is received, the Proposal will be handed to him or his authorized agent unopened. No Bidder may withdraw his Proposal within ninety (90) days after the day of opening Proposals.

The Bidder whose Proposal is accepted shall enter into a written contract, upon the Agreement form included herein, for the performance of the work and furnish the required Public Construction Bond within twenty (20) days after written notice by the City of Award of Contract has been served on such Bidder personally or after receipt of the written notice by registered mail to such Bidder at the address given in his Proposal.

If the Bidder to whom a Contract is awarded refuses or neglects to execute it or fails to furnish the required Public Construction Bond within twenty (20) days after receipt by him of the Notice of Award of Contract, the amount of his bid security shall be forfeited and shall be retained by the City as liquidated damages, and not as a penalty, it being now agreed that said sum is a fair estimate of the amount of damages that the City will sustain in case said Bidder fails to enter into a Contract and furnish the required Public Construction Bond. If a Bid Bond was furnished, the full amount of the Bond shall become due and payable as liquidated damages caused by such failure. The full amount of the bid security shall be forfeited as liquidated damages without consideration of the fact that an award may be less than the full amount of the Bidder's Proposal, excepting that the award shall be within the conditions of said Proposal relating to the basis of consideration for an award. No plea of mistake in the bid or misunderstanding of the conditions of forfeiture shall be available to the Bidder for the recovery of his deposit or as a defense to any action based upon the neglect or refusal to execute a contract.

I-2.05 LAWS AND REGULATIONS
The Bidder who is awarded the Contract must comply with all laws of the State of Florida, and all applicable Ordinances of the City of Tampa respecting labor and compensation and with all other statutes, ordinances, rules and regulations applicable and having the force of law.

I-2.06 PUBLIC CONSTRUCTION BOND
The Bidder who is awarded the Contract will be required to furnish a Public Construction Bond upon the form provided herein, equal to 100 percent of the Contract price, such Bond to be executed by a surety company acceptable to the City of Tampa and licensed to underwrite contracts in the State of Florida. Surety companies shall have a rating of not less than: B+ Class VI as evaluated in the most recently circulated BEST'S KEY RATING GUIDE PROPERTY-LIABILITY.

I-2.07 SIGNATURE AND QUALIFICATIONS OF BIDDERS
Proposals must be signed in ink by the Bidder with signature in full. When a firm is a Bidder, the Proposal shall be signed in the name of the firm by one or more of the partners. When a corporation is a Bidder the officer signing shall set out the corporate name in full beneath which he shall sign his name and give the title of his office. The Proposal shall also bear the seal of the corporation attested by its secretary. Anyone signing the Proposal as agent must file with it legal evidence of his authority to do so.

Bidders who are nonresident corporations shall furnish to the City a duly certified copy of their permit to transact business in the State of Florida, signed by the Secretary of State, within ten days of the notice to do so. Such notice will be given to Bidders who are nonresident corporations, to whom it appears an award will be made, and the copy of the permit must be filed with the City before the award will be made. Failure to promptly submit this evidence of qualification to do business in the State of Florida may be basis for rejection of the Proposal.

I-2.08 REJECTION OF PROPOSALS
The City reserves the right to reject any Proposal if investigation of the Bidder fails to satisfy the City that such Bidder is properly qualified to carry out the obligations and to complete the work contemplated therein. Any or all Proposals will be rejected if there is reason to believe that collusion exists among Bidders. Proposals will be considered irregular and may be rejected if they show serious omissions, alterations in form, additions not called for, conditions or unauthorized alternates, or irregularities of any kind. The City reserves the right to reject any or all Proposals and to waive such technical errors as may be deemed best for the interests of the City.

I-2.09 QUANTITIES ESTIMATED ONLY
The estimate of quantities of the various items of work and materials, if set forth in the Proposal Form, is approximate only and is given solely to be used as a uniform basis for the comparison of Proposals. The quantities actually required to complete the Contract work may be less or more than so estimated, and if awarded a Contract for the work specified, the Contractor agrees that he will not make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work assumed for comparison of Proposals and quantities of work actually performed. The City further reserves the right to vary the quantities in any amount.

I-2.10 COMPARISON OF PROPOSALS
Except jobs bid on a "One Lump Sum" basis, proposals will be compared on the basis of a total computed price arrived at by taking the sum of the estimated quantity of each time and the corresponding unit price of each item, and including any lump sum prices on individual items.

The computed total prices for individual Contract Items and the total computed price for the entire Contract, as entered by the Bidder in the Proposal Form, are for convenience only and are subject to correction in the tabulation and computation of the Proposals.

I-2.11 BASIS OF AWARD
The Contract will be awarded, if at all, to the lowest responsible Bidder or Bidders, as determined by the City and by the terms and conditions of the Contract Documents. Unless all bids are rejected, the award will be made within ninety (90) days after the opening of Proposals. The successful Bidder will be required to possess, or obtain, a valid City Occupational License.

I-2.12 INSURANCE REQUIRED
The successful Bidder and his subcontractors will be required to procure and pay for insurance covering the work in accordance with the provisions of Article 6.02 of the Agreement as indicated on special instructions pages beginning with INS-1.

I-2.13 NO ASSIGNMENT OF BID
No Bidder shall assign his bid or any rights thereunder.

I-2.14 NONDISCRIMINATION IN EMPLOYMENT
Contracts for work under this Proposal will obligate the contractors and subcontractors not to discriminate in employment practices.

Bidders must, if requested, submit with their initial bid a signed statement as to whether they have previously performed work subject to the President's Executive Order Nos. 11246 and 11375.
Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the Contract.

Successful Bidders must, if requested, submit a list of all subcontractors who will perform work on the project and written,

signed statement from authorized agents of the labor pools with which they will or may deal for employees on the work together with supporting information to the effect that said labor pools practices and policies are in conformity with Executive Order No. 11246 and that said labor pools will affirmatively cooperate in or offer no hindrance to the recruitment, employment and equal treatment of employees seeking employment and performing work under the Contract, or a certification as to what efforts have been made to secure such statements when such agents or labor pools have failed or refused to furnish them prior to the award of the Contract.

I-2.15 LABOR STANDARDS
The Bidder's attention is directed to the Contract Provisions of the Labor Standards for federally assisted projects which may be attached to and made a part of the Agreement.

I-2.16 NOTICE TO LABOR UNIONS
If applicable, the successful Bidder will be required to provide Labor Unions and other organizations of workers a completed copy of the form entitled "Notice to Labor Unions or Other Organizations of Workers", and such form may be made a part of the Agreement.

I-2.17 NOTICE TO PROSPECTIVE FEDERALLY-ASSISTED CONSTRUCTION CONTRACTORS
A Certification of Nonsegregated Facilities, as required by the May 9, 1967, Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to said Secretary prior to the award of a federally-assisted construction and Contract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The form of certification may be bound herein following the form of Bid Bond.

Contractors receiving federally-assisted construction Contract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of the following notice to prospective subcontractor for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause:

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENT
FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES

"A Certification of Nonsegregated Facilities, as required by the May 9, 1967, Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause."

"Contractors receiving subcontract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide from the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause."

The United States requires a pre-award conference if a proposed construction contract exceeds one million dollars to determine if the the prospective contractor is in compliance with the Equal Employment Opportunity requirements of Executive Order 11246 of September 24, 1965. In such instances, a meeting may be scheduled at which the prospective contractor must specify what affirmative action he has taken or proposed to take to assure equal employment opportunity which must be approved by the United States before award of the contract will be authorized.

Bidders must be prepared to submit an Equal Employment Opportunity (EEO) plan at a pre-award conference. The plan must include bidding opportunities offered by the Bidder to minority subcontractors.

On October 13, 1971, President Nixon issued Executive Order 11246 emphasizing the government's commitment to the promotion of minority business enterprise. Accordingly, the United States is firmly committed to the utilization of available resources to support this important program. U.S. agencies are most interested in realizing minority participation on the subject. Achieving equal employment opportunity compliance is required through Executive Order 11246. WE cannot emphasize too strongly that minority subcontractors be extended subcontractors bidding opportunities as but one step in your affirmative action policy.

Due to the importance of this contract, U.S. Agencies may conduct an EEO Conference prior to the award of the Contract. It is suggested that the responsive Bidder confirm the minority subcontractors he contacted for bids or quotations in his EEO plan submitted at the conference.

I-2.18 EEO AFFIRMATIVE ACTION REQUIREMENTS
By the submission of a Proposal, each Bidder acknowledges that he understands and will agree to be bound by the equal opportunity requirements of Federal regulations which shall be applicable throughout the performance of work under any contract awarded pursuant to solicitation. Each Bidder agrees that if awarded a contract, he will similarly bind contractually each subcontractor. In policies, each Bidder further understands and agrees that if awarded a contract, he must engage in Affirmative Action directed to promoting and ensuring equal employment opportunity in the work force used under the contract (and he must require contractually the same effort of all subcontractors whose subcontracts exceed $100,000). The Bidder understands and agrees that "Affirmative Action" as used herein shall constitute a good faith effort to achieve and maintain minority employment in each trade in the on-site work force used on the project. * * * * * * * END of SECTION * * * * * * *

# CITY OF TAMPA INSURANCE REQUIREMENTS

During the life of the award/contract the Awardee/Contractor shall provide, pay for, and maintain insurance with companies authorized to do business in Florida, with an A.M. Best rating of B+ (or better) Class VII (or higher), or otherwise be acceptable to the City if not rated by A.M. Best. All insurance shall be from responsible companies duly authorized to do business in the State of Florida.

All commercial general liability insurance policies (and Excess or Umbrella Liability Insurance policies, if applicable) shall provide that the City is an additional insured as to the operations of the Awardee/Contractor under the award/contract including the additional insured endorsement, the subrogation wavier endorsement, and the Severability of Interest Provision. In lieu of the additional named insured requirement, if the Awardee/Contractor's company has a declared existing policy which precludes it from including additional insureds, the City may permit the Contractor to purchase an Owners and Contractors Protective Liability policy. Such policy shall be written in the name of the City at the same limit as is required for General Liability coverage. The policy shall be evidenced on an insurance binder which must be effective from the date of issue until such time as a policy is in existence and shall be submitted to the City in the manner described below as applicable to certificates of insurance.

The insurance coverages and limits required must be evidenced by a properly executed Acord 25 Certificate of Insurance form or its equivalent. Each Certificate must be personally manually signed by the Authorized Representative of the insurance company shown in the Certificate with proof that he/she is an authorized representative thereof. Thirty days' written notice must be given to the City of any cancellation, intent not to renew, or reduction in the policy coverages, except in the application of the aggregate liability limits provisions. Should any aggregate limit of liability coverage be reduced, it shall be immediately increased back to the limit required by the contract. The insurance coverages required herein are to be primary to any insurance carried by the City or any self-insurance program thereof.

The following coverages are required:

A. Commercial General Liability Insurance shall be provided on the most current Insurance Services Office (ISO) form or its equivalent. This coverage must be provided to cover liability arising from premises and operations, independent contractors, products and completed operations, personal and advertising injury, contractual liability, and XCU exposures (if applicable). Completed operations liability coverage shall be maintained for a minimum of one-year following completion of work. The amount of Commercial General Liability insurance shall not be less than the amount specified.

(a) $1,000,000 per occurrence and a $2,000,000 general aggregate for projects valued at $2,000,000 or less. General aggregate limit for projects over that price shall equal or exceed the price of the project. An Excess or Umbrella Liability insurance policy can be provided to meet the required limit. Risk Management may be contacted for additional information regarding projects of this nature.

B. Automobile Liability Insurance shall be maintained in accordance with the laws of the State of Florida, as to the ownership, maintenance, and use of all owned, non-owned, leased, or hired vehicles. The amount of Automobile Liability Insurance shall not be less than the amount specified.

(a) $500,000 combined single limit each occurrence bodily injury & property damage- for projects valued at $100,000 and under

(b) $1,000,000 combined single limit each occurrence bodily injury & property damage – for projects valued over $100,000

C. Worker's Compensation and Employer's Liability Insurance shall be provided for all employees engaged in the work under the contract, in accordance with the Florida Statutory Requirements. The amount of the Employer's Liability Insurance shall not be less than:

(a) $500,000 bodily injury by accident and each accident, bodily injury by disease policy limit, and bodily injury by disease each employee – for projects valued at $100,00 and under
(b) $1,000,000 bodily injury by accident and each accident, bodily injury by disease policy limit, and bodily injury by disease each –for projects valued over $100,000

D. Excess Liability Insurance or Umbrella Liability Insurance may compensate for a deficiency in general liability, automobile, or worker's compensation insurance coverage limits. If the Excess or Umbrella policy is being provided as proof of coverage, it must name the City of Tampa as an additional insured **(IF APPLICABLE).**

E. Builder's Risk Insurance, specialized policy designed to cover the property loss exposures that are associated with construction of buildings. The amount of coverage should not be less than the amount of the project. **(IF APPLICABLE).**

F. Installation Floater- a builder's risk type policy that covers specific type of property during its installation, is coverage required for highly valued equipment or materials such as compressors, generators, or other machinery that are not covered by the builder's risk policy **(IF APPLICABLE).**

G. Longshoreman's & Harbor Worker's Compensation Act/Jones Act coverage shall be maintained for work being conducted upon navigable water of the United States. The limit required shall be the same limit as the worker's compensation/employer's liability insurance limit **(IF APPLICABLE).**

H. Professional Liability shall be maintained against claims of negligence, errors, mistakes, or omissions in the performance of the services to be performed and furnished by the Awardee/Contractor or any of its subcontractors when it acts as a DESIGN PROFESSIONAL. The amount of coverage shall be no less than amount specified **(IF APPLICABLE).**

(a) $1,000,000 per incident and general aggregate. Note all claims made policies must provide the date of retroactive coverage.

The City may waive any or all of the above referenced insurance requirements based on the specific nature of goods or services to be provided under the award/contract.

ADDITIONAL INSURED - The City must be included as an additional insured by on the general and (Excess or Umbrella liability policies) if applicable. Alternatively, the Contractor may purchase a separate owners protective liability policy in the name of the City in the specified amount as indicated in the insurance requirements.

CLAIMS MADE POLICIES - If any liability insurance is issued on a claims made form, Contractor agrees to maintain uninterrupted coverage for a minimum of one year following completion and acceptance of the work either through purchase of an extended reporting provision, or through purchase of successive renewals with a retroactive date not later than the beginning of performance of work for the City. The retroactive date must be provided for all claims made policies.

CANCELLATION/NON-RENEWAL - Thirty (30) days written notice must be given to the City of any cancellation, intent to non-renew or material reduction in coverages (except aggregate liability limits). However, ten (10) days notice may be given for non-payment of premium. Notice shall be sent to the City of Tampa Department of Public Works, 306 E. Jackson Street, Tampa, FL 33602.

NUMBER OF POLICIES - General and other liability insurance may be arranged under single policies for the full amounts required or by a combination of underlying policies with the balance provided by an excess or umbrella liability insurance policy.

WAIVER OF SUBROGATION - Contractor waives all rights against City, its agents, officers, directors and employees for recovery of damages to the extent such damage is covered under the automobile or excess liability policies.

SUBCONTRACTORS - It is the Contractor's responsibility to require all subcontractors to maintain adequate insurance coverage.

PRIMARY POLICIES - The Contractor's insurance is primary to the City's insurance or any self insurance program thereof.

RATING - All insurers shall be authorized to do business in Florida, and shall have an A.M. Best rating of B+ (or better), Class VII (or higher), or otherwise be acceptable to the City if not rated by A.M. Best.

DEDUCTIBLES - The Contractor is responsible for all deductibles. In the event of loss which would have been covered but for the presence of a deductible, the City may withhold from payment to Contractor an amount equal to the deductible to cover such loss should full recovery not be obtained under the insurance policy.

INSURANCE ADJUSTMENTS - These insurance requirements may be increased, reduced, or waived at the City's sole option with an appropriate adjustment to the Contract price.

Document updated on 12/22/2009 by RLD (Risk Management)

# *City of Tampa MBD Office*

# *U-WMBE Goal Setting Firms Report*

# *4/15/14*

## ELECTRICAL SERVICES

**Brown & Brown Electric, Inc.** **Federal**
59-2283934
6555 N.W. 9th Ave. S-205
Ft. Lauderdale, FL 33310-5003
**Phone** (954) 938-8986
**Fax** (954) 938-9272
**Minority** African American
**Contact** Winston Brown
**E-mail** winston@brownandbrownelectric.com

**Acktel Electric Company, Inc.** **Federal**
59-3579225
P.O. Box 52292
Jacksonville, FL 32201-2292
**Phone** (904) 356-1274
**Fax** (904) 356-1374
**Minority** African American
**Contact** Sedley Huey
**E-mail** acktelel@bellsouth.net

**All-In-One Electric, Inc.** **Federal**
04-3689273
1201 W Waters Ave.
Tampa, FL 33604
**Phone** (813) 849-6331
**Fax** (813) 514-0473
**Minority** African American
**Contact** Rodney Jones
**E-mail** allinoneelectric@msn.com

**Prime Electric, LLC** **Federal**
20-1137443
1229 W. Main St
Leesburg, FL 34748
**Phone** (352) 728-5966
**Fax** (352) 728-5921
**Minority** African American
**Contact** Wylie Hamilton
**E-mail** wylie@primeelectricllc.net

**MDH Enterprises, Inc.** **Federal**
55-0849332
281 E C St.
Orange City, FL 32763
**Phone** (386) 789-2672
**Fax** (866) 681-5026
**Minority** African American
**Contact** Matize Hoskins
**E-mail** matize@my-es.com

## PAINTING AND OTHER SERVICES, INTERIOR & EXTERIOR

**USAMA Specialty Finishes, Inc.** **Federal**
59-2877558
P.O. Box 1748
Safety Harbor, FL 34695-1748
**Phone** (727) 725-9005
**Fax** (727) 726-7363
**Minority** African American
**Contact** Muqit Usama
**E-mail** usama57@verizon.net

**Fletcher Painting, Inc. d/b/a/ Fletcher Enterprise** **Federal**
59-3587717
4355 Fairmont Street #8
Orlando, FL 32808
**Phone** (407) 290-1188
**Fax** (407) 290-9309
**Minority** African American
**Contact** Junior Fletcher
**E-mail** fletcherent-stacy@cfl.rr.com

# *City of Tampa MBD Office*

# *U-WMBE Goal Setting Firms Report*

# *4/15/14*

## PIPE AND PIPE FITTINGS

**Suca Pipe Supply, Inc.** **Federal**
59-2499571

P.O. Box 272482
Tampa, FL 33618

**Phone** (813) 249-7902
**Fax** (813) 249-7384

**Minority** African American
**Contact** Secedrick McIntyre

**E-mail** slmau44@yahoo.com

**Terrell Industries, Inc.** **Federal**
65-0530148

2067 1st Avenue N
St. Petersburg, FL 33713

**Phone** (727) 823-4424
**Fax** (727) 823-3977

**Minority** African American
**Contact** Grady Terrell

**E-mail** gterrell@verizon.net

**Suca Pipe Supply, Inc. One** **Federal**
26-3669556

4910 Lowell Road
Tampa, FL 33624

**Phone** (813) 249-7902
**Fax** (813) 249-7384

**Minority** African American
**Contact** Ashley McIntyre

**E-mail** mactwinau1@yahoo.com

# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## ELECTRICAL SERVICES

**Apollo Construction & Engineering Services, Inc.** **Federal Number** 59-2811166

P.O. Box 5848
Sun City Center, FL 33571-5848

**Phone** (813) 645-4926
**Fax** (813) 645-3351
**E-mail** tkamprath@apollo-construction.com

**Minority** Small Business
**Contact** Thomas Kamprath

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**Gaylord / Miller Electric Corp** **Federal Number** 59-1631953

602 North Oregon Avenue
Tampa, FL 33606

**Phone** (813) 254-4681
**Fax** (813) 254-9473
**E-mail** james.gmelectric@verizon.net

**Minority** Small Business
**Contact** James A. Tepper

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**All-In-One Electric, Inc.** **Federal Number** 04-3689273

1201 W Waters Ave.
Tampa, FL 33604

**Phone** (813) 849-6331
**Fax** (813) 514-0473
**E-mail** allinoneelectric@msn.com

**Minority** Small Business
**Contact** Rodney Jones

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**JDP Electric, Inc.** **Federal Number** 59-3511620

6600 N. Florida Avenue
Tampa, FL 33604

**Phone** (813) 234-4004
**Fax** (813) 236-0394
**E-mail** jdpinc@tampabay.rr.com

**Minority** Small Business
**Contact** Jeffrey Priede

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**Mandy Electric, Inc.** **Federal Number** 59-2914874

9353 E. Fowler Ave.
Thonotosassa, FL 33592

**Phone** (813) 264-9234
**Fax** (813) 333-9701
**E-mail** lhernandez@mandyselectric.com

**Minority** Small Business
**Contact** Armando Hernandez

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**Ralph A. Philbrook, III LLC** **Federal Number** 61-1460231

3316 Bainbridge Dr.
Holiday, FL 34691

**Phone** (727) 847-3766
**Fax** (727) 845-3567
**E-mail** philbrook3llc@aol.com

**Minority** Small Business
**Contact** Ralph Philbrook III

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**Crevello Electric, Inc.** **Federal Number** 59-3559003

3305 N. Stanley Rd.
Plant City, FL 33565

**Phone** (813) 986-6106
**Fax** (813) 986-9633
**E-mail** crevelloelectric@gmail.com

**Minority** Small Business
**Contact** Bill Crevello

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# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## ELECTRICAL SERVICES

**Electrical Handyman Services** **Federal Number** 27-2406369

7046-B West Hillsborough Ave
Tampa, FL 33634

**Phone** (813) 901-8185
**Fax** (813) 884-5060
**E-mail** ehs915@aol.com

**Minority** Small Business
**Contact** Jose Cruz

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**SJM Electric Corporation** **Federal Number** 20-4183090

333 North Falkenburg Rd, Suite B201
Tampa, FL 33619

**Phone** (813) 684-7459
**Fax** (813) 654-0420
**E-mail** tami@sjmelectric.com

**Minority** Small Business
**Contact** Scott Mroczkowski

---

**YES Electric, LLC** **Federal Number** 27-1341928

2412 E. 7th Avenue
Tampa, FL 33605

**Phone** (813) 447-2531
**Fax**
**E-mail** yeselectric@tampabay.rr.com

**Minority** Small Business
**Contact** George Pages

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**JBC Builders & Electric, Inc.** **Federal Number** 08-0054484

5001 N. Nebraska Avenue, Suite A
Tampa, FL 33603

**Phone** (813) 232-5000
**Fax** (813) 232-3555
**E-mail** jbc@tampabay.rr.com

**Minority** Small Business
**Contact** Gerald Martinez

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**Best Price Electric Service, LLC** **Federal Number** 27-1211988

P.O. Box 6516
Seffner, FL 33583

**Phone**
**Fax** (813) 409-3154
**E-mail** BestPriceElectricServ@hotmail.com

**Minority** Small Business
**Contact** Frank Fleites

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**Manatee Electric, Inc.** **Federal Number** 59-3454485

845 Thompson Road
Lithia, FL Fl

**Phone** (813) 645-7000
**Fax** (813) 654-7568
**E-mail** john@reliableelectricusa.com

**Minority** Small Business
**Contact** John Babuka

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**Slentz Electric, Inc.** **Federal Number** 59-1996013

1202 Gary Ave
Ellenton, FL 34222

**Phone** (941) 722-9227
**Fax** (941) 722-3318
**E-mail** georgeperry2@gmail.com

**Minority** Small Business
**Contact** George Perry

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# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## ELECTRICAL SERVICES

**Aguila Electrical Services, Inc.** **Federal Number** 20-0818128

8928 N. Newport Avenue
Tampa, FL 33604

**Phone** (813) 368-9323
**Fax** (813) 884-4092
**E-mail** sales@aguilaelectrical.com

**Minority** Small Business
**Contact** Jael Aguila

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**A American Electrical Contractor, Inc.** **Federal Number** 59-2603773

9170 126th Avenue N
Largo, FL 33773

**Phone** (727) 588-0126
**Fax** (727) 588-9170
**E-mail** mark.aaec@yahoo.com

**Minority** Small Business
**Contact** Mark Comerford

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**Rhythms Electric Corporation** **Federal Number** 27-3150153

433 37th Ave NE
St. Petersburg, FL 33704

**Phone** (727) 460-8779
**Fax**
**E-mail** rhythmselectric@me.com

**Minority** Small Business
**Contact** Mathew Krchmar

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**TAMCO Electric, Inc.** **Federal Number** 59-1396630

P.O. Box 579
Tampa, FL 33614

**Phone** (813) 986-3472
**Fax** (813) 986-5979
**E-mail** atrujill@tampabay.rr.com

**Minority** Small Business
**Contact** Steven Moates

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## PAINTING AND OTHER SERVICES, INTERIOR & EXTERIOR

**USAMA Specialty Finishes, Inc.** **Federal Number** 59-2877558

P.O. Box 1748
Safety Harbor, FL 34695-1748

**Phone** (727) 725-9005
**Fax** (727) 726-7363
**E-mail** usama57@verizon.net

**Minority** Small Business
**Contact** Muqit Usama

---

**West Star Painting, Inc.** **Federal Number** 59-3295920

1717 Virginia Ave.
Palm Harbor, FL 34683

**Phone** (727) 253-4637
**Fax** (727) 772-7417
**E-mail** weststarpainting@aol.com

**Minority** Small Business
**Contact** Flora Giannas

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# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## PAINTING AND OTHER SERVICES, INTERIOR & EXTERIOR

**Harry's Painting & Enterprises, Inc.** **Federal Number** 59-2820441

5250 Avery Road
New Port Richey, FL 34652

**Phone** (727) 848-1950
**Fax** (727) 847-3474
**E-mail** hp@harryspainting.com

**Minority** Small Business
**Contact** Sherrie Satterfield

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**Diversified Coatings & Finishes, Inc.** **Federal Number** 59-3460053

12540 Green Oak Lane
Dade City, FL 33525

**Phone** (813) 494-5543
**Fax** (352) 567-1718
**E-mail** bobcookdcf@gmail.com

**Minority** Small Business
**Contact** Bob Cook

---

**Gulf Coast Contracting, LLC** **Federal Number** 20-1424580

P.O. Box 2178
Tarpon Springs, FL 34688-2178

**Phone** (727) 938-6081
**Fax** (727) 937-0967
**E-mail** gulfcoastoffL@aol.com

**Minority** Small Business
**Contact** Manuel Gialousis

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**C&C Painting Contractors Inc.** **Federal Number** 59-3617521

8372 Standish Bend Dr.
Tampa, FL 33615

**Phone** (813) 886-7100
**Fax** (813) 886-7102
**E-mail** carlos@ccpainting.com

**Minority** Small Business
**Contact** Carlos Cubas

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**CMK Construction, Inc.** **Federal Number** 20-1609262

2053 Mountain Ash Way
New Port Richey, FL 34655

**Phone** (727) 243-9234
**Fax** (727) 848-2026
**E-mail** manny@cmkconstructioninc.com

**Minority** Small Business
**Contact** Manuel Kavouklis

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**Kimszal Contracting Inc.** **Federal Number** 20-3450022

3435 Chessington Drive
Land O' Lakes, FL 34638

**Phone** (813) 949-1750
**Fax** (813) 948-0451
**E-mail** edkimszal@msn.com

**Minority** Small Business
**Contact** Edward Kimszal

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**Leo's Construction, Inc.** **Federal Number** 51-0456226

1320 Illinois Ave.
Palm Harbor, FL 34683

**Phone** (727) 858-0266
**Fax**
**E-mail** LeosConstructionInc@yahoo.com

**Minority** Small Business
**Contact** Travis Smudde

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# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## PAINTING AND OTHER SERVICES, INTERIOR & EXTERIOR

**Elite Industrial Painting, Inc.** **Federal Number** 90-0658000

55 Dodecanese Blvd
Tarpon Springs, FL 34689

**Phone** (727) 487-3636
**Fax** (727) 940-5224
**E-mail** Thmanglis@yahoo.com

**Minority** Small Business
**Contact** Theofilos Manglis

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**Universal Contracting Services, Inc.** **Federal Number** 20-1452205

11311 Hollyglen Drive
Tampa, FL 33624

**Phone** (813) 966-1508
**Fax**
**E-mail** ucs@email.com

**Minority** Small Business
**Contact** Hadeel Eishesbaiy

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## PIPE AND PIPE FITTINGS

**Suca Pipe Supply, Inc.** **Federal Number** 59-2499571

P.O. Box 272482
Tampa, FL 33618

**Phone** (813) 249-7902
**Fax** (813) 249-7384
**E-mail** slmau44@yahoo.com

**Minority** Small Business
**Contact** Secedrick McIntyre

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**2 Meyer Corp.** **Federal Number** 56-2384669

6308 Lake Sunrise Dr.
Apollo Beach, FL 33572

**Phone** (813) 645-3150
**Fax** (813) 645-5634
**E-mail** Renatonjr@aol.com

**Minority** Small Business
**Contact** Melissa Gugliotti

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**Larsen Civil Construction LLC** **Federal Number** 20-3567884

10456 66th Street
Pinellas Park, FL 33782

**Phone** (727) 547-8100
**Fax** (727) 547-8101
**E-mail** jim@larsencivil.com

**Minority** Small Business
**Contact** Benjamin Larsen

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**Mar Supply Co.** **Federal Number** 27-0206845

2851 8th St.
Englewood, FL 34224

**Phone** (941) 286-3240
**Fax** (941) 214-8215
**E-mail** info@marsupplyco.com

**Minority** Small Business
**Contact** Raul Corona

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# *City of Tampa MBD Office*

# SLBE Goal Setting Firms Report

***as of 4/15/2014***

## PIPE AND PIPE FITTINGS

**Terrell Industries, Inc.** **Federal Number** 65-0530148

2067 1st Avenue N
St. Petersburg, FL 33713

**Phone** (727) 823-4424
**Fax** (727) 823-3977
**E-mail** gterrell@verizon.net

**Minority** Small Business
**Contact** Grady Terrell

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**Suca Pipe Supply, Inc. One** **Federal Number** 26-3669556

4910 Lowell Road
Tampa, FL 33624

**Phone** (813) 249-7902
**Fax** (813) 249-7384
**E-mail** mactwinau1@yahoo.com

**Minority** Small Business
**Contact** Ashley McIntyre

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**ASAP Fabrication, Inc.** **Federal Number** 45-4589570

5340 W. US Highway 92 W
Plant City, FL 33566

**Phone** (813) 752-1999
**Fax** (813) 752-1997
**E-mail** hp.hynes@asapfabrication.com

**Minority** Small Business
**Contact** Patricia Haynes

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**SLBE Contract Goal**

| Goal |
| --- |
| 21.1% |

Instructions Regarding Use of the SLBE Goal Setting List

**Bidders must solicit a subcontracting bid from ALL of the firms listed on the SLBEs list provided on the City's web site,** and provide documentation of emails, faxes, phone calls, letters, or other communication with the firms a first step in demonstrating Good-Faith Efforts to achieve the goal set for SLBE participation on this contract.

The list is formatted to facilitate e-mailing of a solicitation to the listed firms by copying and pasting the email addresses.

The SLBE participation Goal is based upon the availability of the certified firms indicated on the attached list. The Goal and Requirements of the City's Equal Business Opportunity Program are stated in the Bid/Contract Document, Specifications.

SOLICITATION FOR SUBCONTRACTOR QUOTES

From:
OUR COMPANY NAME:
TELEPHONE NUMBER:
ADDRESS:
FAX NUMBER:
E-MAIL ADDRESS:

To Subcontractor:

Our firm is in the process of preparing a bid for a **City of Tampa Contract**. Please accept this notice as our request for quotes for the scope of work identified below. Please respond to this request by filling in the information below and returning via e-mail or fax to the address or number provided. Please contact us if you need any assistance in obtaining bonding, lines of credit, insurance, assistance in obtaining necessary equipment, supplies, materials, participation in a City-sponsored mentor-protégé program, or if you have any questions.

Plans and Specs for this project are posted at:
http://www.tampagov.net/dept_contract_administration/programs_and_services/construction_project_bidding/

CONTRACT NO.:
CONTRACT NAME:
CITY'S BID OPENING DATE:
DEADLINE FOR YOUR SUBCONTRACTOR BID OR RESPONSE:
SPECIFIC SCOPE OF WORK:

Please complete and submit with your subcontract bid or response:
YOUR FIRM'S NAME:
MAILING ADDRESS:
CITY:
STATE:
ZIP:
FAX NUMBER:
E-MAIL ADDRESS:
__Yes, my company is interested in quoting this project for the following items of work:

__No, my company will not quote this project for the following reason(s):

(Sample Suggested Sub Solicitation 3-9-9 Tampa MBDO)

Contract 14-C-00009; Krause Pump Station Rehabilitation

PROPOSAL

To the Mayor and City Council of the City of Tampa, Florida:

Name of Bidder _____

_____
Business Phone Number and Email Address

_____
Business Name and Mailing Address

_____
Phone Number and Name of Contact Regarding Permits

_____
Contractor/Qualifiers Name and Federal Identification Number

Date of Proposal _____

(If Bidder is a firm, fill in the following blanks):

Names and Residential Addresses of Partners

_____

_____

(If Bidder is a corporation, fill in the following blanks):

Organized under the laws of the State of _____

Names and Address of President

_____

_____

Name and Address of Vice President

_____

_____

Name and Address of Secretary

_____

_____

Names and Address of Treasurer

_____

_____

The above-named Bidder affirms and declares:

(1) That the Bidder is of lawful age and that no other person, firm or corporation has any interest in this Proposal or in the Contract proposed to be entered into.

(2) That this Proposal is made without any understanding, agreement or connection with any other person, firm, or corporation making Proposal for the same purposes, and is in all respects fair and without collusion or fraud.

(3) That the Bidder is not in arrears to the City of Tampa, upon debt or contract, and is not a defaulter, as surety or otherwise, upon any obligation to the City of Tampa.

(4) That no officer or employee or person whose salary is payable in whole or in part from the City Treasury is, shall be or become interested, directly or indirectly, as a contracting party, partner, stockholder, surety or otherwise, in this Proposal, or in the performance of the Contract, or in the supplies, materials, or equipment and work or labor to which it relates, or in any portion of the profits thereof.

(5) That the Bidder has carefully examined the site of the work and that, from his own investigations, he has satisfied himself as to the nature and location of the work, the character, quality, and quantity of materials and the kinds and extent of equipment and other facilities needed for the performance of the work, the general and local conditions and all difficulties to be encountered, and all other items which may, in any way, affect the work or its performance.

(6) That the Bidder

_____ Has; Treasury Number _____

_____ Has not
(Check applicable box)

previously performed work under the President's Executive Order Nos. 11246 and 11375.

(7) That the undersigned, as Bidder, also declares that he has carefully examined and fully understands all the component parts of the Contract Documents and agrees that he will execute the Contract and finish the required Performance Bond and will completely perform the work in strict accordance with the terms of the Contract and the Contract Documents therein referred to for the following prices, to wit:

| Contract Item No. | Estimated Quantity | Description and Price in Words | Computed Total Price for Item in Figures |
|---|---|---|---|
| BASE BID | LS | The work includes the furnishing of all labor, equipment, and material to remove existing pumps, motors and concrete pedestals from pump No.1 – constant speed 300 hp motor, Nos. 2 & 4 – variable speed 105 hp motors and No 3- constant speed 400 hp motor, four (4)-24" discharge valves, piping, pump controls, and existing 4160V electrical equipment; install four (4) 400 HP pumps and immersible motors, discharge and suction valves, piping, concrete pedestal supports, air compressors; install four (4) 480V variable frequency drives, pump controls, annunciator panel, motor control center, electrical switchgear, concrete duct bank system, conduits, wiring, and other electrical equipment needed to convert the pump station from 4160V service to 480V service and new ventilation system. The contract also includes furnishing all labor, materials, and equipment, to install a new 36" flow meter outside the station, temporary bypass pumping, any Contingency Allowances as stated in SP-60, and with all associated work required for a complete project in accordance with the Contract Documents.<br><br>_____<br><br>_____ dollars<br><br>and _____ cents<br><br>(BASE BID) LS | $_____ |

Computed Total Price In Words:

_____

_____ dollars and _____ cents.

Computed Total Price in Figures: $_____

The bidder acknowledges that the following addenda have been received and that the changes covered by the addendum(s) have been taken into account in this proposal: #1 ___ #2 ___ #3 ___ #4___ #5___.

The bidder acknowledges the requirements of the City of Tampa's Equal Business Opportunity Program.

Bidder acknowledges that included in the various items of the proposal and the Total Bid Price are costs for complying with the Florida Trench Safety Act (90096), (Laws of Fla.) effective October 1, 1990. The bidder further identifies the costs to be summarized below:

| | Trench Safety Measure (Description) | Unit of Measure (LF, SY) | Unit Quantity | Unit Cost | Extended Cost |
|---|---|---|---|---|---|
| A. | _____ | _____ | _____ | _____ | _____ |
| B. | _____ | _____ | _____ | _____ | _____ |
| C. | _____ | _____ | _____ | _____ | _____ |
| D. | _____ | _____ | _____ | _____ | _____ |

Total Cost $_____

Signed _____

Failure to complete the above may result in the bid being declared non-responsive.

Accompanying this Proposal is a certified check, cashier's check or Bid Bond (form included herein must be used) on the form at least five (5) percent of the total amount of the Proposal which check shall become the property of the

_____ of _____
(Name of Bank or Surety) (City & State)

City of Tampa, or which bond shall become forthwith due and payable to the City of Tampa, if this Proposal shall be accepted by the City of Tampa and the undersigned shall fail to execute a contract with and to furnish the required Performance Bond and Payment Bond to the City of Tampa within twenty (20) days after the date of receipt of written Notice of Award by the City of Tampa to the undersigned so to do.

Dated _____, 2014

_____
(Name of Bidder)

_____
(Address of Bidder)

_____
(Signature)

_____
(Title)

Where Bidder is a Corporation:

Attest:

_____
Secretary

AFFIX
CORPORATE
SEAL

(ACKNOWLEDGMENT OF PRINCIPAL)

STATE OF )
) SS:
COUNTY OF )

For a Corporation:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ of _____, a _____ corporation, on behalf of the corporation. He/she is ___ personally known or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

For an Individual:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ who is ___ personally known to me or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

For a Firm:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ who signed on behalf of the said firm. He/she is ___ personally known or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

_____

# Good Faith Effort Compliance Plan for Small Local Business Subcontracting

City of Tampa - Equal Business Opportunity Program

**Contract** _____ **Bid Date** _____

**Bidder** _____

**Signature** _____ **Date** _____

**Name** _____ **Title** _____

**The following Compliance Plan is a true report of Good Faith Efforts made to accomplish subcontracting goals for Small Local Business Enterprises, SLBEs, on the referenced contract:**

□ **The goal for SLBE participation has been met or exceeded. See the DMI form reporting subcontractors to be utilized.**
(Check Box, if appropriate; the remainder of the Compliance Plan need not be reported.)

□ **The goal for SLBE participation has not been met. The following is a recap of Good Faith Efforts made:**
(Check applicable boxes below. Enclose additional documents, and/or add remarks below as needed.)

(1) Soliciting through reasonable and available means the interest of SLBEs that have the capability to perform the work of the contract. The Bidder or Contractor must solicit this interest within sufficient time to allow the SLBEs to respond. The Bidder or Contractor must take appropriate steps to follow up initial solicitations with interested SLBEs. □ See DMI report forms for subcontractors solicited. □ See enclosed supplemental data on solicitation efforts. □ Remarks:

(2) Providing interested SLBEs with adequate information about the plans, specifications, and requirements of the contract, including addenda, in a timely manner to assist them in responding to the solicitation. □ See enclosed sample solicitation. □ Remarks:

(3) Negotiating in good faith with interested SLBEs that have submitted bids. Documentation of negotiation must include the names, addresses, and telephone numbers of SLBEs that were solicited; the date of each such solicitation; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why agreements could not be reached with SLBEs to perform the work. That there may be some additional costs involved in soliciting and using SLBEs is not a sufficient reason for a contractor's failure to meet the goals, as long as such costs are reasonable. Bidders are not required to accept higher quotes in order to meet the goal. □ DMI subcontractor-utilized forms reflect successful negotiations □ This project is of a low-bid nature and negotiations are limited to clarifications of scope and specifications. □ See enclosed document. □ Remarks:

(4) Not rejecting SLBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The SLBEs standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations are not legitimate causes for rejecting or not soliciting bids to meet the goals. □ Not applicable. □ See attached explanation for rejection of a low-bidding subcontractor's bid. □ Remarks:

(5) Making a portion of the work available to SLBE subcontractors and suppliers and to select those portions of the work or material consistent with the available SLBE subcontractors and suppliers, so as to facilitate meeting the goal. □ Sub-Contractors were allowed to bid on their own choice of work or trade without restriction to a pre-determined portion. □ See enclosed comments. □ Remarks:

(6) Making good faith efforts, despite the ability or desire of a Bidder or Contractor to perform the work of a contract with its own organization. A Bidder or Contractor who desires to self-perform the work of a contract must demonstrate good faith efforts unless the goal has been met. □ Sub-Contractors were not prohibited from submitting bids on work not usually sub-contracted. □ Remarks:

(7) Selecting portions of the work to be performed by SLBEs in order to increase the likelihood that the goals will be met. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate SLBE participation, even when the Bidder or Contractor might otherwise prefer to perform these work items with its own forces. □ Sub-Contractors were allowed to bid on their own choice of work or trade without restriction to a pre-determined portion. □ Sub-Contractors were not prohibited from submitting bids on work not usually sub-contracted. □ See enclosed comments. □ Remarks:

(8) Making efforts to assist interested SLBEs in obtaining bonding, lines of credit, or insurance as required by the city or contractor. □ See enclosed sample solicitation □ see enclosed document. □ Remarks:

(9) Making efforts to assist interested SLBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, including participation in a City-sponsored mentor-protégé program. □ See enclosed sample solicitation. □ See enclosed document. □ Remarks:

(10) Effectively using the services of the City and other organizations that provide assistance in the recruitment and placement of SLBEs. □ See enclosed document. □ The following services were used:

Other Supporting Good Faith Efforts: □ See enclosed document. □ Remarks:

## Compliance Plan: Guidance For Meeting Good Faith Efforts

1. All firms on the SLBE Goal Setting List must be solicited and documentation provided for email, fax, letters, phone calls, and other communication with the listed firms. The DMI Solicited and DMI-Utilized forms must be completed for all firms solicited or utilized. Other opportunities for subcontracting may be explored by consulting the City of Tampa and/or Hillsborough County certification listings of SLBE's.

2. Solicitation of SLBEs, via written or electronic notification, should provide specific information on the services needed, where plans can be reviewed and assistance offered in obtaining these, if required. Solicitations should be typically be sent a week or more before the bid date. Sample copies of the bidder's solicitations should be provided.

3. With any quotes received, a follow-up should be made whenever needed to confirm scope of work. For any SLBE low quotes rejected, an explanation should be provided detailing negotiation efforts.

4. If a low bid SLBE is rejected or deemed unqualified the contractor must provide an explanation and supporting documentation for this decision.

5. Prime should break down portions of work into economical feasible opportunities for subcontracting. The SLBE directory can be useful in identifying additional subcontracting opportunities and firms not listed in the "SLBE Goal Setting Firms List."

6. Contractor should not preclude SLBEs from bidding on any part of work, even if the Contractor can self-perform the work.

7. Contractor should avoid relying solely on subcontracting out work where availability is not sufficient to attain pre-determined goal.

8. In its solicitations, the Bidder should offer assistance to SLBEs in obtaining bonding, insurance, etc, if required of subcontractors by the City or Prime Contractor.

9. In its solicitation, the Bidder should offer assistance in obtaining equipment for a specific job to SLBEs, if needed.

**10.** Contractor should use the services offered by such agencies as the Minority Business Development Office of the City of Tampa, Hillsborough County and the NAACP Empowerment Center for the recruitment and placement of SLBEs.

# City of Tampa –DMI -Schedule of All Sub-(Contractors/Consultants/Suppliers) Solicited

*(FORM MBD-10)*

Contract No.:_____ Contract Name:_____

Contractor Name:_____ Address:_____

Federal ID:_____Phone:_____ Fax:_____ Email:_____

[] No Firms were contacted/solicited for this contract.

[] No Firms were contacted because:_____

[] See attached documents with supplemental information.

NIGP Code General Categories: Buildings = 909, General = 912, Heavy = 913, Trades = 914, Architects = 906, Engineers & Surveyors = 925, Supplier = 912-77

This DMI Schedule Must Be Submitted with the Bid or Proposal (Do Not Modify This Form)

| S = SLBE<br>W=WMBE<br><br>Federal ID | Company Name<br>Address<br>Phone & Fax | Type of Ownership<br>(F=Female M=Male)<br>BF BM = African Am.<br>HF HM = Hispanic Am.<br>AF AM = Asian Am.<br>NF NM = Native Am.<br>CF CM = Caucasian | Trade or Services<br><br>NIGP Code (listed above) | Contact Method<br>L=Letter<br>F=Fax<br>E=Email<br>P=Phone | Quote or Resp. Rec'd Y/N |
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It is hereby certified that the information provided is an accurate and true account of contacts and solicitations for sub – contracting opportunitieson this contract. ***This form must be completed and submitted with the bid or proposal***.Modifying or failing to sign DMI forms may result in Non-Compliance and/or deemed non-responsive.

Signed:_____ Name/Title:_____ Date:_____



**Note: Detailed Instructions for completing this form are on the next page**

# Instructions for completing The Sub-(Contractors/Consultants/ Suppliers) Solicited Form (Form MBD-10)

**This form must be submitted with all bids or proposals**. All subcontractors (regardless of ownership or size) solicited and subcontractors from whom unsolicited quotations were received must be included on this form. The instructions that follow correspond to the headings on the form required to be completed.Note: Ability or desire to self-perform all work shall not exempt the prime from Good Faith Efforts when Goal has been established.

- **Contract No.** This is the number assigned by the City of Tampa for the bid or proposal.
- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business.
- **Address.** The physical address of your business.
- **Federal ID.**FIN. A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Firms were contacted/solicited for this contract.** Checking the box indicates that a pre-determined Subcontract Goal was not set by the City resulting in your business not using subcontractors and will self-perform all work. If during the performance of the contract you employ subcontractors, the City must pre-approve subcontractors. Use of the "Sub-(Contractors/Consultants/Suppliers) Payments" form must be submitted with your invoices. Note: Certified SLBE or WMBE firms bidding as Primes are not exempt from outreach and solicitation of subcontractors.
- **No Firms were contacted because.** Provide brief explanation why no firms were contacted/solicited.
- **See attached documents.**Check box, if after you have completed the DMI Form in its entirety, you are providing any additional documentation relating to the form.All DMI data not submitted on the MBD Form-10 must be in the same format and have all requested data from MBD Form-10 included.

The following instructions are for information of any and all subcontractors solicited.

- **"S" = SLBE, "W" = WMBE.** Enter "**S**" for firms Certified by the City as Small Local Business Enterprises and/or "**W**" for firms Certified by the City as Women/Minority Business Enterprise.
- **Federal ID.**FIN. A number assigned to a business for tax reporting purposes. This information is critical in proper identification of the subcontractor.
- **Company Name, Address, Phone & Fax**. Provide company information for verification of payments.
- **Type of Ownership.** Indicate the Ethnicity and Gender of the owner of the subcontracting business.
- **Trade, Services, or Materials** Indicate the trade, service, or material provided by the subcontractor. NIGP codes are listed at top section of document.
- **Contact Method L=letter, F=fax, E=Email, P=Phone.** Indicate with letter the method of soliciting for bid.
- **Quote or Resp. (response) Rec'd (received) Y/N**. Indicate "Y" Yes if you received a quotation or if you received a response to your solicitation. Indicate "N" No if you received no response to your solicitation from the subcontractor.

If any additional information is required or you have any questions, you may call the Minority Business Development Office at (813) 274-5522.

# City of Tampa –DMI Schedule of Sub-(Contractors/Consultants/Suppliers) to be Utilized

*(FORM MBD-20)*

Contract No.:_____ Contract Name:_____

Contractor Name:_____ Address:_____

Federal ID:_____Phone:_____ Fax:_____ Email:_____

[ ] See attached documents.

[ ] No Subcontracting (of any kind) will be performed on this contract.

NIGP Code General Categories: Buildings = 909, General = 912, Heavy = 913, Trades = 914, Architects = 906, Engineers & Surveyors = 925, Supplier = 912-77

## This DMI Schedule Must Be Submitted with the Bid or Proposal (Do Not Modify This Form)

Enter "S" for firms Certified as Small Local Business Enterprises, "W" for firms Certified as Women/Minority Business Enterprise

| S = SLBE<br>W=WMBE<br>Federal ID | Company Name<br>Address<br>Phone & Fax | Type of Ownership<br>(F=Female M=Male)<br>BF BM = African Am.<br>HF HM = Hispanic Am.<br>AF AM = Asian Am.<br>NF NM = Native Am.<br>CF CM = Caucasian | Trade, Services, or Materials<br>NIGP Code Listed above | Amount of Quote. Letter of Intent if available. | Percent of Scope/Contract % |
|---|---|---|---|---|---|
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Total Subcontract/Supplier Utilization $_____

Total SLBE Utilization $ _____

Total WMBE Utilization $ _____

Percent SLBE Utilization of Total Bid/Proposal Amt. _____% Percent WMBE Utilization of Total Bid/Proposal Amt. _____%

It is hereby certified that the following information is a true and accurate account of utilization for sub-contracting opportunities on this contract. ***This form must be completed and submitted with the bid or proposal.*** Modifying or failing to sign DMI forms may result in Non-Complianceand/or deemed non-responsive.

Signed:_____ Name/Title:_____ Date:_____



**Note: Detailed Instructions for completing this form are on the next page.**

**Instructions for completing The Sub-(Contractors/Consultants/ Suppliers) to be Utilized Form**

# (Form MBD-20)

***This form must be submitted with all bids or proposals. All subcontractors projected to be utilized must be included on this form.***

- **Contract No.** This is the number assigned by the City of Tampa for the bid or proposal.
- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business.
- **Address.** The physical address of your business.
- **Federal ID.**FIN. A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Subcontracting (of any kind) will be performed on this contract.** Checking box indicates your business will not use subcontractors when no Subcontract Goal has been set by the City, but will self-perform all work. When subcontractors are utilized during the performance of the contract, the "Sub-(Contractors/Consultants/Suppliers) Payments" form must be submitted with your invoices. Note: Certified SLBE or WMBE firms bidding as Primes are not exempt from outreach and solicitation of subcontractors.
- **See attached documents.** Check if you have provided any additional documentation relating to the utilization of subcontractors.
-

The following instructions are for information of Any and All subcontractors to be utilized.

- **Federal ID.**FIN. A number assigned to a business for tax reporting purposes. This information is critical in proper identification of the subcontractor.
- **"S" = SLBE, "W" = WMBE.** Enter "**S**" for firms Certified by the City as Small Local Business Enterprises and/or "**W**" for firms Certified by the City as Women/Minority Business Enterprise.
- **Company Name, Address, Phone & Fax**. Provide company information for verification of payments.
- **Type of Ownership.** Indicate the Ethnicity and Gender of the owner of the subcontracting business.
- **Trade, Services, or Materials (NIGP code if Known)** Indicate the trade, service, or material provided by the subcontractor. NIGP codes are available at http:/www.tampagov.net/mbd.
- **Amount of Quote, Letters of Intent** (required for both SLBEs and WMBEs)
- **Percent of Work/Contract.** Indicate the percent of the total contract price the subcontract(s) represent.
- **Total Subcontract/Supplier Utilization.** – Provide total dollar amount of all subcontractors/suppliers projected to be used for the contract. (Dollar amounts may not apply to CCNA proposals.)
- **Total SLBE Utilization.** Provide total dollar amount for all projected SLBE subcontractors/Suppliers used for this contract. (Dollar amounts may not apply to CCNA proposals.)
- **Total WMBE Utilization.** Provide total dollar amount for all projected WMBE subcontractors/Suppliers used for this contract. (Dollar amounts may not apply to CCNA proposals.)
- **Percent SLBE Utilization.** Total amount allocated to SLBEs divided by the total bid amount. (Dollar amounts may not apply to CCNA proposals.)
- **Percent WMBE Utilization.** Total amount allocated to WMBEs divided by the total bid/proposal amount. (Dollar amounts may not apply to CCNA proposals.)

If any additional information is required or you have any questions, you may call the Minority Business Development Office at (813) 274-5522.

TAMPA BID BOND
Contract 14-C-00009; Krause Pump Station Rehabilitation

KNOW ALL MEN BY THESE PRESENTS, that we, _____

_____

(hereinafter called the Principal) and _____

(hereinafter called the Surety) a Corporation chartered and existing under the laws of the State of _____, with its principal offices in the City of _____, and authorized to do business in the State of Florida, are held and firmly bound unto the City of Tampa, a Municipal Corporation of Hillsborough County, Florida, in the full and just sum of 5% of the amount of the (Bid) (Proposal) good and lawful money of the United States of America, to be paid upon demand of the City of Tampa, Florida, to which payment will and truly to be made we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally and firmly these presents.

WHEREAS, the Principal is about to submit, or has submitted to the City of Tampa, Florida, a Proposal for the construction of certain facilities for the City designated Contract 14-C-00009, Krause Pump Station Rehabilitation.

WHEREAS, the Principal desires to file this Bond in accordance with law, in lieu of a certified Bidder's check otherwise required to accompany this Proposal.

NOW, THEREFORE: The conditions of this obligation are such that if the Proposal be accepted, the Principal shall, within twenty (20) days after the date of receipt of written Notice of Award, execute a contract in accordance with the Proposal and upon the terms, conditions and price set forth therein, in the form and manner required by the City of Tampa, Florida and execute a sufficient and satisfactory Public Construction Bond payable to the City of Tampa, Florida in an amount of one hundred percent (100%) of the total contract price, in form and with security satisfactory to said City, then this Bid Bond obligation is to be void; otherwise to be and remain in full force and virtue in law, and the Surety shall, upon failure of the Principal to comply with any or all of the foregoing requirements within the time specified above, immediately pay to the aforesaid City, upon demand, the amount thereof, in good and lawful money of the United States of America, not as a penalty, but as liquidated damages.

IN TESTIMONY THEREOF, the Principal and Surety have caused these presents to be duly signed and sealed this _____ day of _____, 2014.

Principal _____

BY _____

TITLE _____

BY _____

TITLE _____

(SEAL)

_____
Producing Agent

_____
Producing Agent's Address

_____
Name of Agency

_____
The addition of such phrases as "not to exceed" or like import shall render the (Bid) (Proposal)non-responsive.

# AGREEMENT

For furnishing all labor, materials and equipment, together with all work incidental thereto, necessary and required for the performance of the work for the construction of Contract 14-C-00009 in accordance with your Proposal dated _____, amounting to a total of $_____ as completed in accordance with subsections I-2.09 and I-2.10 of the Instruction to Bidders.

THIS AGREEMENT, made and entered into in triplicate, this ____ day of _____, 2014, between the City of Tampa, Florida, hereinafter called the City, and hereinafter called the Contractor.

WITNESSETH that, in consideration of the mutual stipulations, agreements, and covenants herein contained, the parties hereto have agreed and hereby agree with each other, the Party of the First Part for itself, its successors and assigns, and the Party of the Second Part for itself, or himself, or themselves, and its successors and assigns, or his or their executors, administrators and assigns, as follows:

Contract 14-C-00009; Krause Pump Station Rehabilitation, shall include, but not be limited to, furnishing all labor, materials, and equipment to remove existing pumps, motors and concrete pedestals from pump No.1 – constant speed 300 hp motor, Nos. 2 & 4 – variable speed 105 hp motors and No 3- constant speed 400 hp motor, four (4)-24" discharge valves, piping, pump controls, and existing 4160V electrical equipment; install four (4) 400 HP pumps and immiscible motors, discharge and suction valves, piping, concrete pedestal supports, air compressors; install four (4) 480V variable frequency drives, pump controls, annunciator panel, motor control center, electrical switchgear, concrete duct bank system, conduits, wiring, and other electrical equipment needed to convert the pump station from 4160V service to 480V service and new ventilation system. The contract also includes furnishing all labor, materials, and equipment, to install a new 36" flow meter outside the station, temporary bypass pumping with all associated work required for a complete project in accordance with the Contract Documents.

Contract Documents referred to in Article 1.01 of this Agreement also includes this volume, applicable standard drawings, the plans and any provisions referred to whether actually attached or not.

# TAMPA AGREEMENT

## SECTION 1
## GENERAL

### ARTICLE 1.01 THE CONTRACT

Except for titles, subtitles, headings, running headlines, and tables of contents (all of which are printed herein merely for convenience), the following, except for such portions thereof as may be specifically excluded, constitute the Contract:

The Notice to Bidders;
The Instructions to Bidders, including Special Instructions and General Instructions;
The Proposal;
The Bid Bond;
The Certification of Nonsegregated Facilities;
The Notice of Award;
The Agreement;
The Performance Bond;
The Notice To Proceed;
The Specifications, including the General Provisions, the Workmanship and Materials, the Specific Provisions or the Contract Items
The Plans;
All Supplementary Drawings Issued after award of the Contract;
All Addenda issued by the City prior to the receipt of proposals;
All provisions required by law to be inserted in this Contract, whether actually inserted or not.

### ARTICLE 1.02 DEFINITIONS

The following words and terms, or pronouns used in their stead, shall, wherever they appear in this Contract, be construed as follows, unless different meaning is clear from the context:

(a)"City" shall mean the City of Tampa, Florida, represented by its Mayor and City Council, Party of the First Part, or such other City official as shall be duly empowered to act for the City on matters relating to this Contract.

(b)"Contractor" shall mean the Party of the Second Part hereto, whether corporation, firm or individual, or any combination thereof, and its, their, or his successors, personal representatives, executors, administrators, and assigns, and any person, firm or corporation who or which shall at any time be substituted in the place of the Party of the Second Part under this Contract.

(c)"Engineer" shall mean the Director of the Department or his duly authorized representative.

(d)"Consultant" shall mean the engineering or architectural firm or individual employed by the City to consult with and advise the City in the construction of the project.

(e)"Surety" shall mean any person, firm or corporation that has executed as Surety the Contractor's Performance Bond securing the performance of this Contact.

(f)"The Work" shall mean everything expressly or implied required to be furnished and done by the Contractor under the Contract, and shall include both Contract Work and Extra Work.

(g)"Contract Work" shall mean everything expressly or implied required to be furnished and done by the Contractor by any one or more of the Contract parts referred to in Article 1.01 hereof, except Extra Work, as hereinafter defined; it being understood that, in case of any inconsistency in or between any part or parts of this Contract, the Engineer shall determine which shall prevail.

(h)"Contract" or "Contract Documents" shall mean each of the various part of the Contract referred to in Article 1.01 hereof, both as a whole and severally.

(i)"Extra Work" shall mean work other than that required either expressly or implied by the contract in its present form.

(j)"Plans" shall mean only those drawings specifically referred to as such in these documents, or in any Addendum. Drawings issued after the execution of the Contract to explain further, or to illustrate, or to show changes in the work, will be known as "Supplementary Drawings" and shall be binding upon the Contractor with the same force as the Plans.

(k)"Specifications" shall mean all of the directions, requirements, and standards of performance applying to the work, as hereinafter detailed and designated as such, or which may be issued in an addendum.

(l)"Addendum or Addenda" shall mean the additional contract provisions issued in writing prior to the receipt of bids.

(m)"Notice" shall mean written notice. Notice shall be served upon the Contractor, either personally or by leaving the said notice at his residence or with any employee found on the work, or addressed to the Contractor at the residence or place of business given in his proposal and deposited in a postpaid wrapper in any post office box regularly maintained by the United States Post Office.

(n)"Project" shall mean the entire improvement package or related work. The "project" may consist of several different, but related, contracts.

(o)"Site" shall mean, and be limited to, the area upon or in which the Contractor's operations are carried on and such other appropriate areas as may be designed as such by the Engineer.

(p)"Subcontractor" shall mean any person, firm, or corporation, other than employees of the Contractor, who or which contracts with the Contractor to furnish, or actually furnishes labor, or labor and materials, or labor and equipment or labor, materials, and equipment at the site.

(q)Whenever in the Contract the words "directed", "required", "permitted", "ordered", "designated", "prescribed", and words of like import are used, they shall imply the direction, requirement, permission, order, designation, or prescription of the Engineer; and "approved", "acceptable", "satisfactory", "in the judgement of", and words of like import shall mean approved by, or acceptable to, or satisfactory to, or in the judgment of the Engineer.

(r)Whenever in the Contract the word "day" is used, it shall mean calendar day.

(s)"Final Acceptance" shall mean acceptance of the

work as evidenced by an official resolution of the City. Such acceptance shall be deemed to have taken place only if and when an approving resolution has been adopted by the City Council. The final acceptance shall be signed only after the City has assured itself by tests, inspection, or otherwise, that all of the provisions of the Contract have been carried out to its satisfaction.

(t)"Eastern Standard Time" shall be construed as the time being observed in the City on the day proposals are received or other documents issued or signed.

## SECTION 2
## POWERS OF THE CITY'S REPRESENTATIVES

**ARTICLE 2.01 THE ENGINEER**

It is covenanted and agreed that the Engineer, in addition to those matters elsewhere herein expressly made subject to his determination, direction, or approval, shall have the power, subject to such express provisions and limitations herein contained as are not in conflict herewith, and subject to review by the Mayor and City Council:

(a)To monitor the performance of the work.

(b)To determine the amount, kind, quality, sequence, and location of the work to be paid for hereunder and, when completed, to measure such work for payment.

(c)To determine all questions of an engineering character in relation to the work, to interpret the Plans, Specifications and Addenda.

(d)To determine how the work of this Contract shall be coordinated with the work of other contractors engaged simultaneously on this project.

(e)To make minor changes in the work as he deems necessary, provided such changes do not result in a net increase in the cost to the City or to the Contractor of the work to be done under the Contract.

(f)To amplify the Plans, add explanatory information and furnish additional Specifications and Drawings consistent with the intent of the Contract Documents.

The power of the Engineer shall not be limited to the foregoing enumeration, for it is the intent of this Contract that all of the work shall be subject to his determinations and approval, except where the determination or approval of someone other than the Engineer is expressly called for herein and except as subject to review by the Mayor and City Council. All orders of the Engineer requiring the Contractor to perform work as Contract work shall be promptly obeyed by the Contractor.

The Engineer shall not, however, have the power to issue an extra work order, and the performance of such work on the order of the Engineer without previously obtaining written confirmation thereof from the Mayor in accordance with Article 7.02 hereof may constitute a waiver of any right to extra compensation therefor. The Contractor is warned that the Engineer has no power to change the terms and provisions of this Contract, except minor changes where such change results in no net increase in the Contract Price.

**ARTICLE 2.02 DIRECTOR**

The Director of the Department in addition to those matters expressly made subject to his determination, direction or approval in his capacity as "Engineer", shall also have the power:

(a)To review any and all questions in relation to this Contract and its performance, except as herein otherwise specifically provided, and his determination upon such review shall be final and conclusive upon the Contractor.

(b)With the approval of the Mayor and City Council to authorize modifications or changes in the Contract so as to require: (1) the performance of extra work, or (2) the omission of Contract work whenever he deems it in the interest of the City to do so, or both.

(c)To suspend the whole or any part of the work whenever, in his judgment, such suspension is required: (1) in the interest of the City generally, or (2) to coordinate the work of the various Contractors engaged on this project, or (3) to expedite the completion of the entire project, even though the completion of this particular Contract may be thereby delayed, without compensation to the Contractor for such suspension other than extending the time for the completion of the work, as much as it may have been, in the opinion of the City, delayed by such a suspension.

(d)If, before the final acceptance of all the work contemplated herein, it shall be deemed necessary to take over, use, occupy, or operate any part of the completed or partly completed work, the Engineer shall have the right to do so and the Contractor will not, in any way, interfere with or object to the use, occupation, or operation of such work by the City after receipt of notice in writing from the Engineer that such work or part thereof will be used by the City on and after the date specified in such notice. Such taking over, use, occupancy or operation of any part of the completed or partially completed work shall not constitute final acceptance or approval of any such part of the work.

**ARTICLE 2.03 NO ESTOPPEL**

The City shall not, nor shall any department, officer, agent, or employee thereof, be bound, precluded, or estopped by any determination, decision, acceptance, return, certificate, or payment made or given under or in connection with this Contract by any officer, agent or employee of the City at any time either before or after final completion and acceptance of the work and payment therefor: (a) from showing the true and correct classification, amount, quality, or character of the work done, or that any determination, decision, acceptance, return certificate or payment is untrue, incorrect or improperly made in any particular, or that the work or any part thereof does not in fact conform to the requirements of the Contract Documents, and (b) from demanding and recovering from the Contractor any overpayments made to him or such damages as it may sustain by reason his failure to comply with the requirements of the Contract of Documents, or both.

**ARTICLE 2.04 NO WAIVER OF RIGHTS**

Neither the inspection, nor any order, measurements or certificate of the City or its employees, officers, or agents, nor by any order of the City for payment of money, nor any money, nor payments for or acceptance of the whole or any part of the work by the City, nor any extension of time, nor any changes in the Contract, Specifications or Plans, nor any possession by the City or its employees shall operate as a

waiver of any provisions of this Contract, nor any power herein provided nor shall any waiver of any breach of this Contract be held as a waiver of any other subsequent breach.

Any remedy provided in this Contract shall be taken and construed as cumulative, namely, in addition to each and every other suit, action, or legal proceeding. The City shall be entitled as of right to an injunction against any breach of the provisions of this Contract.

## SECTION 3
## PERFORMANCE OF WORK

**ARTICLE 3.01 CONTRACTOR'S RESPONSIBILITY**
The Contractor shall do all the work and furnish, at his own cost and expense, all labor, materials, equipment, and other facilities, except as herein otherwise provided, as may be necessary and proper for performing and completing the work under this Contract. The Contractor shall be responsible for the entire work until completed and finally accepted by the City.

The work shall be performed in accordance with the true intent and meaning of the Contract Documents. Unless otherwise expressly provided, the work must be performed in accordance with the best modern practice, with materials as specified and workmanship of the highest quality, all as determined by and entirely to the satisfaction of the Engineer.

Unless otherwise expressly provided, the means and methods of construction shall be such as the Contractor may choose, subject, however, to the approval of the Engineer. Only adequate and safe procedure, methods, structures and equipment shall be used. The Engineer's approval or the Engineer's failure to exercise his right thereon shall not relieve the Contractor of obligations to accomplish the result intended by the Contract, nor shall such create a cause of action for damages.

**ARTICLE 3.02 COMPLIANCE WITH LAWS**
The Contractor must comply with all local, State and Federal laws, rules, ordinances and regulations applicable to this Contract and to the work done hereunder, and must obtain, at his own expense, all permits, licenses or other authorization necessary for the prosecution of the work.

No work shall be performed under this Contract on Sundays, legal holidays or after regular working hours without the express permission of the Engineer. Where such permission is granted, the Engineer may require that such work be performed without additional expense to the City.

**ARTICLE 3.03 INSPECTION**
During the progress of the work and up to the date of final acceptance, the Contractor shall, at all times, afford the representatives of the City, the Florida Department of Environmental Regulation, and if applicable, the Federal Environmental Protection Agency and the Federal Department of Labor every reasonable, safe and proper facility for inspecting the work done or being done at the site. The inspection of any work shall not relieve the Contractor of any of his obligations to perform proper and satisfactory work as herein specified. Finished or unfinished work found not to be in strict accordance with the Contract shall be replaced as directed by the Engineer, even though such work may have been previously approved and payment made therefor.

The City shall have the right to reject materials and workmanship which are defective or require their correction. Rejected work and materials must be promptly removed from the site, which must at all times be kept in a reasonably clean and neat condition.

Failure or neglect on the part of the City to condemn or reject bad or inferior work or materials shall not be construed to imply an acceptance of such work or materials, if it becomes evident at any time prior to the final acceptance of the work by the City. Neither shall it be construed as barring the City at any subsequent time from the recovery of damages of such a sum of money as may be needed to build anew all portions of the work in which inferior work or improper materials were used, wherever found.

Should it be considered necessary or advisable by the City at any time before final acceptance of the entire work to make examinations of work already completed, by removing or tearing out all or portions of such work, the Contractor shall, on request, promptly furnish all necessary facilities, labor, and material for that purpose. If such work is found to be defective in any material respect, due to the fault of the Contractor or his subcontractors, he shall defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the work shall be considered an item of extra work to be paid for in accordance with the provisions of Article 7.02 hereof.

**ARTICLE 3.04 PROTECTION**
During performance and until final acceptance, the Contractor shall be under an absolute obligation to protect the finished and unfinished work against any damage, loss, or injury. The Contractor shall take proper precaution to protect the finished work from loss or damage, pending completion and the final acceptance of all the work included in the entire Contract, provided that such precaution shall not relieve the Contractor from any and all liability and responsibility for loss or damage to the work occurring before final acceptance by the City. Such loss or damage shall be at the risk of and borne by the Contractor, whether arising from acts or omissions of the Contractor or others. In the event of any such loss or damage, the Contractor shall forthwith repair, replace, and make good the work without extension of time therefor, except as may be otherwise provided herein.

The provisions of this Article shall not be deemed to create any new right of action in favor of third parties against the Contractor or the City.

**ARTICLE 3.05 PRESERVATION OF PROPERTY**

The Contractor shall preserve from damage all property along the line of the work, or which is in the vicinity of or is in anywise affected by the work, the removal or destruction of which is not called for by the Plans. This applies, but is not limited, to the public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, public streets (except natural wear and tear of streets resulting from legitimate use thereof by the Contractor), and wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor and at his own expense.

In case of failure on the part of the Contractor to restore such property, or make good such damage or injury, the City may, upon forty-eight (48) hour written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any monies due or which may become due the Contractor under this Contract. Nothing in this clause shall prevent the Contractor from receiving proper compensation for the removal, damage, or replacement of any public or private property not shown on the Plans, when this is made necessary by alteration of grade or alignment authorized by the Engineer, provided that such property has not been damaged through fault of the Contractor, his employees or agents.

**ARTICLE 3.06 BOUNDARIES**
The Contractor shall confine his equipment, apparatus, the storage of materials, supplies and apparatus of his workmen to the limits indicated on the plans, by law, ordinances, permits or direction of the Engineer.

**ARTICLE 3.07 SAFETY AND HEALTH REGULATIONS**
The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91- 596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL91-54).

**ARTICLE 3.08 TAXES**
All taxes of any kind and character payable on account of the work done and materials furnished under this Contract shall be paid by the Contractor and shall be deemed to have been included in his bid. The laws of the State of Florida provide that sales and use taxes are payable by the Contractor upon the tangible personal property incorporated in the work and such taxes shall be paid by the Contractor and shall be deemed to have been included in his bid.

**ARTICLE 3.09 ENVIRONMENTAL CONSIDERATIONS**
The Contractor, in the performance of the work under this Contract, shall comply with all Local, State and Federal laws, statutes, ordinances, rules and regulations applicable to protection of the environment; and, in the event he violates any of the provisions of same, he shall be answerable to the Local, State and Federal agencies designated by law to protect the environment. In the event the City receives, from any of the environmental agencies, a citation which is occasioned by an act or omission of the Contractor or his subcontractor or any officers, employees or agents of either, it is understood and agreed that the Contractor shall automatically become a party-respondent under said citation; and the City immediately shall notify the Contractor and provide him with a copy of said citation.

The Contractor shall comply with the requirements of the citation and correct the offending conditions(s) within the time stated in said citation and further shall be held fully responsible for all fines and/or penalties.

## SECTION 4
## TIME PROVISIONS

**ARTICLE 4.01 TIME OF START AND COMPLETION**
The Contractor must commence work within thirty (30) days subsequent to the date of the receipt of the "Notice to Proceed" by the City unless otherwise provided in the Specific Provisions and Special Instructions. Time being of the essence of this Contract, the Contractor shall thereafter prosecute the work diligently, using such means and methods of construction as well as secure its full completion in accordance with the requirements of the Contract Documents no later than the date specified therefor, or on the date to which the time for completion may be extended.

The Contractor must complete the work covered by this Contract in the number of consecutive calendar days set forth in the Instructions to Bidders, unless the date of completion is extended pursuant to the provisions of Article 4.05 hereof. The period for performance shall start from the date of signing of this Agreement by the City.

The actual date of completion will be established after a final inspection as provided in Article 4.07 hereof.

**ARTICLE 4.02 PROGRESS SCHEDULE**
To enable the work to be laid out and prosecuted in an orderly and expeditious manner, the Contractor shall submit to the Engineer a proposed progress schedule within fifteen (15) days after the award of this Contract.

The schedule shall state the Contract starting date, time for completion and date of completion and shall show the anticipated time of starting and completion of each of the various operations to be performed under this Contract, together with all necessary and appropriate information regarding sequence and correlation of work and an estimated time required for the delivery of all materials and equipment required for the work. The proposed schedule shall be revised as directed by the Engineer until finally approved by him, and, after such approval, shall be strictly adhered to by the Contractor. The approved progress schedule may be changed only with the written permission of the Engineer.

If the Contractor shall fail to adhere to the approved progress schedule or the schedule as revised, he shall promptly adopt such other or additional means and methods of construction as will make up for the time lost, and will assure completion in accordance with the contract time.

**ARTICLE 4.03 APPROVAL REQUESTS**
From time to time, as the work progresses and in the sequence indicated by the approved schedule, the Contractor must submit to the Engineer a specific request, in writing, for each item of information or approval required of him by the Contract. These requests must be submitted sufficiently in advance of the date upon which the information or approval is actually required by the Contractor to allow for the time the Engineer may take to act upon such submissions or resubmissions. The Contractor shall not have any right to an extension of time on account of delays due to his failure to submit his requests for the required information or the required approval in accordance with these requirements.

**ARTICLE 4.04 COORDINATION WITH OTHER CONTRACTORS**
During progress of the work, other Contractors may be engaged in performing other work on this project or on other projects on the site. In that event, the Contractor shall coordinate the work to be done hereunder with the work of such other Contractors in such manner as the Engineer may direct.

**ARTICLE 4.05 EXTENSION OF TIME**
If such an application is made, the Contractor shall be entitled to an extension of time for delay in completion of the work should the Contractor be obstructed or delayed in the commencement, prosecution or completion of any part of said work by any act or delay of the City, or by acts or omissions of other Contractors on this project, or by a riot, insurrection, war, pestilence, acts of public authorities, fire, lightning, hurricanes, earthquakes, tornadoes, floods, extremely abnormal and excessive inclement weather as indicated by the records of the local weather bureau for a five-year period preceding the date of the Contract, or by strikes, or other causes, which causes of delay mentioned in this Article, in the opinion of the City, are entirely beyond the expectation and control of the Contractor.

The Contractor shall, however, be entitled to an extension of time for such causes only for the number of days of delay which the City may determine to be due solely to such causes and only to the extent that such occurrences actually delay the completion of the project and then only if the Contractor shall have strictly complied with all of the requirements of Articles 4.01, 4.02, 4.03 and 4.04 hereof. It is hereby understood that the determination by the Engineer as to the order and sequence of the work shall not in itself constitute a basis for extension of time.

The determination made by the City on an application for an extension of time shall be binding and conclusive on the Contractor.

Delays caused by failure of the Contractor's materialmen, manufacturers, and dealers to furnish approved working drawings, materials, fixtures, equipment, appliances, or other fittings on time or failure of subcontractors to perform their work shall not constitute a basis of extension of time.

The Contractor agrees to make no claim for damages for delay in the performance of this Contract occasioned by any act or omission to act of the City or any of its representatives or because of any injunction which may be brought against the City or its representatives and agrees that any such claim shall be fully compensated for by an extension of time to complete performance of the work as provided herein.

**ARTICLE 4.06 LIQUIDATED DAMAGES**
It is mutually agreed between the parties that time is the essence of this Contract and that there will be on the part of the City considerable monetary damage in the event the Contractor should fail to complete the work within the time fixed for completion in the Contract or within the time to which such completion may have been extended.

The amount per day set forth in the Instructions to Bidders is hereby agreed upon as the liquidated damages for each and every calendar day that the time consumed in completing the work under this Contract exceeds the time allowed.

This amount shall, in no event, be considered as a penalty or otherwise than as the liquidated and adjusted damages to the City because of the delay and the Contractor and his Surety agree that the stated sum per day for each such day of delay shall be deducted and retained out of the monies which may become due hereunder and if not so deductible, the Contractor and his Surety shall be liable therefor.

**ARTICLE 4.07 FINAL INSPECTION**
When the work has been completed in accordance with the requirements of the Contract and final cleaning up performed, a date for final inspection of the work by the Engineer shall be set by the Contractor in a written request therefor, which date shall be not less than ten (10) days after the date of such request. The work will be deemed complete as of the date so set by the Contractor if, upon such inspection, the Engineer determines that no further work remains to be done at the site.

If such inspection reveals interms of work still to be performed, however, the Contractor shall promptly perform them and then request a reinspection. If, upon such inspection, the Engineer determines that the work is complete, the date of final completion shall be deemed to be the last day of such reinspection.

## SECTION 5
## SUBCONTRACTS AND ASSIGNMENTS

**ARTICLE 5.01 LIMITATIONS AND CONSENT**
The Contractor shall not assign, transfer, convey, sublet or otherwise dispose of this Contract or of his right, title, or interest therein, or his power to execute such Contract, or to assign any monies due or to become due thereunder to any other person, firm or corporation unless the previous written consent of the City shall first be obtained thereto and the giving of any such consent to a particular subcontract or assignment shall not dispense with the necessity of such consent to any further or other assignment.

Before making any subcontract, the Contractor must submit a

written statement to the Engineer, giving the name and address of the proposed contractor, the portion of the work and materials which he is to perform and furnish and any other information tending to prove that the proposed subcontractor has the necessary facilities, skill, integrity, past experience and financial resources to perform the work in accordance with the terms and conditions of this Contract.

If the City finds that the proposed subcontractor is qualified, the Contractor will be notified in writing. The City may revoke approval of any subcontractor when such subcontractor evidences an unwillingness or inability to perform his work in strict accordance with these Contract Documents. Notice of such revocation of approval will be given in writing to the Contractor.

The Contractor will promptly, upon request, file with the City a conformed copy of the subcontract. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of these Contract Documents, insofar as applicable to the work of subcontractors, and to give the Contractor the same power as regards terminating any subcontracts that the City may exercise over the Contractor under provisions of these Contract Documents.

The Contractor shall be required to perform with his own forces at least twenty-five (25) percent of the work, unless written consent to subcontract a greater percentage of the work is first obtained from the City.

**ARTICLE 5.02 RESPONSIBILITY**
The approval by the City of a subcontractor shall not relieve the Contractor of any of his responsibilities, duties, and liabilities hereunder. The Contractor shall be solely responsible to the City for the acts or defaults or omissions of his subcontractor and of such subcontractor's officers, agents, and employees, each of whom shall for all purposes be deemed to be the agent or employee of the Contractor. Nothing contained in the Contract Documents shall create any contractual relationship between any subcontractor and the City.

## SECTION 6
## SECURITY AND GUARANTY

**ARTICLE 6.01 CONTRACT SECURITY**
The Contractor shall execute and deliver to the City a Performance Bond on the form as provided herein, in an amount at least equal to one hundred (100) percent of the full Contract price, such Bond to be executed by a surety company acceptable to the City. The surety on such Performance Bond shall be a surety company duly authorized to do business in the State of Florida, and the Bond shall be issued or countersigned by a local resident producing agent of such surety company who is a resident of the State of Florida, regularly commissioned and licensed in said State, and satisfactory evidence of the authority of the person or persons executing such Bond shall be submitted with the Bond. The Performance Bond shall serve as security for the faithful performance of this Contract, including maintenance and guaranty provisions, and for the payment of all persons performing labor and furnishing materials in connection with the Contract. The premiums on the Performance Bond shall be paid by the Contractor.

If, at any time, the City shall become dissatisfied with any surety or sureties then upon the Performance Bond, or if for any other reason such bond shall cease to be adequate security for the City, the Contractor shall, within five days after notice so to do, substitute an acceptable Bond in such form and sum and signed by such other sureties as may be satisfactory to the City. The premiums on such Bond shall be paid by the Contractor. No further partial payments shall be deemed due or shall be made until the new sureties have qualified.

**ARTICLE 6.02 CONTRACTORS INSURANCE**
Insurance required shall be as indicated on Special Instructions pages beginning with "INS-1"

**ARTICLE 6.03 AGAINST CLAIMS AND LIENS**
The City may withhold from the Contractor as much as any approved payments to him as may, in the opinion of the City, be necessary to secure (a) just claims of any persons supplying labor or materials to the Contractor or any of his subcontractors for the work then due and unpaid; (b) loss due to defective work not remedied, or (c) liability, damage, or loss due to injury to persons or damages to the work or property of other contractors, subcontractors, or others, caused by the act or neglect of the Contractor or of any of his subcontractors. The City shall have the right, as agent for the Contractor, to apply any such amounts so withheld in such manner as the City may deem proper to satisfy such claims or to secure such protection. Such application of such money shall be deemed payments for the account of the Contractor.

**ARTICLE 6.04 MAINTENANCE AND GUARANTY**
The Contractor hereby guarantees all the work furnished under this Contract against any defects in workmanship and materials for a period of one year following the date of final acceptance of the work by the City. Under this guarantee, the Contractor hereby agrees to make good, without delay, at his own expense, any failure of any part of the work due to faulty materials or manufacture, construction, or installation, or the failure of any equipment to perform satisfactorily all the work put upon it within the limits of the Contract Documents, and further, shall make good any damage to any part of the work caused by such failure. It is hereby agreed that the Performance Bond shall fully cover all guarantees contained in this Article.
It is also agreed that all warranties, expressed or implied, inure to the benefit of the City and are enforceable by the City.

## SECTION 7
## CHANGES

**ARTICLE 7.01 MINOR CHANGES**
The City reserves the right to make such additions, deductions, or changes to this Contract from time to time as

it deems necessary and in a manner not materially affecting the substance thereof or materially changing the price to be paid in order to carry out and complete more fully and perfectly the work herein agreed to be done and performed. This Contract shall in no way be invalidated by any such additions, deductions, or changes, and no claim by the Contractor shall be made for any loss of anticipated profits thereby.

Construction conditions may require that minor changes be made in the location and installation of the work and equipment to be furnished and other work to be performed hereunder, and the Contractor when ordered by the Engineer, shall make such adjustments and changes in said locations and work as may be necessary, without additional cost to the City, provided such adjustments and changes do not alter the character, quantity of cost of the work as a whole, and provided further that Plans and Specifications showing such adjustments and changes are furnished to the Contractor by the City within a reasonable time before any work involving such adjustment and changes is begun. The Engineer shall be the sole judge of what constitutes a minor change for which no additional compensation shall be allowed.

**ARTICLE 7.02 EXTRA WORK**

The City may at any time by a written order and without notice to the sureties require the performance of such extra work as it may find necessary or desirable. An order for extra work shall be valid only if issued in writing and signed by the Mayor and the work so ordered must be performed by the Contractor.

The amount of compensation to be paid to the Contractor for any extra work as so ordered shall be determined as follows:

(a)By such applicable unit prices, if any, as are set forth in the Proposal; or

(b)If no such unit prices are set forth then by a lump sum or other unit prices mutually agreed upon by the City and the Contractor; or

(c)If no such unit prices are set forth in the Proposal and if the parties cannot agree upon a lump sum or other unit prices then by the actual net cost in money to the Contractor of the extra work performed, which cost shall be determined as follows:

(1) For all labor and foreman in direct charge of the authorized operations, the Contractor shall receive the current local rate of wages to be agreed upon, in writing, before starting such work for each hour that said labor and foremen are actually engaged thereon, to which shall be added an amount equal to 25 percent of the sum thereof which shall be considered and accepted as full compensation for general supervision, FICA taxes, contributions under the Florida Unemployment Compensation Act, insurance, bond, subcontractor's profit and overhead, the furnishing of small tools and miscellaneous equipment used, such as picks, shovels, hand pumps, and similar items.

(2) For all materials used, the Contractor shall receive the actual cost of such materials delivered at the site or previously approved delivery point as established by original receipted bills. No percentage shall be added to this cost.

(3) For special equipment and machinery such as power-driven pumps, concrete mixers, trucks, and tractors, or other equipment, required for the economical performance of the authorized work, the Contractor shall receive payment based on the average local area rental price for each item of equipment and the actual time of its use on the work. No percentage shall be added to this sum.

(4) Records of extra work done under this procedure shall be reviewed at the end of each day by the Contractor or his representative and the Engineer. Duplicate copies of accepted records shall be made and signed by both Contractor or his representative and the Engineer, and one copy retained by each.

Request for payment for approved and duly authorized extra work shall be submitted in the same form as Contract work or in the case of work performed under paragraph (c) (1) above upon a certified statement supported by receipted bills. Such statement shall be submitted for the current Contract payment for the month in which the work was done.

**ARTICLE 7.03 DISPUTED WORK**

If the Contractor is of the opinion that any work required, necessitated, or ordered violates the terms and provisions of this Contract, he must promptly notify the Engineer, in writing, of his contentions with respect thereto and request a final determination thereof. If the Engineer determines that the work in question is Contract work and not extra work or that the order complained of is proper, he will direct the Contractor to proceed and the Contractor shall promptly comply. In order, however, to reserve his right to claim compensation for such work or damages resulting from such compliance, the Contractor must, within five (5) days after receiving notice of the Engineer's determination and direction, notify the City in writing that the work is being performed or that the determination and direction is being complied with under protest. Failure of the Contractor to notify shall be deemed as a waiver of claim for extra compensation or damages therefor.

Before final acceptance by the City, all matters of dispute must be adjusted to the mutual satisfaction of the parties thereto. Final determinations and decisions, in case any questions shall arise, shall constitute a condition precedent to the right of the Contractor to receive the money therefor until the matter in question has been adjusted.

**ARTICLE 7.04 OMITTED WORK**

The City may at any time by a written order and without notice to the sureties require the omission of such Contract work as it may find necessary or desirable.

An order for omission of work shall be valid only if signed by the Mayor and the work so ordered must be omitted by the Contractor. The amount by which the Contract price shall be reduced shall be determined as follows:

(a) By such applicable unit prices, if any, as are set forth in the Contract; or

(b) By the appropriate lump sum price set forth in the Contract; or

(c) By the fair and reasonable estimated cost to the City

of such omitted work as determined by the Engineer and approved by the City.

## SECTION 8
## CONTRACTOR'S EMPLOYEES

**ARTICLE 8.01 CHARACTER AND COMPETENCY**
The Contractor and his subcontractors shall employ upon all parts of the work herein contracted for only competent, skillful, and trustworthy workers. Should the Engineer at any time give notice, in writing, to the Contractor or his duly authorized representative on the work that any employee in his opinion is incompetent, unfaithful, disorderly, careless, unobservant of instructions, or in any way a detriment to the satisfactory progress of the work, such employee shall immediately be dismissed and not again allowed upon the site.

**ARTICLE 8.02 SUPERINTENDENCE**
The Contractor shall give his personal supervision to the faithful prosecution of the work and in case of his absence shall have a competent, experienced, and reliable supervisor or superintendent, acceptable to the Engineer on the site who shall follow without delay all instructions of the Engineer in the prosecution and completion of the work and every part thereof, in full authority to supply workers, material, and equipment immediately. He shall keep on hand at all times copies of the Contract Documents.

**ARTICLE 8.03 EMPLOYMENT OPPORTUNITIES**
The Contractor shall, in the performance of the work required to be done under this Contract, employ all workers without discrimination regarding race, creed, color, sex or national origin and must not maintain or provide facilities that are segregated on the basis of race, color, creed or national origin.

**ARTICLE 8.04 RATES OF WAGES**
On federally assisted projects, the rates of wages to be paid under this Contract shall not be less than the rates of wages set forth in Section 12 of this Agreement.

On other projects, no wage rate determination is included. Florida's Prevailing Wage Law (Section 215.19, Florida Statutes) was repealed effective April 25, 1979.

**ARTICLE 8.05 PAYROLL REPORTS**
The Contractor and each subcontractor shall, if requested to do so, furnish to the Engineer a duly certified copy of his payroll and also any other information required by the Engineer to satisfy him that the provisions of the law as to the hours of employment and rate of wages are being observed.

Payrolls shall be prepared in accordance with instructions furnished by the City and on approved forms. The Contractor shall not carry on his payroll any persons not employed by him. Subcontractor's employees shall be carried only on the payrolls of the employing subcontractor.

## SECTION 9
## CONTRACTOR'S DEFAULT

**ARTICLE 9.01 CITY'S RIGHT AND NOTICE**
It is mutually agreed that: (a) if the Contractor fails to begin work when required to do so, or (b) if at any time during the progress of the work it shall appear to the Engineer that the Contractor is not prosecuting the work with reasonable speed, or is delaying the work unreasonably and unnecessarily, or (c) if the force of workmen or quality or quantity of material furnished are not sufficient to insure completion of the work within the specified time and in accordance with the Specifications hereto attached, or (d) if the Contractor shall fail to make prompt payments for materials or labor or to subcontractors for work performed under the Contract, or (e) if legal proceedings have been instituted by others than the City in such manner as to interfere with the progress of the work and may subject the City to peril of litigation or outside claims of (f) if the Contractor shall be adjudged a bankrupt or make an assignment for the benefit of creditors, or (g) if in any proceeding instituted by or against the Contractor an order shall be made or entered granting an extension of time of payment, composition, adjustment, modification, settlement or satisfaction of his debts or liabilities, or (h) if a receiver or trustee shall be appointed for the Contractor or the Contractor's property, or (i) if the Contract or any part thereof shall be sublet without the consent of the City being first obtained in writing, or (j) if this Contract or any right, monies, or claim thereunder shall be assigned by the Contractor, otherwise than as herein specified, or (k) if the Contractor shall fail in any manner of substance to observe the provisions of this Contract, or (l) if any of the work, machinery, or equipment shall be defective, and shall not be replaced as herein provided, or (m) if the work to be done under this Contract shall be abandoned, then such fact or conditions shall be certified by the Engineer and thereupon the City without prejudice to any other rights or remedies of the City, shall have the right to declare the Contractor in default and so notify the Contractor by a written notice, setting forth the ground or grounds upon which such default is declared and the Contractor must discontinue the work, either as a portion of the work or the whole thereof, as directed.

**ARTICLE 9.02 CONTRACTOR'S DUTY UPON DEFAULT**
Upon receipt of notice that his Contract is in default, the Contractor shall immediately discontinue all further operations on the work or such part thereof, and shall immediately quit the site or such part thereof, leaving untouched all plant, materials, equipment, tools, and supplies.

**ARTICLE 9.03 COMPLETION OF DEFAULTED WORK**
The City, after declaring the Contractor in default, may then have the work completed or the defective equipment or machinery replaced or anything else done to complete the work in strict accordance with the Contract Documents by such means and in such manner, by Contract with or without public letting, or otherwise, as it may deem advisable,

utilizing for such purpose without additional cost to the City such of the Contractor's plant, materials, equipment, tools, and supplies remaining on the site, and also such subcontractors as it may deem advisable.

The City shall reimburse all parties, including itself, for the expense of such completion, including liquidated damages, if any, and the cost of reletting. The City shall deduct this expense from monies due or to become due to the Contractor under this Contract, or any part thereof, and in case such expense is more than the sum remaining unpaid of the original contract price, the Contractor and his sureties shall pay the amount of such deficiency to the City.

**ARTICLE 9.04 PARTIAL DEFAULT**
In case the City shall declare the Contractor in default as to a part of the work only, the Contractor shall discontinue such part, shall continue performing the remainder of the work in strict conformity with the terms of the Contract, and shall in no way hinder or interfere with any other contractor or person whom the City may engage to complete the work as to which the Contractor was declared in default.

## SECTION 10
## PAYMENTS

**ARTICLE 10.01 PRICES**
For the Contractor's complete performance of the work, the City will pay and the Contractor agrees to accept, subject to the terms and conditions hereof, the lump sum prices or unit prices in the Contractor's Proposal and the award made therein, plus the amount required to be paid for any extra work ordered under Article 7.02 hereof, less credit for any work omitted pursuant to Article 7.04 hereof. Under unit price items, the number of units actually required to complete the work under the Contract may be more than stated in the Proposal. The Contractor agrees that no claim will be made for any damages or for loss of profits because of a difference between the quantities of the various classes of work assumed and stated in the Proposal Form as a basis for comparing Proposals and the quantities of work actually performed.

The sum as awarded for any lump sum Contract or lump sum Contract Item shall represent payment in full for all of the various classes of work, including materials, equipment, and labor necessary or required to complete, in conformity with the Contract Document, the entire work shown, indicated or specified under the lump sum Contract or lump sum Contract Item.

The amount as awarded as a unit price for any unit price Contact Item shall represent payment in full for all the materials, equipment, and labor necessary to complete, in conformity with the Contract Documents, each unit of work shown, specified, or required under the said unit price Contract Item.

No payment other than the amount as awarded will be made for any class of work included in a lump sum Contract Item or a unit price Contract Item, unless specific provision is made therefor in the Contract Documents.

**ARTICLE 10.02 SUBMISSION OF BID BREAKDOWN**
Within fifteen (15) days after the execution of this Contract, the Contractor must submit to the Engineer in duplicate an acceptable breakdown of the lump sums and unit prices bid for items of the Contract, showing the various operations to be performed under the Contract, as described in the progress schedule required under Article 4.02 hereof, and the value of each of such operations, the total of such items to equal the total price bid. The Contractor shall also submit such other information relating to the bid prices as may be required and shall revise the bid breakdown as directed. Thereafter, the breakdown may be used for checking the Contractor's applications for partial payments hereunder but shall not be binding upon the City or the Engineer for any purpose whatsoever.

**ARTICLE 10.03 REPORTS, RECORDS AND DATA**
The Contractor shall furnish to the Engineer such schedules of quantities and costs, progress schedules, reports, invoices, delivery tickets, estimates, records, and other data as the Engineer may request concerning work performed or to be performed and the materials furnished under the Contract.

**ARTICLE 10.04 PAYMENTS BY CONTRACTOR**
The Contractor shall pay (a) for all transportation and utility services not later than the 20th day of the calendar month following that in which such services are rendered, (b) for all materials, tools, and equipment delivered at the site of the project, and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used, and (c) to each of his subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors, to the extent of each subcontractor's interest therein; and proof of such payments or releases therefor shall be submitted to the Engineer upon request.

**ARTICLE 10.05 PARTIAL PAYMENTS**
On or about the first of each month, the Contractor shall make and certify an estimate, on forms prescribed by the City, of the amount and fair value of the work done, and may apply for partial payment therefor. The Contractor shall revise the estimate as the Engineer may direct. When satisfactory progress has been made, and shows that the value of the work completed since the last payment exceeds one percent (1%) of the total Contract price in amount, the Engineer will issue a certificate that such work has been completed and the value thereof. The City will then issue a voucher to the Contractor in accordance with the following schedule:

**FOR CONTRACT AMOUNTS UNDER $250,000**
(A)In the amount of ninety percent (90%) of the value of the work completed as certified until construction is one hundred percent (100%) complete (operational or beneficial occupancy), the withheld amount may be reduced below ten percent (10%), at the Engineer's option, to only that amount necessary to assure completion.

**FOR CONTRACT AMOUNTS OVER $250,000**

(A)In the amount of ninety percent (90%) of the value of the work completed as certified until construction is fifty percent (50%) complete.

(B)When the dollar value, as determined by the Engineer, of satisfactorily completed work in place is greater than fifty percent (50%) of the original contract price, vouchers for partial payment will be issued by the City to the Contractor in the amount of one hundred percent (100%) of the value of the work, above 50%, completed as certified for that payment period.

(C)If the Contractor has performed satisfactorily and the work is substantially complete (operational or beneficial occupancy) the withheld amount may be reduced, at the Engineer's option, to only that amount necessary to assure completion.

In addition to the Conditions set forth in (A), (B), and (C) above, payments will always be less any sums that may be retained or deducted by the City under the terms of any of the contract documents and less any sums that may be retained to cover monetary guarantees for equipment, materials or progress performance.

Payment on estimates made on or about the first of the month may be expected on or about the 20th of the month.

Unless specified otherwise in the Contract Items, the delivered cost of equipment and nonperishable materials suitably stored at the site of the work and tested for adequacy may be included in the Contractor's application for partial payment provided, however, that the Contractor shall furnish evidence satisfactory to the City that the Contractor is the unconditional owner and in possession of such materials or equipment. The amount to be paid will be 90 percent of the invoice cost to the Contractor which cost shall be supported by receipted bills within 30 days of the date of payment by the City to the Contractor. Such payment shall not relieve the Contractor from full responsibility for completion of the work and for protection of such materials and equipment until incorporated in the work in a permanent manner as required by the Contract Documents.

Before any payment will be made under this Contract, the Contractor and every subcontractor, if required, shall deliver to the Engineer a written, verified statement, in satisfactory form, showing in detail all amounts then due and unpaid by such Contractor or subcontractor to all laborers, workmen, and mechanics, employed by him under the Contract for the performance of the work at the site thereof, for daily or weekly wages, or to other persons for materials, equipment, or supplies delivered at the site of the work during the period covered by the payment under consideration.

**ARTICLE 10.06 FINAL PAYMENT**

Under determination of satisfactory completion of the work under this Contract as provided in Article 4.07 hereof, the Engineer will prepare the final estimate showing the value of the completed work. This estimate will be prepared within 30 days after the date of completion or as soon thereafter as the necessary measurements and computations can be made. All prior certificates and estimates, being approximate only, are subject to correction in the final estimate and payment.

When the final estimate has been prepared and certified by Engineer, he will submit to the Mayor and City Council the final certificate stating that the work has been completed and the amount based on the final estimate remaining due to the Contractor. The City will then accept the work as fully completed and will, not later than 30 days after the final acceptance, as defined in Article 1.02, of the work done under this Contract, pay the Contractor the entire amount so found due thereunder after deduction of all previous payments and all percentages and amounts to be kept and retained under provisions of this Contract; provided, however, and it is understood and agreed that, as a precedent to receiving final payment, the Contractor shall submit to the City a sworn affidavit that all bills for labor, service, materials, and subcontractors have been paid and that there are no suits pending in connection with this work. The City, at its option, may permit the Contractor to execute a separate surety bond in a form satisfactory to the City. The surety bond shall be in the full amount of the suit or suits.

Neither the final payment nor any part of the retained percentage shall be paid until the Contractor, if required, shall furnish the City with a complete release from any should remain unsatisfied after all payments are made, the Contractor shall refund to the City all monies which the City may be compelled to pay in discharging such claim, including incidental costs and attorney's fees.

**ARTICLE 10.07 ACCEPTANCE OF FINAL PAYMENT**

The acceptance by the Contractor, or by anyone claiming by or through him, of the final payment shall operate as and shall be a release to the City and every officer and agent thereof from any and all claims and liability to the Contractor for anything done or furnished in connection with the work or project and for any act or neglect of the Contractor or of any others relating to or affecting the work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this Contract or the Performance Bond.

## SECTION 11
## MISCELLANEOUS PROVISIONS

**ARTICLE 11.01 CONTRACTOR'S WARRANTIES**

In consideration of, and to induce the award of this contract to him, the Contractor represents and warrants:

(a)That he is not in arrears to the City upon debt or contract, and he is not a defaulter, as surety, contractor, or otherwise.

(b)That he is financially solvent and sufficiently experienced and competent to perform the work.

(c)That the work can be performed as called for by the Contract Documents.

(d)That the facts stated in his proposal and the information given by him are true and correct in all respects.

(e)That he is fully informed regarding all the conditions affecting the work to be done and labor and materials to be

furnished for the completion of this Contract, and that his information was secured by personal investigation and research.

**ARTICLE 11.02 PATENTED DEVICES, MATERIAL AND PROCESSES**

It is mutually understood and agreed that Contract prices include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the work. Whenever the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall indemnify and save harmless the City, its officers, agents and employees from any and all claims for infringement by reason of the use of any such patented design, device, tool, material, equipment, or process, to be performed under the Contract, and shall indemnify the said City, its officers, agents, and employees for any costs, expenses, and damages which may be incurred by reason of such infringement at any time during the prosecution or after completion of the work.

**ARTICLE 11.03 SUITS AT LAW**

In case any action at law or suit in equity may or shall be brought against the City or any of its officers, agents, or employees for or on account of the failure, omission, or neglect of the Contractor or his subcontractors, employees, or agents, to do or perform any of the covenants, acts, matters, or things by this Contract undertaken to be done or performed by the Contractor of his subcontractors, employees, or agents, or from any injuries done to property or persons and caused by the negligence or alleged negligence of the Contractor of his subcontractors, employees, or agents, or in any other manner arising out of the performance of this Contract, then the Contractor shall immediately assume and take charge of the defense of such actions or suits in like manner and to all intents and purposes as if said actions or suits have been brought directly against the Contractor, and the Contractor shall also indemnity and save harmless the City, its officers, agents, and employees from any and all loss, cost or damage whatever arising out of such actions or suits, in like manner and to all intents and purposes as if said actions or suits have been brought directly against the Contractor.

The Contractor shall and does hereby assume all liability for and agrees to indemnify the City or its Engineer against any or all loss, costs, damages, and liability for any or by reason of any lien, claims or demands, either for materials purchased or for work performed by laborers, mechanics, and others and from any damages, costs, actions, or causes of action and judgement arising from injuries sustained by mechanics, laborers, or other persons by reason of accidents or otherwise, whether caused by the carelessness or inefficiency or neglect of said Contractor, his subcontractors, agents, employees, workmen or otherwise.

**ARTICLE 11.04 CLAIMS FOR DAMAGES**

If the Contractor shall claim compensation for any damage sustained, other than for extra or disputed work covered by Article 7.02 and 7.03 hereof, by reason of any act or omission of the City, its agents, or any persons, he shall, within five days after sustaining such damage, make and deliver to the Engineer a written statement of the nature of the damage sustained and of the basis of the claim against the City. On or before the 15th of the month succeeding that in which any damage shall have been sustained, the Contractor shall make and deliver to the Engineer an itemized statement of the details and amounts of such damage, duly verified by the Contractor. Unless such statements shall be made delivered within the times aforesaid, it is stipulated that and all claims for such compensation shall be forfeited and invalidated, and the Contractor shall not be entitled to payment on account of such claims.

**ARTICLE 11.05 NO CLAIMS AGAINST INDIVIDUALS**

No claim whatsoever shall be made by the Contractor against any officer, agent, employee of the City for, or on account of, anything done or omitted to be done in connection with this Contract.

**ARTICLE 11.06 LIABILITY UNAFFECTED**

Nothing herein contained shall in any manner create any liability against the City on behalf of any claim for labor, services, or materials, or of subcontractors, and nothing herein contained shall affect the liability of the Contractor or his sureties to the City or to any workmen or materialsmen upon bond given in connection with this Contract.

**ARTICLE 11.07 INDEMNIFICATION PROVISIONS**

Whenever there appears in this Agreement, or in the other Contact Documents made a part hereof, an indemnification provision within the purview of Chapter 725.06, Laws of Florida, the monetary limitation on the extent of the indemnification under each such provision shall be One Million Dollars or a sum equal to the total Contract price, whichever shall be the greater.

**ARTICLE 11.08 UNLAWFUL PROVISIONS DEEMED STRICKEN**

If this contract contains any unlawful provisions not an essential part of the Contract and which shall not appear to have a controlling or material inducement to the making thereof, such provisions shall be deemed of no effect and shall, upon notice by either party, be deemed stricken from the Contract without affecting the binding force of the remainder.

**ARTICLE 11.09 LEGAL PROVISIONS DEEMED INCLUDED**

Each and every provision of any law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein, and the Contract shall be read and enforced as though it were included herein and if, through mistake or otherwise, any such provision is not inserted or is not correctly inserted, then upon application of either party the Contract shall forthwith be physically amended to make such insertion.

**ARTICLE 11.10 DEATH OR INCOMPETENCY OF CONTRACTOR**

In the event of death or legal incompetency of a Contractor who shall be an individual or surviving member of a contracting firm, such death or adjudication of incompetency

shall not terminate the Contract, but shall act as default hereunder to the effect provided in Article 9.01 hereof and the estate of the Contractor and his surety shall remain liable hereunder to the same extent as though the Contractor had lived. Notice of default, as provided in Article 9.01 hereof, shall not be required to be given in the event of such death or adjudication of incompetency.

**ARTICLE 11.11 NUMBER AND GENDER OF WORDS**

Whenever the context so admits or requires, all references herein in one number shall be deemed extended to and including the other number, whether singular or plural, and the use of any gender shall be applicable to all genders.

**ARTICLE 11.12 ACCESS TO RECORDS**

Representatives of Federal Agencies, if applicable, and the State of Florida shall have access to the work whenever it is in preparation of progress. On federally assisted projects the Federal Agency, the Comptroller General of the United States, or any authorized representative shall have access to any books, documents, papers, and records of the Contractor which are pertinent to the project for the purpose of making audit, examination, excerpts, and transcription thereof.

## SECTION 12
## LABOR STANDARDS

**ARTICLE 12.01 LABOR STANDARDS**

The Contractor shall comply with all of the regulations set forth in "Labor Standards Provisions for Federally Assisted Construction Contracts", which may be attached, and any applicable Florida Statutes.

**ARTICLE 12.02 NOTICE TO LABOR UNIONS**

If required, the Contractor shall provide Labor Unions and other organizations of workers, and shall post, in a conspicuous place available to employees or applicants for employment, a completed copy of the form entitled "Notice to Labor Unions or Other Organizations of Workers" attached to and made a part of this Agreement.

**ARTICLE 12.03 SAFETY AND HEALTH REGULATIONS**

The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91- 596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54). Nothing in these Acts shall be construed to supersede or in any manner affect any worker's compensation law or statutory rights, duties, or liabilities of employers and employees under any law with respect to injuries, diseases, or death of employees arising out of, or in the course of, employment.

**ARTICLE 12.04 EEO AFFIRMATIVE ACTION REQUIREMENTS**

The Contractor understands and agrees to be bound by the equal opportunity requirements of Federal regulations which shall be applicable throughout the performance of work under this Contract. The Contractor also agrees to similarly bind contractually each subcontractor. In policies, the Contractor agrees to engage in Affirmative Action directed at promoting and ensuring equal employment opportunity in the work force used under the Contract (and the Contractor agrees to require contractually the same effort of all subcontractors whose subcontractors exceed $100,000). The Contractor understands and agrees that "Affirmative Action" as used herein shall constitute a good faith effort to achieve and maintain minority employment in each trade in the on-site work force used on the Contract.

**ARTICLE 12.05 PREVAILING RATES OF WAGES**

Florida's prevailing wage law was repealed effective April 25, 1979.

For Federally assisted projects, appropriate prevailing wage rate determinations are indicated on pages beginning with WR-1.

* * * * * * *

IN WITNESS THEREOF, the parties have hereunto set their hands and seals, and such of them as are corporation have caused these present to be signed by their duly authorized officers.

CITY OF TAMPA, FLORIDA

_____
Bob Buckhorn, Mayor
(SEAL)

ATTEST:

_____
City Clerk

Approved as to Form:

The execution of this document was authorized by Resolution No. _____

_____
Justin R. Vaske, Assistant City Attorney

Contractor

By:_____
(SEAL)

Title:

ATTEST:

_____
Secretary

STATE OF )
) SS:
COUNTY OF )

For a Corporation:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ of _____, a _____ corporation, on behalf of the corporation. He/she is ___ personally known or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

For an Individual:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ who is ___ personally known to me or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

For a Firm:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ of _____, 2014 by _____ who signed on behalf of the said firm. He/she is ___ personally known or has ___ produced _____ as identification.

_____
Notary

My Commission Expires:

_____

_____

PUBLIC CONSTRUCTION BOND

Bond No. (enter bond number)_____

Name of Contractor:_____

Principal Business Address of Contractor:_____

_____

Telephone Number of Contractor:_____

Name of Surety (if more than one list each):_____

_____

Principal Business Address of Surety:_____

_____

Telephone Number of Surety:_____

Owner is The City of Tampa, Florida

Principal Business Address of Owner: 306 E Jackson St, Tampa, FL 33602

Contract Administration Department (280A4N)

Telephone Number of Owner: 813/274-8456

Contract Number Assigned by City to contract which is the subject of this bond:_____

Legal Description or Address of Property Improved or Contract Number is:_____

_____

_____

_____

General Description of Work and Services:_____

_____

_____

_____

KNOW ALL MEN BY THESE PRESENTS That we, _____

_____
(Name of Contractor)

as Principal, hereinafter called CONTRACTOR, of the State of _____, and

_____(Name of Surety)
a corporation organized and existing under and by virtue of the laws of the State of _____, and regularly authorized to do business in the State of Florida, as SURETY, are held and firmly bound unto the City of Tampa, a municipal corporation organized and existing under the laws of the State of Florida, hereinafter called Owner, in the penal sum of _____Dollars and _____Cents ($_____), lawful money of the United States of America, for the payment whereof well and truly to be made, we bind ourselves, our heirs, executors, and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND is that if Principal:

1. Performs the contract dated _____, _____, 20___, between Principal and Owner for construction of _____, the contract being made a part of this bond by reference, in the time and in the manner prescribed in the contract; and

2. Promptly makes payments to all claimants, as defined in Section 255.05(1) (Section 713.01), Florida Statutes, supplying Principal with labor, materials, or supplies, used directly or indirectly by Principal in the prosecution of the work provided for in the contract; and

3. Pays Owner all losses, damages, expenses, costs, and attorney's fees, including appellate proceedings, that Owner sustains because of a default by Principal under the contract; and

4. Performs the guarantee of all work and materials furnished under the contract for the time specified in the contract, then this bond is void; otherwise it remains in full force.

5. Contractor and Surety acknowledge that the Work for which this bond has been issued may be one of several such contract documents for a group of projects. This bond does not secure covenants to pay for or to perform design services survey or program management services. The Owner/Obligee is expected to reasonably account for damages that are caused to Owner with respect to Principal's (Contractor's) default in performance of the scope of the Work incorporated by reference into the bond, and notwithstanding any contractual or common law remedy permitted to Owner as against Contractor, the obligation of Surety for any damages under this bond shall be determined by the cost of completion of the Work less the contract balance unpaid upon default of Contractor for the Work plus liquidated damages at the rate of $500.00 per day for delays by the Contractor and/or Surety in reaching substantial completion.

6. The notice requirements for claimants and conditions for entitlement to payment set forth in Section 255.05, Fla. Stat. and the limitations period to actions upon Section 255.05, Fla. Stat. bonds apply to claimants seeking payment from surety under this bond. Any action instituted by a claimant under this bond for payment must be in accordance with the notice and time limitation provisions in Section 255.05, Florida Statutes.

7. The Surety, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the contract documents or other Work to be performed hereunder, or the specifications referred to therein shall in any way affect its obligations under this bond, and it does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to Work or to the specifications.

8. The above SURETY states that it has read all of the Contract Documents made by the CONTRACTOR with the CITY, hereto attached, and the terms and conditions of the contract and work, and is familiar therewith and in particular those portions of the Agreement concerning the guaranty of such CONTRACTOR for a period of one year following the date of the final acceptance of the completed work under the Contract by the CITY, all of which this BOND includes.

DATED ON _____, 20___

_____
(Name of Principal)

_____
(Principal Business Address)

By _____

Title _____

_____
Telephone Number of Principal

Countersignature:

_____
(Name of Local Agency)

_____
(Address of Resident Agent)

By _____

Title _____

_____
Telephone Number of Local Agency

_____
(Name of Surety)

_____
(Surety Address)

By _____
(As Attorney in Fact)*

_____
Telephone Number of Surety

Accepted by City of Tampa:

By _____
Bob Buckhorn, Mayor

Date: _____ 20____

Approved as to legal sufficiency:

By _____
Assistant City Attorney

Date: _____, 20____

*(As Attorney in Fact) attach Power of Attorney and Current Certificate with Original Signature

# SPECIFICATIONS
# GENERAL PROVISIONS

## SECTION 1
## SCOPE AND INTENT

### G-1.01 DESCRIPTION
The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

### G-1.02 WORK INCLUDED
The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Provisions, for which there are no specific Contract Items, shall be considered as part of the overhead cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefor.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his plant and equipment, prior approval of the Engineer notwithstanding.

### G-1.03 PUBLIC UTILITY INSTALLATIONS AND STRUCTURES
Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the City, other governmental bodies or privately owned by individuals, firms, or corporations, and used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water or other public or private property which may be affected by the work.

The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

The Contractor shall protect all public utility installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor which are shown on the Plans or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as directed by the Engineer. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the City or other governmental body which are shown on the Plans to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefor.

Where public utility installations or structures owned or controlled by the City or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction or such work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided for in Article 7.02 of the Agreement.

The Contractor shall, at all times in performance of the work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of public utility installations and structures; and shall, at all times in the performance of the work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.

All City and other governmental utility departments and other owners of public utilities, which may be affected by the work, will be informed in writing by the Engineer within two weeks after the execution of the Contract or Contracts covering the work. Such notice will set out, in general, and direct attention to, the responsibilities of the City and other governmental

utility departments and other owners of public utilities for such installations and structures as may be affected by the work and will be accompanied by one set of Plans and Specifications covering the work under such Contract or Contracts.

In addition to the general notice given by the Engineer, the Contractor shall give written notice to all City and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight (48) hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Underground Utility Notification Center for Excavators (Call Candy)".

The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the Engineer.

## SECTION 2
## PLANS AND SPECIFICATIONS

**G-2.01 PLANS**
The Plans referred to in the Contract Documents bear the general project name and number as shown in the Notice To Bidders.

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.

**G-2.02 COPIES FURNISHED TO CONTRACTOR**
After the Contract has been executed, the Contractor will be furnished with five sets of paper prints, the same size as the original drawings, of each sheet of the Plans and five copies of the Specifications. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

The Contractor shall furnish each of the subcontractors, manufacturers, and material suppliers such copies of the Contract Documents as may be required for his work.

**G-2.03 SUPPLEMENTARY DRAWINGS**
When, in the opinion of the 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 by the Engineer and five paper prints thereof will be given to the Contractor.

The Supplementary Drawings shall be binding upon the Contractor with the same force as the Plans. Where such Supplementary Drawings require either less or more than the estimated quantities of work, credit to the City or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

**G-2.04 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 Engineer, 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 Engineer 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-2.05 SPECIFICATIONS**
The specifications consist of four parts, the General Provisions, the Technical Specifications, the Special Provisions and the Contract Items. The General Provisions and Technical Specifications contain general requirements which govern the work. The Special Provisions and the Contract Items modify and supplement these by detailed requirements for the work and shall always govern, whenever there appears to be conflict.

**G-2.06 INTENT**
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.

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.

## SECTION 3
## WORKING DRAWINGS

**G-3.01 SCOPE**
The Contractor shall promptly prepare and submit layout, detail and shop drawings to insure proper construction, assembly, and installation of the work using those materials and methods as hereafter specified under the Technical Specifications, Special Provisions and Contract Items.

These drawings shall accurately and distinctly present the following:

a. All working and erection dimensions.
b. Arrangements and sectional views.
c. Necessary details, including complete information for making connections between work under this Contract and work under other Contracts.
d. Kinds of materials and finishes.
e. Parts listed and description thereof.

Drawings for mechanical equipment shall present, where applicable, such data as dimensions, weight and performance characteristics. These data shall show conformance with the performance characteristics and other criteria incorporated in the Plans and Specifications.

Each drawing shall be dated and shall contain the name of the project, Division number and description, the technical specifications section number, names of equipment or materials and the location at which the equipment or materials are to be installed. Location shall mean both physical location and location relative to other connected or attached material. The Engineer will return unchecked any submittal which does not contain complete data on the work and full information on related matters.

Stock or standard drawings will not be accepted for review unless full identification and supplementary information is shown thereon in ink or typewritten form.

The Contractor shall review all working drawing submittals before transmitting them to the Engineer to determine that they comply with requirements of the Specifications. Drawings which are incomplete or are not in compliance with the Contract Documents shall not be submitted for processing by the Engineer. The Contractor shall place his stamp of approval on all working drawings submitted to the Engineer to indicate compliance with the above.

**G-3.02 APPROVAL**
If the working drawings show departures from the Contract requirements, the Contractor shall make specific mention thereof in his letter of submittal; otherwise approval of such submittals shall not constitute approval of the departure. Approval of the drawings shall constitute approval of the subject matter thereof only and not of any structure, material, equipment, or apparatus shown or indicated.

The approval of drawings will be general and shall not relieve the Contractor of responsibility for the accuracy of such drawings, nor for the proper fitting and construction of the work, nor for the furnishing of materials or work required by the Contract and not indicated on the drawings. No work called for by working drawings shall be done until such drawings have been approved by the Engineer.

The procedure in seeking approval of the working drawings shall be as follows:

1.The Contractor shall submit four complete sets of drawings and other descriptive data together with one copy of a letter of transmittal to the Engineer for approval. The letter of transmittal shall contain the name of the project, contract number, technical specifications section number, the name of the Contractor, a list of drawings with numbers and titles, and any other pertinent information.

2.Drawings or descriptive data will be stamped "Approved", "Approved Subject to Corrections Marked", or "Examined and Returned for Correction" and one copy with a letter of transmittal will be returned to the Contractor.

3.If a drawing or other data is stamped "Approved", the Contractor shall insert the date of approval on five additional copies of the document and transmit the five copies to the Engineer together with one copy of a letter of transmittal containing substantially the same information as described in Instruction 1. above.

4.If a drawing or other data is stamped "Approved Subject to Corrections Marked", the Contractor shall make the corrections indicated and proceed as in Instruction 3., above.

5.If a drawing or data is stamped "Examined and Returned for Correction", the Contractor shall make the necessary corrections and resubmit the documents as set forth in Instruction 1., above. The letter of transmittal shall indicate that this is a resubmittal.

The Contractor shall revise and resubmit the working drawings as required by the Engineer, until approval thereof is obtained.

## SECTION 4
## MATERIALS AND EQUIPMENT

**G-4.01 GENERAL REQUIREMENTS**
All materials, appliances, and types or methods of construction shall be in accordance with the Specifications and shall, in no event, be less than that necessary to conform to the requirements of any applicable laws, ordinances, and codes.

All materials and equipment shall be new, unused, and correctly designed. They shall be of standard first grade quality, produced by expert personnel, and intended for the use for which they are offered. Materials or equipment which, in the opinion of the Engineer, are inferior or of a lower grade than indicated, specified, or required will not be accepted.

The quality of Workmanship and Materials entering into the work under this Contract shall conform to the requirements of the pertinent sections, clauses, paragraphs, and sentences, both directly and indirectly applicable thereto, of that part of the Technical Specifications, whether or not direct reference to such occurs in the Contract Items.

Equipment and appurtenances shall be designed in conformity with ANSI, ASME, IEEE, NEMA and other

generally accepted standards and shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation, and all conditions of operation. All bearings and moving parts shall be adequately protected against wear by bushings or other approved means and shall be fully lubricated by readily accessible devices. Details shall be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, and the like, shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be mitered.

Equipment shall be of the approximate dimensions as indicated on the Plans or as specified, shall fit the spaces shown on the Plans with adequate clearances, and shall be capable of being handled through openings provided in the structure for this purpose. The equipment shall be of such design that piping and electrical connections, ductwork, and auxiliary equipment can be assembled and installed without causing major revisions to the location or arrangement of any of the facilities.

Machinery parts shall conform exactly to the dimensions shown on the working drawings. There shall be no more fitting or adjusting in setting up a machine than is necessary in assembling high grade apparatus of standard design. The equivalent parts of identical machines shall be made interchangeable. All grease lubricating fittings on equipment shall be of a uniform type. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI and applicable state and local codes.

**G-4.02 MANUFACTURER**

The names of proposed manufacturers, suppliers, material, and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval, as early as possible, to afford proper investigation and checking. 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.

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.

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

**G-4.03 REFERENCE TO STANDARDS**

Whenever reference is made to the furnishing of materials or testing thereof to conform to the standards of any technical society, organization or body, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the date of advertisement for proposals, even though reference has been made to an earlier standard, and such standards are made a part hereof to the extent which is indicated or intended.

Reference to a technical society, organization or body may be made in the Specifications by abbreviations, in accordance with the following list:

AASHTO for American Association of State Highway and Transportation Officials (formerly AASHO)
ACI for American Concrete Institute
AGMA for American Gear Manufacturer's Association
AFBMA for Anti-Friction Bearing Manufacturer's Association
AISC for American Institute of Steel Construction
AISI for American Iron and Steel Institute
ANSI for American National Standards Institute
ASCE for American Society of Civil Engineers
ASTM for American Society for Testing and Materials
ASME for American Society of Mechanical Engineers
AWS for American Welding Society
AWWA for American Water Works Association
AWPA for American Wood Preservers Association
CEMA for Conveyor Equipment Manufacturers Association
CIPRA for Cast Iron Pipe Research Association
IEEE for Institute of Electrical and Electronic Engineers
IPCEA for Insulated Power Cable Engineers Association
NEC for National Electrical Code
NEMA for National Electrical Manufacturers Association
SAE for Society of Automotive Engineers
SHBI for Steel Heating Boiler Institute
Fed.Spec. for Federal Specifications
Navy Spec. for Navy Department Specifications
U.L.,Inc. for Underwriters' Laboratories, Inc.

When no reference is made to a code, standard or specification, the Standard Specifications of the ANSI, the ASME, the ASTM, the IEEE, or the NEMA shall govern.

**G-4.04 SAMPLES**

The Contractor shall, when required, submit to the Engineer for approval typical samples of materials and equipment. The samples shall be properly identified by tags and shall be submitted sufficiently in advance of the time when they are to be incorporated into the work, so that rejections thereof will not cause delay. A letter of transmittal, in duplicate, from the Contractor requesting approval must accompany all such samples.

**G-4.05 EQUIVALENT QUALITY**

Whenever, in the Contract Documents, an article, material, apparatus, equipment, or process is called for by trade name or by the name of a patentee, manufacturer, or dealer or by reference to catalogs of a manufacturer or dealer, it shall be understood as intending to mean and specify the article, material, apparatus, equipment or process designated, or any

equal thereto in quality, finish, design, efficiency, and durability and equally serviceable for the purposes for which it is intended.

Whenever material or equipment is submitted for approval as being equal to that specified, the decision as to whether or not such material or equipment is equal to that specified shall be made by the Engineer.

Upon rejection of any material or equipment submitted as the equivalent of that specifically named in the Contract, the Contractor shall immediately proceed to furnish the designated material or equipment.

Neither the approval by the Engineer of alternate material or equipment as being equivalent to that specified nor the furnishing of the material or equipment specified, shall in any way relieve the Contractor of responsibility for failure of the material or equipment, due to faulty design, material, or workmanship, to perform the functions required of them by the Specifications.

**G-4.06 DELIVERY**
The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete thw work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid a delay in, or impediment of, the progress of the work of any related Contractor.

**G-4.07 CARE AND PROTECTION**
The Contractor shall be solely responsible for properly storing and protecting all materials, equipment, and work furnished under the Contract from the time such materials and equipment are delivered at the site of the work until final acceptance thereof. He shall, at all times, take necessary precautions to prevent injury or damage by water, freezing, or by inclemencies of the weather to such materials, equipment and work. All injury or damage to materials, equipment, or work resulting from any cause whatsoever shall be made good by the Contractor.

The Engineer shall, in all cases, determine the portion of the site to be used by the Contractor for storage, plant or for other purposes. If, however, it becomes necessary to remove and restack materials to avoid impeding the progress of any part of the work or interference with the work to be done by any other Contractor, the Contractor shall remove and restack such materials at his own expense.

**G-4.08 TOOLS AND ACCESSORIES**
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.

Spare parts shall be furnished as specified.

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.

**G-4.09 INSTALLATION OF EQUIPMENT**
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.

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.

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.

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. Grout shall completely fill the space between the equipment base and the foundation.

**G-4.10 OPERATING INSTRUCTIONS**
The Contractor, through qualified individuals, shall adequately instruct designated employees of the City in the operation and care of all equipment installed hereunder, except for equipment that may be furnished by the City.

The Contractor shall also furnish and deliver to the Engineer three complete sets for permanent files, identified in accordance with Subsection G-3.01 hereof, of instructions, technical bulletins and any other printed matter, such as diagrams, prints or drawings, containing full information required for the proper operation, maintenance, and repair, of the equipment installed and the ordering of spare parts, except for equipment that may be furnished by the City.

In addition to the above three copies, the Contractor shall furnish any additional copies that may be required for use during construction and start-up operations.

**G-4.11 SERVICE OF MANUFACTURER'S ENGINEER**
The Contract prices for equipment shall include the cost of furnishing 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 City, such engineer or superintendent shall make all adjustments and tests required by the Engineer to provide that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the City in the proper operation and maintenance of such equipment.

## SECTION 5
## INSPECTION AND TESTING

**G-5.01 GENERAL**
The Contractor's attention is hereby directed to Article 3.03 of the Agreement.

Inspection and testing of materials will be performed by the City unless otherwise specified.

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Five copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material and equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the City.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the City formally takes over the operation thereof.

**G-5.02 COSTS**
All inspection and testing of materials furnished under this Contract will be performed by the City or duly authorized inspection engineers or inspection bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the City for compliance. The Contractor shall reimburse the City for the expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

**G-5.03 INSPECTIONS OF MATERIALS**
The Contractor shall give notice, in writing to the Engineer, sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice the Engineer will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

**G-5.04 CERTIFICATE OF MANUFACTURE**
When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

**G-5.05 SHOP TESTS OF OPERATING EQUIPMENT**
Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

Five copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval.

The cost of the shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

**G-5.06 PRELIMINARY FIELD TESTS**
As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments, and replacements required.

**G-5.07 FINAL FIELD TESTS**
Upon completion of the work and prior to final payment, all equipment and appliances installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment, and instruments necessary for all acceptance tests, at no additional cost to the City.

**G-5.08 FAILURE OF TESTS**
Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor by replacements or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make those corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees or specified requirements, the City, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the City rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the City may, after the expiration of a period of thirty calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under this Contract.

The City agrees to obtain other equipment within a reasonable time and the Contractor agrees that the City may use the equipment furnished by him without rental or other charges until the new equipment is obtained.

Materials or work in place that fails to pass acceptability tests shall be retested at the direction of the construction engineer all such retests shall be at the Contractor's expense. The rates charged shall be in accordance with the Department of Public Works current annual inspection contract which is available for inspection at the offices of the Department of Public Works.

**G-5.09 FINAL INSPECTION**
The procedures for final inspection shall be in accordance with the provisions of Article 4.07 of the Agreement. During such final inspections, the work shall be clean and free from water. In no case will the final estimate be prepared until the Contractor has complied with all the requirements set forth and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily cosntructed in accordance with the requirements of the Contract Documents.

## SECTION 6

## TEMPORARY STRUCTURES

**G-6.01 GENERAL**
All false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the work and which are not herein described or specified in detail, must be furnished, maintained and removed by the Contractor, and he shall be responsible for the safety and efficiency of such works and for any damages that may result from their failure or from their improper construction, maintenance, or operation.

**G-6.02 PUBLIC ACCESS**
At all points in the work where public access to any building, house, place of business, public road, or sidewalk would be obstructed by any action of the Contractor in executing the work required by this Contract, the Contractor shall provide such temporary structure, bridges or roadway as may be necessary to maintain public access at all times. At least one lane for vehicular traffic shall be maintained in streets in which the Contractor is working. Street closure permits are required from the Department of Public Works.

The Contractor shall provide suitable temporary bridges, as directed by the Engineer, at street intersections when necessary for the maintenance of vehicular and pedestrian traffic.

Prior to temporarily cutting of access to driveways and garages, the Contractor shall give twelve (12) hours notice to affected property owners. Interruptions to use of private driveways shall be kept to a minimum.

**G-6.03 CONTRACTOR'S FIELD OFFICE**
The Contractor shall erect, furnish and maintain a field office with a telephone at the site during the entire period of construction. He or an authorized agent shall be present at this office at all times while his work is in progress. Readily accessible copies of both the Contract Documents and the latest approved working drawings shall be kept at this field office.

**G-6.04 TEMPORARY FENCE**
If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

**G-6.05 RESPONSIBILITY FOR TEMPORARY STRUCTURES**
In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance, or operation and will indemnify and save harmless the City from

all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

## SECTION 7
## TEMPORARY SERVICES

**G-7.01 WATER**
The Contractor shall provide the necessary water supply at his own expense. He shall, if necessary, provide and lay necessary waterlines from existing mains to the place of using, shall secure all necessary permits and pay for all taps to water mains or hydrants and for all water used at the established rates.

**G-7.02 LIGHT AND POWER**
The Contractor shall provide, at his own expense, temporary lighting and power facilities required for the proper prosecution and inspection of the work. If, in the opinion of the Engineer, these facilities are inadequate, the Contractor will not be permitted to proceed with any portion of the work affected thereby.

**G-7.03 SANITARY REGULATIONS**
The Contractor shall prohibit and prevent the committing of nuisances on the site of the work or on adjoining property and shall discharge any employee who violates this rule.

Ample washrooms and toilet facilities and a drinking water supply shall be furnished and maintained in strict conformity with the law by the Contractor for use by his employees.

**G-7.04 ACCIDENT PREVENTION**
Precautions shall be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, building and construction codes shall be observed. The Contractor shall comply with the U. S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596), and under Section 107 of the Contract Work. Hours and Safety Standards Act (PL 91-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act.

**G-7.05 FIRST AID**
The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when men are employed on the work.

**G-7.06 HEATING**
The Contractor shall provide temporary heat, at his own expense, whenever required on account of work being carried on during cold weather and to prevent freezing of water pipes and other damage to the work.

## SECTION 8
## LINES AND GRADES

**G-8.01 GENERAL**
All work done under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

The Engineer will establish bench marks and base line controlling points. Reference remarks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the use of the reference marks provided. He shall remove any obstructions placed by him contrary to this provision.

**G-8.02 SURVEYS**
The Contractor shall furnish and maintain, at his own expense, stakes and other such materials, and give such assistance, including qualified helpers, as may be required by the Engineer for setting reference marks. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks set by the Engineer, and shall be solely responsible for the accuracy thereof. He shall, however, be subject to the check and review of the Engineer.

The Contractor shall keep the Engineer informed a reasonable time in advance as to his need for line and grade reference marks, in order that they may be furnished and all necessary measurements made for record and payment with the minimum of inconvenience to the Engineer or of delay to the Contractor.

It is the intention not to delay the work for the establishment of reference marks but, when necessary, working operations shall be suspended for such reasonable time as the Engineer may require for this purpose.

**G-8.03 SAFEGUARDING MARKS**
The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

**G-8.04 DATUM PLANE**
All elevations indicated or specified refer to the Mean Sea Level Datum of the U.S.C. & G.S. (N.O.S.) which is 0.80 feet above the Mean Low Water Datum of the U. S. Army

Corps of Engineers.

## SECTION 9
## ADJACENT STRUCTURES AND LANDSCAPING

**G-9.01 RESPONSIBILITY**
The responsibility for removal, replacement, relocation, repair, rebuilding or protection of all public utility installations, including poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes, sewers, traffic control and fire alarm signal circuit installations and other appurtenances and facilities shall be in accordance with G-1.02 and G-1.03.

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation, and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate payment will be made therefor. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the Engineer, removal or relocation and reconstruction is necessary to avoid interference with the work, payment therefor will be made as provided for extra work in Article 7.02 of the Agreement.

**G-9.02 PROTECTION OF TREES**
All trees and shrubs shall be adequately protected by the Contractor with boxes or otherwise and, within the City of Tampa, in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season, and at the sole expense of the Contractor.

Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.

The City may order the Contractor, for the convenience of the City, to remove trees along the line of trench excavation. If so ordered, the City will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

**G-9.03 LAWN AREAS**
Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed and later replaced, or the area where sod has been removed shall be restored with new sod in the manner described in the Technical Specifications section.

**G-9.04 RESTORATION OF FENCES**
Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the Engineer. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or Items, or if no specific Item is provided therefor, as part of the overhead cost of the work, and no additional payment will be made therefor.

## SECTION 10
## PROTECTION OF WORK AND PUBLIC

**G-10.01 TRAFFIC REGULATIONS**
The Contractor shall arrange his work to comply with Article G-6.02. The work shall be done with the least possible inconvenience to the public and to that end the work may be confined by the Engineer to one block at a time.

**G-10.02 BARRIERS AND LIGHTS**
During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers, and lights, as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public. Such barriers and signs shall be constructed to State of Florida Department of Transportation standards and placed as recommended by the Traffic Division of the City's Department of Public Works.

No open fires will be permitted.

**G-10.03 SMOKE PREVENTIONS**
The Contractor shall use hard coal, coke, oil or gas as fuel for equipment generating steam. A strict compliance with ordinances regulating the production and emission of smoke will be required.

**G-10.04 NOISE**
The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

Except in the event of an emergency, no work shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Sundays. If the proper and efficient prosecution of the work requires operations during the night, the written permission of the Engineer shall be obtained before starting such items of the work.

**G-10.05 ACCESS TO PUBLIC SERVICES**
Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

**G-10.06 DUST PREVENTION**
The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the streets sprinkled with water at all times.

**G-10.07 PRIVATE PROPERTY**
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 obtained the owner's written consent thereto and shall have shown this consent to the Engineer.

## SECTION 11
## SLEEVES AND INSERTS

**G-11.01 COORDINATION**
When the Contract requires the placing of conduits, saddles, boxes, cabinets, sleeves, inserts, foundation bolts, anchors, and other like work in floors, roofs, or walls of buildings and structures, they shall be promptly installed in conformity with the construction program. The Contractor who erects the floors, roofs, and walls shall facilitate such work by fully cooperating with the Contractors responsible for installing such appurtenances. The Contractor responsible for installing such appurtenances shall arrange the work in strict conformity with the construction schedule and avoid interference with the work of other contractors.

**G-11.02 OPENINGS TO BE PROVIDED**
In the event timely delivery of sleeves and other materials cannot be made and to avoid delay, the affected Contractor may arrange to have boxes or other forms set at the locations where the appurtenances are to pass through or into the floors, roofs, walls, or other work. Upon the subsequent installation of these appurtenances, the Contractor erecting the structure shall fill around them with materials as required by the Contract. The necessary expenditures incurred for the boxing out and filling in shall be borne by the Contractor or Contractors required to furnish the sleeves and inserts. Formed openings and later installation of sleeves will not be permitted at locations subject to hydrostatic pressure.

## SECTION 12
## CUTTING AND PATCHING

**G-12.01 GENERAL**
The Contractor shall do all cutting, fitting, or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

## SECTION 13
## CLEANING

**G-13.01 DURING CONSTRUCTION**
During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris, and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.

The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefor develops.

**G-13.02 FINAL CLEANING**
At the conclusion of the work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished, and new appearing condition.

## SECTION 14
## MISCELLANEOUS

**G-14.01 PROTECTION AGAINST SILTATION AND BANK EROSION**
The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed watercourses and drainage ditches.

**G-14.02 EXISTING FACILITIES**
The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Work shall be scheduled to minimize bypassing during construction. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

**G-14.03 USE OF CHEMICALS**
All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

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# SPECIFIC PROVISIONS

## SP-1 Scope

The work included under these Contract Documents is as described in the Proposal.

All work shall be constructed, installed and maintained complete in place as specifically described in these Specifications, as shown on the Plans and as described and directed by the Engineer in accordance with the obvious or expressed intent of the Contract.

This work also includes general cleanup, start-up and testing of all installed equipment to ensure satisfactory operation of the pumping station and all other work required by the Contract Documents necessary to make the pumping station complete and functional.

## SP-2 Permits

The City will obtain the Florida Department of Environmental Protection (FDEP) Permit for Constructing a Domestic Wastewater Collection/Transmission System, currently administered by Hillsborough County Environmental Protection Commission (EPC).

The Contractor shall obtain all permits required to comply with SP-4 Maintenance of Traffic, contained herein. The Contractor may also be required to Permit for disposal of debris and sludge removed during the wet well cleaning operations.

The Contractor shall have in his possession the proper license to perform the work before submittal of his bid and shall obtain any required City/County building permits and shall obtain and pay for all other licenses and authorizations required for the prosecution of the work, including the cost of all work performed in compliance with the terms and conditions of such permits, licenses and authorizations, whether by himself or others.

City/County building permit fees will be paid by the City. Right-of-way and maintenance of traffic permit fees shall be paid by the Contractor.

The Contractor shall require all subcontractors to be currently licensed by the City to perform the proposed work in their respective fields and to obtain permits for the execution of said work. All work shall be performed in accordance with the licenses, permits and the requirements of the current Building and Construction Regulations Chapter of the City of Tampa Code.

The Contractor is responsible to schedule and coordinate with the City Inspectional Services Division of the Department of Housing and Development Coordination all required inspections and tests for all phases of work to obtain final approval thereof.

The Contractor is encouraged to contact the City's Permitting Department and Building Inspections Bureau prior to commencement of work to ascertain their respective requirements.

SP-3 Wastewater Facilities

Wastewater facilities protection and replacement work not specifically shown or described 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 in accordance with these specifications and in accordance with the City of Tampa Wastewater Standards, as though it were specifically delineated or described. The cost of this work shall be included in the cost of the pay item to which it is incidental, and no additional payment will be made therefor. This work may include, but is not limited to the removal and restoration of manhole frame, covers and/or top slabs and repair of manhole chimneys and gravity sanitary sewers for installation of bypass pumping equipment.

SP-4 Maintenance of Traffic

The Contractor shall arrange his work so that there will be as little disruption of traffic as possible.

At least seventy-two hours before starting any work in City streets, the Contractor shall obtain a City of Tampa Street Closure Permit for any traffic lane or street closure within the City. The permit will establish the requirements for closures related to the number of lanes and time of day lanes or streets may be closed. If the Contractor proposes a complete street closure, a detailed traffic maintenance plan shall be submitted to the City of Tampa Traffic Engineering Division together with the application for the Street Closure Permit. The traffic maintenance plan shall include proposed detour routes and locations and descriptions of direction signs for the construction area and detour routes. Two approved copies of all Street Closure Permits shall be submitted to the Engineer before starting any work in City streets. No changes to approved Street Closure Permits will be permitted without prior approval by the City.

The Contractor shall furnish and maintain all necessary signs, barricades, lights and flagmen necessary to control traffic and provide for safety to the public, all in compliance with the Florida Department of Transportation “Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations,” with subsequent revisions and additions, and to the satisfaction of the Engineer.

The cost of maintaining traffic and of any additional earth excavation, selected fill, temporary wearing surface, temporary bridges, barricades, warning lights, flagmen, and like work required therefor shall be included in the total Lump Sum Price, as applicable, and no additional payment with be made therefor.

SP-5 Working Drawings

Prior to performing any work requiring working drawings, as specified on the Plans and in the Workmanship and Materials Sections, the Contractor shall submit the working drawings in accordance with the General Provisions section headed "Working Drawings."

SP-6 Environmental Protection

The Contractor will be held liable for the violation of any and all environmental regulations. Violation citations carry civil penalties and in the event of willful violation, criminal penalties. The fact that the permits are issued to the City does not relieve the Contractor in any way of his environmental obligations and responsibilities.

SP-7 Use of Explosives

Explosives shall not be used on the work.

SP-8 Construction Start

Construction shall not begin prior to receipt by the City of the required permits. If issuance of the Notice to Proceed is delayed due to permit acquisition, the contract time will be extended to suit, but no extra payment will be made to the Contractor.

SP-9 Coordination and Cooperation

In performing work under this Contract, the Contractor shall coordinate his work with that of any adjacent contractors for the City, and others, and cooperate with them in every reasonable way, to the end that there shall be the minimum practicable interference with their operations.

SP-10 Connections Between Construction

The Contractor shall provide an approved type spigot cap, bell plug, or standard pipe plug in the force main, discharge header, pipe stub or other location to provide for terminating construction when the work is performed in phases and the connecting phase is not complete.

The Contractor shall remove any such cap or plug encountered when connecting to previously completed work.

The cost of furnishing and removing caps and plugs shall be included in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

SP-11 Easements

In the event that, in the opinion of the Contractor, obtaining a temporary easement for storage of materials is necessary or desirable, it shall be the sole responsibility of the Contractor to obtain such easements from the Owner of the property. If such easements are obtained by the Contractor, they shall contain provisions to hold the City harmless from any operations of the Contractor within the easement limits. The Contractor shall not conduct construction operations on private property outside the limits of any easement obtained by the City or of any City-owned property or right-of-ways unless a copy of the temporary construction easement agreement is filed with the Engineer.

SP-12 Releasing Facilities for Use

It is the intent of these Specifications that all newly constructed force mains, sewers and appurtenant facilities be placed in service as rapidly as an integrated portion of the facilities can be constructed, inspected and accepted by the Engineer. Acceptance or use by the City of any portion of the facilities prior to final acceptance shall not relieve the Contractor of any responsibilities, regarding such facilities, included in the Contract.

SP-13 Material and Equipment Approval

The Contractor shall not enter into any subcontracts, or place any order, for the furnishing of any material or equipment until he has received the Engineer's written approval of the manufacturers. After the Contractor has received approval of the Engineer, equipment procurement shall commence.

The Contractor shall coordinate the procurement process with construction sequence and construction operations to minimize the duration of bypass pumping.

SP-14 Working Hours

Normal working hours for this project will be from 7:00am to 4:00pm, Monday thru Friday. If certain phases of the project require work outside of the normal hours, a minimum of 7-days notice must be provided to allow scheduling of City inspectors.

SP-14A Contractor Emergency Response Time

The Contractor shall be available to service emergency calls seven (7) days a week, twenty-four (24) hours a day. The response time for emergency calls shall be within two (2) hours. A contact person and telephone number shall be provided to the Engineer for such purposes.

During the initial setup and operation of the bypass pumping, the Contractor shall have personnel on site 24 hours a day as described in the subsection headed “Bypass Pumping”.

SP-15 Contractor's Field Office

Delete Article G-6.03 Contractor's Field Office on Page G-14 from GENERAL PROVISIONS. The Contractor or an authorized agent shall be present at all times while his work is in progress. Readily accessible copies of both the contract documents and the latest approved working drawings shall be kept at the job site.

SP-16 Salvage

All existing pipe, appurtenances and equipment removed by the Contractor and which are not designated to be salvaged shall become the property of the Contractor and shall be removed from the site of the work to the Contractor's own place of disposal.

Items which are shown on the Plans, specified or directed to be salvaged shall be removed by the Contractor, delivered, and unloaded at the City of Tampa's Howard F. Curren AWTP, located at 2708 Maritime Blvd or a location within the Department's service area, as directed by the Engineer. The cost of removing, disposing, delivering, and unloading as salvage items of pipe and appurtenances shall be included in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

The Contractor shall carefully remove or dissemble the following items which are intended to be salvaged for this project:

- Medium Voltage Square D Breakers (two)
- GE Multi-lins (two)
- Vertical Air Compressor (one)
- Yaskawa VFDs (two)
- GE 93/30 PLCs (two)
- Motorola MOSCAD PLC (one)
- Detronics gas detector from the wet well (one)
- Yokogawa paperless chart recorder (one)

SP-17 Sequence of Operations

The Contractor shall be responsible for scheduling his work in an orderly fashion to meet the project goals described herein. Due to the peak flows that can occur at the pumping station, start-up of the bypass pumping system and work that requires that the station be placed out of service shall not occur until after the end of the hurricane season, December 1. Completion of construction and start-up of the pumping station must occur prior to the beginning of the following hurricane season, June 1. In summary, Contractor shall schedule and sequence work so that no bypass pumping is required during the hurricane season. The Contractor shall sequence operations generally following the phases described below. It is the intent of these specifications that the Contractor provides bypass pumping for all wastewater flows coming to the Krause Pumping Station during all conditions as described in the subsection headed "Bypass Pumping". During the bypass pumping operations, the Contractor will have full access to the pumping station for the execution of the work.

The general phases of the sequence of operations shall be as follows:

Phase 1 - Perform 36" hot tap on the 54" PCCP force main, as shown. Then construct and hydrostatically test the permanent bypass assembly. Installation of hot tap fittings and completion of the hot tap can occur prior to the end of the hurricane season. Bypass pumping shall not be initiated until all equipment is on site or in the Contractor's control and the hurricane season has ended. When all equipment for the rehabilitation is available, the Contractor shall request permission from the City to begin bypass pumping operations. Setup the station bypass pumping equipment and piping to bypass from the interceptor structures as shown on the conceptual bypass plan to the bypass assembly. A temporary closure of Ashley Street will be required to install a bypass discharge line buried across one lane of traffic that should otherwise remain open during construction. Contractor shall make use and/or modify existing manholes or junction chambers to accomplish this flow diversion.

After the bypass pumps are installed and before the installation of the 3 pipe plugs as shown on the plans, the Contractor shall coordinate with the City to shut down the pumping station and allow the water level in the influent interceptor to rise and back up to an elevation that permits priming of the bypass pumps (water elevation shall not exceed an Elevation of -3.0 feet NAVD 88). During this phase, the Contractor shall operate the bypass pumping 24 hours a day until the system has been operating trouble free for at least 48-consective hours. After the bypass pumps have demonstrated a 48 hour continuous trouble free operation, the contractor may proceed to install the 3 pipe plugs as shown. This may require operation of the existing pumping station to lower the water level as much as possible to facilitate the installation of the plugs.

After the bypass pumps are operational and the plugs have been installed, the Contractor shall also coordinate with the City to close the two force main 36" plug valves on Ashley Street to prevent the flow to return and verify that there are no leaks going through the closed 36-inch isolation plug valves.

The contractor shall monitor the wastewater elevation continually during the bypass pumping operations. This Phase of construction shall be closely coordinated with other construction and procurement operations, so that the duration of the bypass pumping during the pumping station rehabilitation is minimized to the least practical. After it is verified that the plug valves are closed and not leaking, the contractor can proceed to Phase 2.

Phase 2 - During this Phase, the Contractor shall dewater the wet well compartments by pumping into the 30" sanitary sewer running on the north side of the pump station or by the use of vacuum trucks. The Contractor shall also access and clean the dewatered wet well compartments, removing and disposing of debris in accordance with SP-53. Once Phase 2 is completed, proceed with Phase 3 and Phase 4 simultaneously.

Phase 3 - Discharge Piping Modifications.

Phase 3A - Once Phase 2 is complete proceed to excavate, shore working area and expose concrete encasement on the buried discharge manifold outside the station. Proceed to demolish concrete encasement. Proceed to cut and remove steel pipe. Section of steel pipe embedded in concrete wall shall be left in place as a wall sleeve.

Phase 3B - Inside the station, proceed remove and dispose of existing pumps, suction, discharge assemblies, pneumatic valves, air compressor, vacuum pumps and tanks, associated air and vacuum piping and all other items listed in the contract documents.

Phase 3C - Proceed to install new buried discharge manifold outside the station, start with the southernmost fitting, up to the CTSIF short piece on northernmost TEE. Proceed to install flanged custom steel offset and 36" x 42" increaser from the 36" flanged bend that remains. Assemble closure between the 42" tee and increaser.

Phase 3D - Install segments of 24" DIP through the wall sleeve, and complete restraint joint assembly connection at buried TEEs.

Phase 3E - Temporarily cap or plug each 24" DIP segment. Proceed to pressurize assembly to 90 psi. Visually inspect outside buried pipe for leaks. Repair any leaks observed. When there are no visual leaks, proceed to backfill the trench.

Phase 3F - Proceed remove temporary caps on 24" DIP inside the station and continue to install valves, discharge piping.

Phase 4 - Install all equipment within the pumping station, including new pumping equipment, vacuum priming equipment, valves, air compressors, meter in meter vault, air dryer, bubbler system, and controls and perform electrical upgrades, as shown or specified. Coordinate new electrical service with the Tampa Electric Company.

Phase 5 - After electrical upgrades, and installation of new pumping equipment and controls have been completed. Open valves in Ashley Street and new knife gate valves. Proceed to deflate temporary plugs in the influent channel to test and operate the pumping station equipment, with the bypass pumping setup in place (although not being operated).

Phase 6 - After the testing and operation of the new equipment has been successfully placed in operation for approximately one week, and the City personnel has been trained and instructed on the operation of the equipment, proceed to demobilize the bypass pumping equipment and piping.

Phase 7 - Proceed to restore interceptor structures, restore permanent pavement in Ashley Street, construct permanent restoration in Cross-town Expressway Authority property, remove maintenance of traffic plan landscaping, permanent fencing and painting as specified or shown.

Taking over of parts of the work for operation before completion of the entire project shall not relieve the Contractor of any responsibility for proper integrated operations of all parts of the work, nor shall it act to relieve him of any responsibilities under Article A-6.04 of the Agreement, for guaranty of all parts of the work, for one year after the date of acceptance of all the work on the project.

SP-18 Dewatering

Dewatering is the responsibility of the Contractor. All costs associated with dewatering shall be included in the appropriate contract price for items to which dewatering is incidental, or in the total Lump Sum Price, as applicable, and no separate payment shall be made therefor.

Before commencing any excavation at the site of the work, the Contractor shall submit to the Engineer the methods, equipment and arrangement of facilities proposed for the removal and disposal of water at the site and of all water entering any excavation or other part of the work from any source whatsoever. Adequate standby facilities shall be provided to ensure that the excavation will be kept dry in the event of a power failure or mechanical breakdown. Facilities for removal and disposal of water shall be of sufficient capacity to keep the excavation dry under all circumstances with one-half of the facilities out of service. If well points are used, provision shall be made for removing and resetting individual well points without taking the system of which they are a part out of service.

SP-19 Prevention, Control and Abatement of Erosion and Water Pollution

The Contractor shall be responsible for prevention, control and abatement of erosion, siltation and water pollution resulting from construction of the project until final acceptance of the project.

He shall provide, install, construct, and maintain any covering, mulching, sodding, sand bagging, berms, slope drains, sedimentation structures, or other devices necessary to meet City, County, State and Federal regulatory agency codes, rules and laws.

The Contractor shall take sufficient precautions to prevent pollution of streams, canals, lakes, reservoirs and other water impoundments with fuels, oils, bitumen, calcium chloride or other harmful materials. Also, he shall conduct and schedule his operations so as to avoid or otherwise minimize pollution or siltation of such streams, and the like, and to avoid interference with movement of migratory fish. No residue from dust collectors or washers shall be dumped into any live stream.

Storm drainage facilities, both open and closed conduit, serving the construction area shall be protected by the Contractor from pollutant and contaminants. If the Engineer determines that siltation of drainage facilities has resulted due to the project, the Engineer will advise the Contractor to remove and properly dispose of the deposited material. Should the Contractor fail to or elect not to remove the deposits, the City will provide maintenance cleaning as needed and will charge all costs of such service against the amount of money due or to become due the Contractor.

Construction operations in rivers, channels, streams, tidal waters, canals and other impoundments shall be restricted to those areas where it is necessary to perform filling or excavation to accomplish the work shown in the Plans and to those areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, rivers, channels, streams and impoundments shall be promptly cleared of all obstructions placed therein or caused by construction operations.

Except as necessary for construction, excavated materials shall not be deposited in rivers, streams, canals or impoundments, or in a position close enough thereto to be washed away by high water or runoff.

The Contractor shall not disturb lands or waters outside the limits of construction except as may be found necessary and authorized by the Engineer.

The location of and methods of operation in all detention areas, borrow pits, material supply pits and disposal areas furnished by the Contractor shall meet the approval of the Engineer as being such that erosion during and after completion of the work will not likely result in detrimental siltation or water pollution.

The Contractor shall comply with the applicable provisions of the Hillsborough County Land Development Code concerning grading, filling, excavation, soil removal, and the like, as amended.

The Contractor shall schedule his operations such that the area of unprotected erodible earth exposed at any one time is not larger than the minimum area necessary for efficient construction operations; and the duration of exposed, uncompleted construction to the elements shall be as short as practicable.

Clearing and grubbing shall be so scheduled and performed that grading operations can follow immediately thereafter and grading operations shall be so scheduled and performed that permanent erosion control features can follow immediately thereafter if conditions on the project permit.

The Engineer may limit the surface areas of unprotected erodible earth exposed by clearing and grubbing, excavation or filling operations and may direct the Contractor to provide immediate erosion or pollution control measures to prevent siltation or contamination of any river, stream, channel, tidal waters, reservoir, canal or other impoundment or to prevent damage to the project or property outside the project right of way.

SP-20 Existing Wastewater Flows

In order to prepare the pumping station during rehabilitation work as shown and specified, the Contractor shall provide bypass pumping for as long as the pumping station is out of service during construction. The following flow data was obtained from the City of Tampa Wastewater Department and is believed to be reasonably accurate, but not guaranteed to be absolutely so, and is presented only as an approximation:

Low Flow – 4,000 GPM @ 20.3 Feet of TDH
Average Flow – 8,000 GPM @ 21.4 Feet of TDH
Peak Flow – 22,500 GPM @ 32.3 Feet of TDH
Rain Peak – 45,000 GPM @ 60.1 Feet of TDH

SP-21 Bypass Pumping

The Contractor shall submit a detailed plan for bypass pumping to the Engineer for approval prior to proceeding with the work. All required agency approvals and permits, if required, shall be the responsibility of the Contractor. The hydraulic design of the bypass pumping arrangement shall be the sole responsibility of the Contractor. The plan at a minimum, shall include the following information:

- Site plan showing location and arrangement of pumps and piping, including pipe sizes, fittings, valves, and connections
- Pump operation strategy and projected flow rates
- Pump curves for each size pump
- Details of the stop logs

Bypass pumping system shall be capable of providing a minimum peak flow rate of 65 MGD (45,000 gpm). The estimated pipeline pressure at the connection to the existing force main under the peak flow rate is 60.1-ft TDH.

Pump suction pipes shall be installed in the manholes and junction chambers for the 60-inch interceptor and two rows of inflatable plugs, as shown, shall be placed in the influent to the station to block the flow during construction. Suction pipes shall be arranged to avoid suction vortices in the structures. External mechanism, such as anti-vortex plates shall be provided if necessary.

The Krause Pumping Station wet well will be unavailable during bypass operations. Partial backup of wastewater in the influent interceptor sewer is acceptable. The maximum elevation to which the wastewater shall be allowed to rise is Elevation -3.00 ft, which is equivalent to approximately 6 inches above the crown of the influent 60-inch interceptor at the junction chamber located on Ashley Street, just south of Brorein Street. Backup of wastewater beyond this elevation can result in upstream overflows. The Contractor shall assume responsibility for fines and cleanup cost of upstream overflows due to insufficient or defective bypass pumping operation.

The bypass shall be watertight. Individual suction pipes for each bypass pump shall be required, and shall access the junction chamber through the manhole openings. Manhole frames and tops can be removed in coordination with the City. Special consideration shall be given to not damaging the T-Lok lining of the manhole chimneys. Removal of structure tops and manhole chimney shall not be permitted, unless explicitly authorized in writing by the City. Manifold suction arrangements will not be considered acceptable. As a minimum, the bypass discharge pipe shall have an air release valve at the highest point.

The bypass pumping system shall as a minimum consist of the pumps, the pump drives, suction and discharge piping, level sensing equipment, and pump controls to automatically start, stop and control speed of pumps, as necessary, to bypass at a rate equal to the incoming flow. Controls and/or pump drive systems will be required for both electric and diesel pumps so that the pump speed is automatically adjusted to match the incoming flow. The pumps shall be designed to handle the flow rates shown in the subsection heading “Existing Wastewater Flows”. Each pump shall be equipped with a check valve on the discharge to prevent backflow through the pumps.

Temporary covers shall be installed to seal the annular spaces between the suction pipes and the openings in the manholes or structures to prevent the gas from escaping during bypass pumping operations.

Bypass pumping system shall be continuously monitored (24-hrs/day) by the bypass contractor/supplier for the first 48 hours of operation. Once the 48 hour performance test is successful, the system can be placed into unmanned service. During unmanned operation the Contractor shall be available on a 24-hour/7-day/week basis to respond to problems and to make any necessary adjustments and/or repairs needed to maintain continuous operation of the bypass system. The Contractor shall be solely responsible for maintaining the bypass system during the bypass operation.

Bypass system will have a monitoring/alarm system equipped with an auto-dialer that automatically contacts the contractor if one of the primary pumps fail or high water level occurs.

Contractor shall provide a perimeter fence around the bypass equipment, with a padlock so that unauthorized persons cannot operate the equipment. Multiple fences or locked panel may be required, dependent on the individual set up of the bypass pumping layout.

Contractor shall design and size the bypass system and shall guarantee that the system meets the minimum peak flow requirements. Prior to performing any work that will prevent the pumping station from being placed back into service, the minimum flow rates of the bypass system must be confirmed and a performance test of the system must be completed to ensure that the system will provide uninterrupted service under all conditions.

The bypass pumping shall continue in service until the pump station rehabilitation is complete and the wastewater pumps are back in service.

Pumping equipment shall be of a type suitable for pumping raw unscreened wastewater over an indefinite period without clogging or requiring shutdown for routine maintenance. Bypass pumping shall be continuous during the entire length of time each portion of the work is being accomplished. The pumps shall be electrical driven pumps on VFDs. The Contractor shall be responsible from obtaining and removing a temporary power drop and meter from TECO and all associated cost with the installation. The contractor shall also be responsible for costs required to supply and maintain power needed to continuously operate the bypass system

The Contractor shall provide full redundant generator capacity in the event of a temporary outage so that power to all primary pumps, back-up pumps and VFDs are maintained. If the bypass system consist of electric primary pumps with diesel back-up pumps, a sufficient generator system must be provided so that all primary pumps are available during a power failure.

Option for diesel powered pumps on VFDs may be considered, provided that the Contractor has onsite fuel tanks and that are monitored daily. Large capacity pumps for managing peak flows can be diesel driven.

The bypass pumping system shall include backup pumps. The Back-up pumps shall be completely installed and shall automatically be placed into operation in the event one of the primary pumps fail. Back-up pumps shall be no smaller than the largest primary pumps they are replacing. The number of back-up pumps shall conform to the following chart:

| Primary Bypass Pumps | Required Back-up Pumps |
|---|---|
| 1-2 | 1 |
| 3-4 | 2 |
| 5-6 | 3 |
| 7-8 | 4 |
| 9-10 | 5 |

For example, if the primary bypass system has (1) 8” pump and (1) 10” pump then the required back-up pump provided shall be (1) 10” pump. Second example, if the primary bypass system

has (2) 8" pumps and (1) 10" pump then the required back-up pumps provided shall be (1) 8" pump and (1) 10" pump.

Sufficient back-up generators shall be used so that all primary pumps and all back-up pumps remain available for operation in the event of a power loss. Diesel pumps with variable speed controllers may be used as back-up pumps for electrical driven pumps on VFD's as along as a back-up generator is provided to supply power to the electrical pumps. The generator shall be of sufficient size so that all required electrical pumps remain available during a power outage.

Bypass pumping system shall have sufficient fuel storage at all times for a minimum of 48-hours of continuous operation at peak flow rate and all pumps shall be properly secured to avoid damage, vandalism, or unauthorized shutdown. Pumps shall be baffled to comply with all noise abatement ordnances and regulations.

The costs of bypass pumping shall be included in the total Lump Sum Price. There is no separate contract item for bypass pumping and no extra payment shall be made.

SP-22 Pump Station Wet Well

During bypass operations, the Contractor shall dewater and subsequently clean the wet well with a hydrojet prior to initiating any modifications noted in the contract drawings.

The Contractor shall remove all debris and sludge located in the wet well and shall dispose of it in an acceptable and permittable manner. The debris and sludge removed shall be sole in accordance with SP-53 included herein. There is expected to be approximately 75 CY of debris within the wet well that needs to be removed.

SP-23 Project Sign

The Contractor shall furnish two project signs as shown on the detail included herein, and install them in the construction area as directed by the Engineer at least five (5) days prior to commencing work at the site.

The cost of fabrication, erection, maintenance, removal, and proper disposal of the project sign at the completion of the project, including all labor and materials shall be deemed included in the prices bid for the various Contract Items of this Contract, or in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

No extra payment will be made for obliterating of certain names and offices and replacement thereof with others because of administrative changes during the course of the Contract.

SP-24 Construction Operations

In City streets, excavated materials shall, where practicable, be deposited upon streets, sidewalks, driveways, or other paved surfaces within the street right-of-way, except that interruptions to the use of driveways shall be kept to a minimum. The Contractor shall clean up

areas from which soil has been removed at the end of each day by sweeping, washing, or other approved methods. When the work is halted by rain, the Contractor shall clean up the working areas before leaving the site.

Trenches shall be protected at the close of each day's operations by lighted barricades, fences, and other methods to the satisfaction of the Engineer. Fences shall meet ASHA standards and be structurally stable as approved by the Engineer. No excavations shall be left open over a weekend.

In general, pipes shall be laid in open cut trenches, except when another method, such as jacking, augering or tunneling is shown on the Plans, specified or ordered.

In City**,** State and County highways, excavated materials shall not be stored or cast upon the pavement, unless an advance approval of the governing agency is first obtained by the Contractor.

SP-25 Project Cleanup

Cleanup is extremely important and the Contractor will be responsible for keeping the construction site neat and clean with debris to be removed regularly as the work progresses.

SP-26 Work in Streets and Highways

All work within streets and highways shall be subject to the regulations and requirements of the appropriate agencies. Within the City of Tampa, streets and highways are under the jurisdiction of the City of Tampa, Department of Public Works or State of Florida, Department of Transportation. Outside the City of Tampa, streets and highways are under the jurisdiction of the County of Hillsborough or the State Department of Transportation.

Methods and materials of construction used in restoration within such streets and highways, including pavement, sidewalk, curb, curb and gutter removal and replacement, replacement of storm sewerage facilities, excavation and backfilling, and the storage of plant, materials and equipment shall conform to the requirements herein. A detail is shown on the plans for the restoration of City Streets.

SP-27 Surface Restoration

Where construction activities are conducted in existing grassed areas, the grassed areas shall be restored as specified or directed by sodding or grassing. Such restoration of grassed areas shall conform to the requirements of the Workmanship and Materials section headed "Lawn Replacement."

The Contractor shall replace or repair all ground surfaces damaged during construction. Any bushes, flowers, gardens, patios, or other landscaping and irrigation systems disturbed by the construction project shall be repaired or replaced by the Contractor. The cost of such ground surface repair shall be included in the total Lump Sum Price and no separate payment will be made therefor.

Existing corrugated metal and concrete pipe culverts removed during the construction work shall be stored and maintained in sound, useful condition and replaced upon completion of the work. Culverts damaged by the Contractor shall be replaced with new culverts meeting the applicable requirements of the Standard Specifications for Road and Bridge Construction published by the Florida Department of Transportation. No separate payment will be made for replacement of damaged culverts.

SP-28 Work Adjacent to Utilities

Existing utilities including house services adjacent to or crossing the line of the work shall be protected as shown on the Plans, specified herein, and in accordance with the requirements of the General Provisions.

SP-29 Utility Protection Considerations

The Contractor shall protect all utilities and other facilities within and adjacent to the construction as covered in Section G-1.03, unless a utility firm has conclusively indicated, or such is shown on the Plans, that the certain adjustment, removal, reconstruction, or protection of the utility's facility will be performed by that respective utility.

The Contractor shall furnish, install, and remove sheeting and shoring and other protective measures as may be necessary to satisfactorily accomplish the construction of this project. The cost of such sheeting and shoring and other protective measures shall be included in the unit prices as bid for the storm or sanitary sewer pipe items, and no separate payment shall be made therefor.

SP-30 Water and Electric Services

The City will provide potable water service during construction through the established potable water meter and double backflow preventer. The Contractor shall use water through existing connection or fixtures. Any additional water connection required for the project, other than those establish fixtures, shall be constructed and connected downstream of the backflow preventer. Construction and removal of such connections and/or use of a separate construction water service from nearby hydrant due to the disruption of the water meter during construction shall be the responsibility of the Contractor, and such cost shall be included in the Lump Sum Price and no separate payment will be made therefor.

The City will provide electrical services in the station during construction through the established electrical meters and connections, except for times when service from the Tampa Electric Company is being relocated or modified. Any electrical service required during such period shall be responsibility of the Contractor and such cost shall be included in the Lump Sum Price and no separate payment will be made therefor. Any temporary electrical service required for the bypass pumps shall be responsibility of the Contractor and such cost shall be included in the Lump Sum Price and no separate payment will be made therefor

Shop drawings for temporary electrical services required during bypass pumping operations shall be included in the bypass pumping submittal, and shall be submitted prior to commencing any major demolition work.

SP-31 Protection of Trees and Shrubs

All trees and shrubs, except where otherwise shown or ordered, shall be adequately protected by boxes, fences, or otherwise carefully supported, as necessary, by the Contractor. Protective barricades shall be placed around all protected trees and grand trees and shall remain in place until all potentially damaging construction activities are completed (see barricade detail on the Plans). The Parks Department must inspect the site after tree protection devices have been installed and prior to construction. A 48-hour notice must be given to Parks Department to schedule the inspection. No excavated or backfill material shall be placed in a manner which, in the opinion of the Engineer, may result in damage to trees or shrubs. Prior to mobilization, all exposed roots shall be covered with a two (2)-inch layer of mulch. The Contractor shall replace all trees or shrubs which are destroyed or damaged to such extent, in the opinion of the Engineer, to be considered destroyed. Replacement of destroyed trees or shrubs shall be made with new stock conforming to the requirements of the City's Tree Ordinance at the expense of the Contractor, and no separate payment will be made therefor.

Beneath trees within the limits of the excavation, and where possible, pipelines shall be built in short tunnels, except as otherwise shown or specified. When the tree is outside the limits of the excavation but, where the distance from the centerline of the new pipeline to the trunk of any tree is such that, in the opinion of the Engineer, the excavation would result in serious damage to the tree, the pipeline shall be constructed in short tunnel, as ordered in writing by the Engineer. The Contractor shall be responsible for all damage to trees and shrubs as a result of his operations, whether the pipeline is placed on trench, tunnel, or other excavation.

The Contractor shall provide the services of a certified arborist when it is necessary to trim or cut a branch from a tree or prune roots.

The cost of protection of trees and shrubs, replacement or repair of trees or shrubs destroyed by the Contractor, short tunnels, cutting or trimming of tree branches and pruning roots shall be included in the various classified unit price Contract Items for pipelines, or in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

SP-32 Existing Storm Sewer Facilities

In the course of the work, it will be necessary to install temporary pipe and pumps over, under or closely adjacent to existing stormwater swales, grate inlets, culverts and other storm sewerage facilities. The Contractor shall protect all existing storm sewerage facilities which are shown on the Plans or located in the field during the course of the work.

Facilities which are damaged due to the work method of the Contractor shall be replaced by the Contractor to such limits as directed by the Engineer. Materials used for such replacements shall be similar to those used in the existing facility and shall conform to City Standards for the construction of storm sewers for work done in the City of Tampa.

The cost of protecting, replacing, relocating and maintaining storm sewerage facilities shall be included in the various classified unit price Contract Items for pipelines, or in the total Lump

Sum Price, as applicable, and no separate payment will be made therefor, unless otherwise specified in other Contract Items.

The maintenance and guarantee provisions of the Agreement shall also apply to all replacements of damaged or relocated storm sewerage facilities accomplished by the Contractor.

SP-33 Fences

Temporary fences, where required, shall be "wood and wire fence" or other suitable fencing as approved by the Engineer.

Permanent fences shall be restored by the Contractor and shall be finished and installed so that the restoration is equal to the original. Only those portions of original fencing, or materials the Engineer approved for reuse shall be used by the Contractor in fence restoration. All other materials, including lumber, paint, concrete and metal products, shall be furnished by the Contractor.

The cost of temporary fences and permanent fence restoration shall be included the in the total Lump Sum Price and no separate payment will be made therefor.

SP-34 Data to be Submitted on Pipe

Prior to his entering into any subcontract for the manufacture or purchase of any pipe, the Contractor shall submit to the Engineer, in an amount equal to four (4) sets to be retained by the City plus the number of sets desired by the Contractor, the following information:

1. A general description of and specifications for the pipe and pipe joints proposed.

2. Notarized certificates of manufacture for DIP and Steel Pipe stating conformance to applicable standards and specifications.

3. Any additional information that the Engineer may deem necessary in order to evaluate the qualifications of the manufacturer and to determine the suitability of the proposed pipe to meet the requirements of the Contract Documents.

4. Contractor shall coordinate with the pump manufacturer to propose special design fittings that will suit the existing field dimension with the proposed equipment dimensions. This information shall be captured and included in the shop drawing submittal for the special fittings.

The Contractor shall not enter into any subcontract for the furnishing of pipe until he has received the Engineer's approval, in writing, of the proposed manufacturer and pipe.

All pipe of specified classes and materials shall be of one kind and shall be produced by a single manufacturer.

SP-35 Concrete Requirements

Concrete work for sanitary sewer facilities shall comply with specification section 03 30 00 Cast In Place Concrete and as shown on the Plans.

SP-36 Compaction of Suitable Clay Fill Material

The Contractor shall have equipment available to properly compact any suitable clay fill material at no additional cost to the project.

SP-37 Temporary Pavement Restoration

Temporary pavement restoration or steel plates shall be used to cover the trench over the segment of bypass pumping discharge pipe that is required to be buried under one active lane of Ashley Street. Temporary work shall be maintained in a suitable and safe condition for traffic until the permanent pavement is laid, or until final acceptance of the work.

SP-38 Work Directive Change

A Work Directive Change is a written directive to the Contractor, issued on or after the date of the execution of the Agreement, and signed by the Engineer on behalf of the City, ordering an addition, deletion or revision in the work, or responding to an emergency. A Work Directive Change will not change the contract price or the time for completion, but is evidence that the parties expect that the change directed or documented by an Authorization to Proceed with Extra Work letter will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the contract price or the time for completion.

Without invalidating the Agreement, additions, deletions or revisions in the work may, at any time or from time to time, be authorized by a Change Order or a Work Directive Change. Upon receipt of any such document, the Contractor shall promptly proceed with the work involved.

SP-39 Services of Manufacturers' Representatives

The services of manufacturers' representatives shall be provided on the site as required for the supervision of installation, the adjustment and placing in satisfactory trouble-free operation of pipelines, valves, tapping sleeves, pumps, electrical gear and other equipment for instructing City personnel in the operation and maintenance of such equipment.

Such manufacturers' services shall be of sufficient time and include a minimum period of one 8-hour day for instruction of City personnel. Additional time shall be provided if necessary.

The cost of all services of manufacturers' representatives shall be included in the total Lump Sum Price, and no separate payment will be made therefor.

SP-40 Piping and Equipment Identification

All piping and equipment shall be identified as follows:

1. All painted piping and equipment shall be color coded. Such coding on pipelines shall be painted, spiral wrapped with plastic tape or encased on colored polyethylene encasement. See workmanship and materials sections for specific pipe materials.

2. All furnished equipment shall have an identification nameplate. The nameplates shall be of Type 304 stainless steel, No. 6 finish, not less than No. 16 gauge with indented stamped lettering. Namplates shall be attached to equipment bases in accessible locations and shall not be painted. Namplates shall be fastened, in a permanent manner, arranged not to damage equipment, with not less than four stainless steel fasteners. All nameplates shall conform to the following standard:

   Name of Equipment
   12-Digit Number (furnished by the Engineer)

3. Each above ground valve shall be identified with a round brass disc, approximately 1-1/2 inches in diameter and not less than No. 14 gauge. Disc shall be fastened to the valves and stamped with an identification number to be furnished by the Engineer. Valves that are replacing existing valves shall be numbered in accordance to the disc on the existing valve.

4. Piping shall be identified with a designation and direction of flow arrow, after painting. The designation shall be furnished by the Engineer. The designations shall consist of up to 20 letters. The designations and flow arrows shall be painted on using a suitable stencil. Designations and flow arrows shall be arranged to be clearly visible from normal viewing areas.

The cost of piping and equipment identification shall be included in the total Lump Sum Price, and no separate payment will be made therefor.

SP-41 Storage of Materials

The Contractor may use the pump station site for storage of material and equipment. The Contractor may not use that portion of the right-of-way located between the existing/proposed curb lines or existing/proposed edges of pavement to store pipe, structures, materials, surplus excavated fill, or equipment other than that used for excavating or dewatering. The Contractor may use that portion of the right-of-way behind the existing or proposed curb line or off the edge of pavement for storage provided that this use does not obstruct pedestrian or vehicular traffic and conforms to the City's Tree Ordinance. If the area behind the curb line/off the edge of pavement is insufficient in size to accommodate the Contractor's storage needs, the Contractor is required to secure the use of a parcel of land for use as a storage site for the duration of this project. Mechanical and electrical equipment stored at this site, such as pumps, motors or VFDs shall be given adequate protection from the elements as to not compromise its integrity or function.

Upon completion of the project, all storage areas will be restored to a condition which meets

or exceeds the pre-construction condition of the storage area. Payment for use and restoration of storage areas will be included in the appropriate lump sum price and no separate payment will be made therefor.

SP-42 Temporary Work Stoppages

The Contractor shall temporarily discontinue all construction activities, except for bypass pumping, and emergency responses from, and including, Thanksgiving Day through the following Sunday, and December 24 through January 2.

SP-43 Project Photographs

The Contractor will not be required to furnish photographs of the project; however, the Engineer may or may not take photographs of the area immediately prior to and after completion of the construction for record and information. To assure that there will not be any conflict with this photography, the Contractor shall not perform clearing operations or action which will disturb any street or area within the project until the Engineer has been advised thereof and has had adequate opportunity to perform the desired photography.

SP-44 Project Videotaping

The Contractor shall submit to the Engineer for approval prior to commencing work a continuous color videotape recording complete coverage of pre-construction conditions of all surface features within the construction's zone of influence, simultaneously produced audio commentary and electronic display of time and date. The videotape recording shall be sufficient to fulfill the technical and forensic requirements of the project and professionally produced by a firm regularly engaged in the business of construction video documentation, shall provide continuous unedited coverage, establishing locations and viewer orientation with clear, bright, steady and sharp video images with accurate colors free of distortion or other imperfections. The videotaping shall be completed both outside and inside the pumping station and shall include as minimum the following areas:

- Complete video of Ashley Street from right of way to right of way from Platt Street to Brorein Street
- Area north of the Pumping Station up to Brorein Street between the Hillsborough River and Ashley Street
- Area west of the Ashley Street between Brorein Street and the Convention Center. The area shall extend a minimum of 200 feet east of Ashley Street.

SP-45 Valves

Valves shall be handled with care to avoid damage. All valves shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be placed, under any circumstances, against pipe or other fittings in such a manner that damage could result. Slings, hooks or tongs used for lifting shall be padded in such a manner as to prevent damage. If any part of the valves' coating and lining is damaged by the Contractor, the repair and replacement shall be made by the Contractor at his expense in manner satisfactory to the Engineer

before installing. Valves shall also be stored at all times in a safe manner to prevent damage and kept free of dirt, mud or other foreign matter. All valve gaskets shall be stored and placed in a cool location out of direct sunlight and out of contact with petroleum products. All gaskets shall be used on a first-in, first-out basis.

Gate valves and plug valves shall be set and joined to new pipe in a manner heretofore specified for cleaning, laying and joining pipe. Valves shall be installed such that the operating nut is plumb.

Cast iron valve boxes shall be firmly supported and maintained centered and plumb over the operating nut of the valve by the Contractor with box cover flush with the surface of the finished pavement or at such other levels as may be directed. Valve boxes shall have 6-inch thick wire mesh reinforced concrete pads poured around the top section of the valve box when in pavement or when directed by the Engineer. The pad shall be 24 inches square and shall be centered on the valve box. All valve covers shall be painted as prescribed by the American Public Works Association (APWA) uniform color code for utility systems.

The valve and valve box shall be installed so City personnel can insert a valve key through the valve box and completely open and close the valve. Operating nut shall not be more than 24" below grade. Add valve stem extension as necessary. This test will be accomplished before final acceptance of the valve and box.

The work shall include all labor, materials, equipment, tools and any incidentals required for the completion of the work.

Payment for valves shall be included in the price of the work to which the valves are incidental unless a separate pay item is included in these contract documents..

SP-46 Tree Removal and Replacement

The Contractor shall remove and replace trees as identified on the plans and as directed by the Engineer. All tree removal and replacement activities shall be in compliance with the City of Tampa Municipal Code, Chapter 13, Landscaping, Tree Removal and Site Clearing, as amended, latest edition.

The Contractor shall contact the City's Parks Department and the City's Construction Services Center to coordinate removal and replacement details and inspections. Substandard workmanship will be rejected. The Contractor shall pack, transport, and handle the replacement trees with care to ensure protection against injury. Upon arrival, the Contractor shall protect all trees from drying out by properly protecting the trees with soil, wet peat moss, or in a manner acceptable to the Engineer. No tree shall be bound with rope or wire in a manner that could cause damage.

Trees that are transported or planted improperly shall receive a special review established on a case-by-case basis.

The Contractor shall be responsible for maintaining the trees in a vigorous, healthy

condition for a period of 90 days after replacement of all trees has been approved by the Engineer. Tree maintenance shall include, but not necessarily be limited to, watering, fertilizing, pruning, staking, guying, and all measures necessary to successfully maintain the trees to the satisfaction of the Engineer.

SP-47 As-Built Plans

During manufacture and construction, installation and testing, records shall be kept of any changes or adjustments made in the work. All such changes shall be incorporated in the "As-Built" plans, shown in red.

The Contractor shall provide the City of Tampa with one (1) hardcopy and (1) electronic high resolution color PDF copy set of "As-Built" plans along with the supporting survey data. The survey shall be in accordance with the City of Tampa Department of Public Works specifications and note keeping standards for surveys and signed by a Land Surveyor registered in the State of Florida. Plan sheets shall have all deviations from original design annotated in red pencil to clearly show as-built conditions. Relocation of existing facilities and utilities must be clearly noted and their location identified by station, offset and elevation, when performed by the Contractor.

All relocation of structures and pipelines must be clearly shown on Plans with as-built stations and offsets verified. All as-built inverts for the entire project must be clearly noted on plan sheets. No separate payment shall be made for this work.

All as-built plans shall be submitted within seven (7) calendar days of the final inspection. The final payment will not be issued until the as-built plans have been submitted to, and accepted by the City. Upon request the City will provide AutoCAD drawings.

SP-48 Safety

1. Responsibility: Employees shall immediately report any unsafe work practice or unsafe condition to their supervisor(s). The Contractor is solely responsible for the safety of their workers, and shall comply with all applicable requirements [i.e.: 29 CFR 1910 -Occupational Safety and Health Standards, 29 CFR 1926 - Safety and Health Regulations for Construction, etc.] and industry safety standards while at the work site. The fact that City personnel may bring un-safe conditions to the attention of any member of the Contractors work force does not relieve the Contractor of this responsibility.

   All Contractor employees and sub-contractors shall be given a copy of SP-56.

   The Contractor shall have a designated Safety Officer within his organization. At the Pre-Construction meeting, the Contractor shall provide the name and contact information of the Safety Officer to the Engineer.

   At the Pre-Construction meeting, the Contractor will be given pertinent safety related information, necessary forms and instructions (i.e.: AWTP[1] Lockout/Tagout Procedures,

[1] AWTP stands for Howard F. Curren Advanced Wastewater Treatment Plant.

AWTP Hot Work Permits, etc) that pertain to any work that might be utilized during the contract. The Contractor shall be responsible to disseminate that information to their employees and sub-contractors. Special care shall be taken by the Contractor to ensure that any new employee or sub-contractor to the work site shall be briefed on these safety instructions.

If warranted by the project and directed by the Engineer, the Contractor shall develop and implement a comprehensive health and safety plan for their employees that will cover all aspects of onsite construction operations and activities associated with the contract. This plan must comply with all applicable health and safety regulations and any project specific requirements that the contract has specified.

2. Incident Reporting: All accidents that result in personal injury, illness or property damage shall be immediately reported and investigated, regardless of the extent of injury, illness or property damage. Employees must report accidents within one hour (or as soon as practical) from the time of occurrence to their immediate supervisor who in turn will report it to the City's inspector. The City inspector may record the incident in their daily report and report it to the Risk Management Division (274-5708).

3. Air-Borne Debris: All personnel in close proximity to drilling, sawing, sanding, scraping, spraying, power-washing or other work being done, either in enclosed spaces or in the open, that creates dust or air-borne debris shall wear eye protection [29 CFR 1910.133] and a respirator [29 CFR 1910.134].

4. Hot Work: All welding, soldering, brazing, acetylene cutting or any other work at the AWTP or any pump station; that produces high temperatures shall require a AWTP "Hot Work Permit" and may require one or more fire watches. The number and location of fire watches (if any) shall be a condition of the Hot Work Permit. A current, portable, fully charged fire extinguisher shall be located with each person performing hot work and each fire watch. The Hot Work Permit shall be signed off by the appropriate personnel and maintained in the project file.

5. Confined Spaces: OSHA defines a confined space as having limited or restricted means for entry or exit, and is not designed for continuous employee occupancy. Confined spaces include, but are not limited to: vaults, tanks, manholes, wet-wells, pipelines, utility tunnels, etc.

   The Contractor shall take measures [29 CFR 1910.146 (c)(5)] to ensure that atmospheric conditions in confined spaces are not hazardous to occupants. This can be accomplished by forcing a sufficient amount of clean air through the confined space and testing the atmosphere by using a portable certified, calibrated, atmosphere monitor that meets OSHA requirements [29 CFR 1910.146(c)(5)(ii)(C)]. The atmosphere monitor should record oxygen content, flammable gases and vapors and toxic air contaminants, such as the Industrial Scientific TMX-412.

6. Lockout / Tagout Policy: The AWTP Lockout / Tagout program is designed to set standards to help safeguard all employees from hazardous electrical or mechanical energy while they are performing service or maintenance on machines and equipment at the AWTP or any

pump station. This program will also identify the practices and procedures to shut down and Lockout or Tagout machines and equipment. The Contractor shall be given a copy of the AWTP "LOCKOUT / TAGOUT POLICY AND PROCEDURES" instruction and shall make all of his employees and sub-contractors aware of this program.

No padlock (lockout) shall be removed except by the individual that installed it or if not available, by a City of Tampa AWTP team leader.

No tag (tagout) shall be removed except by the individual that installed it or if not available, by a City of Tampa AWTP team leader, except in an Emergency and the tag states "Do Not Use Unless in an Emergency". In that event, the Contractor shall notify the City of Tampa AWTP team leader, who will prepare the necessary follow up report.

7. Trench Safety: Any excavation deeper than four (4) feet shall adhere to the requirements contained in 29 CFR 1926.650 thru 652 and the Florida Trench Safety Act [Florida Statutes, ss 553.60 - 553.64].

8. Open Flames: No fires shall be allowed. No open flames necessary for any construction activity shall ever be left un-attended. A current, portable, fully charged fire extinguisher shall be located with each activity requiring an open flame.

9. Sparks: Any activity lasting more than 10 continuous minutes, that creates sparks, such as grinding or chipping shall have a dedicated fire watch in attendance. A current, portable, fully charged fire extinguisher shall be located with each activity creating sparks, regardless if a fire watch is required or not.

10. First Aid: The Contractor shall furnish appropriate First Aid Kits [29 CFR 1910.151] and shall be responsible to ensure his employees are properly trained to render first aid. If injurious corrosive materials are to be utilized, eye wash and body wash facilities must be provided in the immediate area.

11. Related Costs: All costs associated with these or any safety measures shall be included in the total lump sum contract price or the various contract item unit prices, as applicable, and no separate payment shall be made thereof.

SP-49 Vibration Requirements for Rotating Equipment

The Contractor shall obtain the services of an independent test and balance company that specializes in vibration testing, dynamic balancing, and alignment of rotating equipment. The company selected shall have personnel with experience as an industrial mechanical repairman, plus advanced factory training in dynamic balancing, vibrational analyses and troubleshooting by companies such as Spectral Dynamics, IRD Mechanalysis, B & K, Palomar, or Bentley Nevada.

Testing and balancing shall be performed in accordance with standards for field measurements from companies such as IRD Mechanalysis, Bentley Nevada, Balmad, CSI, or Palomar. Instruments used for testing and balancing of rotating equipment must have been calibrated within a period of six (6) months and checked for accuracy prior to start of work. The

Contractor shall submit the name of the test and balance company to the Engineer for approval within 30 days after receipt of notice to proceed.

The tests shall include vibration signatures taken while equipment is operating under normal load at full speed. The signatures shall be plots of filtered vibration velocity in inches per second peak versus frequency for a range of 100 to 60,000 cycles per minute (cpm). Signatures shall be taken at the bearing radially in two planes and axially.

The vibration limits specified herein shall apply to equipment operational speeds and frequencies. The independent test and balance company shall review and interpret vibration peaks at other frequencies and shall make recommendations regarding whether or not corrective action is required. If the independent test and balance company recommends corrective action, the Contractor shall implement such corrective action in a timely manner and at no change in contract price. If minimum acceptable vibration limits as specified herein for dynamic balance and vibration cannot be demonstrated by the test results, the Contractor shall be responsible for correcting the problem. Modifications proposed shall be submitted to the Engineer for approval. No additional payment will be made for any modification required or for retesting of equipment.

Results of all tests including the initial installation readings and the final readings after any modification or correction shall be submitted to the Engineer for approval.

Dynamic balance and vibration requirements for rotating equipment shall be a follows:

1. Coupling Alignment - All drivers and driven equipment shall be checked for looseness, and tightened to proper bolt torque specifications. Alignment of couplings between driver and driven equipment shall be obtained by the use of solid stainless steel shim plates. However, if required shimming is greater than .125 inch, final shimming shall be of brass shim plates with an area as large as the driver and driven base feet.

   Coupling alignment shall be checked in both the offset and angular directions, initial installation readings and final readings after any modification or correction shall be recorded and submitted as historical data and shall meet the following tolerances or manufacturer's recommended tolerances, whichever are more stringent:

   a. Couplings less than 4-inch diameter shall have no more than 0.002-inch Total Indicator Runout (TIR).

   b. Couplings greater than 4 inches but less than 6 inches shall have no more than 0.003-inch TIR.

   c. Couplings greater than 6 inches but less than 10 inches shall have no more than 0.004-inch TIR.

2. Rotating Equipment "Soft Foot" Condition Check - The driver and driven equipment shall have four (4) individual support feet and shall be checked for a condition known as "soft foot." The condition check shall be as follows:

a. All mounting bolts shall be tight before proceeding.

b. A dial indicator shall be set on the equipment base next to the foot to be checked. The dial on the foot to be checked shall be set to zero. The bolt on the designated foot shall be loosened. A maximum dial reading tolerance (deflection) of 0.001 inch shall be allowed. Any reading greater than 0.001 inch shall be shimmed until the tolerance level is achieved. This procedure shall be conducted for all four feet of both the driver and the driven equipment.

c. The driver unit shall be properly aligned to the driven equipment. Shims shall be placed or removed under two adjacent feet to raise or lower the unit. The equipment shall be moved side to side or front to back to bring coupling faces to within tolerance as specified above.

3. Vibration Severity - The equipment as installed shall have no natural frequencies which occur within 25 percent of any exciting frequency over the range of operating speeds. Exciting frequencies are periodic forces that may occur as the result of unbalance (one times rotation), misalignment (two times rotational), vane pass (multiples of vane numbers), etc.

   Vibration shall be expressed in inches per second (IN/SEC) velocity peak. The values below are consistent with similar existing equipment histories. Four copies of the final report for each piece of equipment shall be submitted to the Engineer for final approval.

   a. Rotary lobe blowers mounted on resilient vibration isolators, operating at 1200 RPM or less shall not exceed 0.450 IN/SEC in any one direction.

   b. Rotary lobe blowers, reciprocating type compressors and rotary lobe pumps which are mounted on fixed bases and operating at 1800 RPM or less shall not exceed 0.150 IN/SEC in any one direction.

   c. Progressive cavity pumps, centrifugal pumps, centrifugal fans and centrifugal blowers and motors operating from 900 RPM to 1800 RPM shall not exceed 0.075 IN/SEC in any one direction.

   d. Centrifugal compressors, centrifugal fans, blowers and motors operating at 3600 RPM shall not exceed 0.050 IN/SEC in any one direction.

   e. Vertical mounted motor and pump units operating at 1100 RPM or less shall not exceed 0.100 IN/SEC in any one direction.

   f. Vertical mounted motor and pump units operating at 1100 RPM to 1800 RPM shall not exceed 0.075 IN/SEC in any one direction.

4. General Machinery Vibration Severity Chart - The Chart, attached at this end of this section, shall be used to cross-reference displacement with frequency to determine vibration severity. For the equipment whose vibration requirements are not specified hereinbefore, the acceptable level of vibration shall be within "VERY GOOD" region or better (vibration

velocity of 0.0392 IN/SEC or lower) in the Chart.

When using the General Machinery Vibration Severity Chart, the following factors shall be taken into consideration:

a. The Chart applies only to measurements taken on the bearings or structure of the machine. The Chart does not apply to measurements of shaft vibration.

b. The Chart applies primarily to machines which are rigidly mounted or bolted to a fairly rigid foundation. Machines mounted on resilient vibration isolators such as coil springs or rubber pads will generally have higher amplitudes of vibration than those rigidly mounted. However, this rule should not be applied to high frequencies of vibration such as those characteristic of gears and defective rolling-element bearings, as the amplitudes measured at these frequencies are less dependent on the method of machine mounting.

SP-50 Training

Provide the services of knowledgeable, technically competent, factory-trained specialists to instruct Pumping Station personnel in the operation and maintenance of the equipment and system components listed herein. The City will furnish training classroom space.

1. Coordinate services with the City, with a minimum of 30 days prior notice.

2. Provide a combination of classroom and "hands-on" instruction designed to completely familiarize operating and maintenance personnel with the systems theory, standard operating procedures, safety features and emergency procedures, and general maintenance of all components.

3. Conduct all training at the Pump Station during regular hours on weekdays.

Provide training for the following equipment:

| **Equipment** | **Minimum Hours of Training** |
|---|---|
| Wastewater Pumps | 4 |
| Pump Controls | 4 |
| Adjustable Frequency Drives | 4 |
| 480 Volt Switchgear | 4 |
| Motor Control Centers | 4 |
| General Controls and Instrumentation | 4 |

Credentials: Submit for approval, credentials of equipment manufacturer representatives who are to be course instructors at least 14 days prior to a proposed training session.

Scheduling: Submit training outline and other information for approval at least 14 days prior to the proposed date for the training sessions. Verify scheduling with the City at least 14 days prior to the training sessions.

Number of Copies: For each training class, provide instructional material for at least ten attendees plus five extra copies, plus duplicate copies of all audio-visual aids utilized during each training course.

Training Topic Detail: Describe "hands-on" demonstrations planned for the training. Reference training aids to be utilized in the training (i.e. video tapes, slides, transparencies) and attach where applicable.

Training Outline:

1. Equipment Operation

    a. Describe equipment's operating (process) function.

    b. Describe equipment's fundamental operating principles and dynamics.

    c. Identify equipment's mechanical, electrical and electronic components and features.

    d. Identify all support equipment associated with the operation of the subject equipment.

1. Detailed Component Description

    a. Identify and describe in detail each component's function.

    b. Where applicable, group related components into subsystems.

    c. Identify, and describe in detail, equipment safety features and control interlocks.

3. Equipment Preventive Maintenance

    a. Describe preventive maintenance inspection procedures required to perform and inspect the equipment in operation, and spot potential trouble symptoms (anticipate breakdowns).

    b. Outline recommended routine lubrication and adjustments (preventive maintenance).

4. Equipment Troubleshooting

    a. Define recommended systematic troubleshooting procedures.

    b. Provide component specific troubleshooting checklists.

    c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.

5. Equipment Corrective Maintenance

    a. Describe recommended equipment preparation requirements.

    b. Identify and describe the use of special tools required for maintenance of the equipment.

    c. Describe component removal/installation and disassembly/ assembly procedures.

    d. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.

    e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.

    f. Define recommended torquing, mounting, calibration, and alignment procedures and settings, as appropriate.

SP-51 Programmed Controls Equipment

Prior to acceptance of computers and programmable logic controllers, the Contractor shall meet the following requirements:

A full set of the original software media and licenses and documentation for all software items used on the equipment shall be provided to the City. All unique configuration files and databases shall be included in as-built documents and in disk format containing itemized filename lists and ASCII Source listings of each. All unique hardware, wiring schemes and dip switch settings, exact as-built program listings, and digital configurations shall be included in the as-built documents.

No aspect of programmed controls equipment shall have any security or access controls which are not totally in the control of the City. No programmed software self-destructs, of any type, shall be allowed. The software shall allow unlimited restorations and backups from any appropriate storage media, to all appropriate equipment.

No Software Restriction Plug-in Modules or Software Activation Keys shall be allowed in any system, unless spare modules and keys are on hand for immediate disaster recovery.

Any part, whether hardware, software, or logical for which spare parts are not readily available; whose function or programming is not fully explained in documentation; or which in any way is not able to be replaced, restored, reprogrammed, and immediately placed back into service by the City using the as-built data, program listings, software media, and other resources provided shall not be accepted by the City.

All security information and data, including security bypass procedures for all approved security features, shall be fully documented to the City prior to acceptance. All unique patch cords,

cables, connectors, tools, and appurtenant programming devices necessary to restore and maintain programming shall be supplied for use by the City and demonstrated in the appropriate training sessions.

The training for all programmed controls equipment shall include instructions on operation and maintenance of hardware and software. The training shall also demonstrate the full backup and restoration of all software after total equipment failure utilizing reinstallation procedures that accommodate unique hardware requirements, unique configuration files and databases, unique dip switch settings, and unique wiring information. The appropriate City personnel shall be trained to bypass all approved security features of all such equipment. The backup and restoration training shall use the actual as-built information and all unique appurtenances and itemize all such documentation and appurtenances to show that these items are complete.

SP-52 Operation and Maintenance Manual, Submittals / Request for Information / Shop Drawings, and Asset Tracking Form

Operation and Maintenance Manuals

The Contractor shall prepare and submit to the Engineer four (4) hardcopies and one (1) high resolution color, bookmarked, and unsecured electronic portable document format (PDF) of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed under this Contract. Black and white copies will not be accepted. When the work reaches 75 to 80 percent completion, the Contractor shall submit to the Engineer for approval one (1) hardcopy and one (1) PDF electronic copy of the manual with all specified material that is available at that time. The submittal shall accompany the Contractor's partial payment request for the specified completion. Within 30 days after approval of the Engineer of the PDF submittal, the Contractor shall furnish to the Engineer four (4) hardcopies of the manual. Appropriate space shall be left in the manual for material not available at the time of submittal. All missing material for the manual shall be submitted prior to the request for final payment.

Also along with the missing material submitted with the request for final payment, one electronic copy (in pdf format) complete with all the missing material to be included in the earlier submitted hard copies shall be submitted. The manual shall be prepared and arranged as follows:

1. Space shall be provided in the manual for a reduced set of record Contract Drawings, size approximately 11 by 17 inches and folded to 8-1/2 by 11 inches. Drawings will be furnished by the Engineer.

2. One copy of all approved shop drawings and diagrams for all equipment furnished. The shop drawings and diagrams shall be reduced to either 8-1/2 by 11 inches or to 11 inches in the vertical dimension and as near as practicable to 17 inches in the horizontal dimension. Such sheets shall be folded to 8-1/2 by 11 inches.

3. One copy of manufacturer's operating, lubrication and maintenance instructions for all equipment and controls furnished. All equipment operating, lubrication and maintenance

instruction and procedures shall be furnished on 8-1/2 by 11 inch commercially printed or typed forms. Such forms shall include equipment name, serial number and other identifying references.

4. One copy of manufacturer's spare parts list for all equipment furnished and prepared as specified in No. 3 above.

5. One valve schedule, giving the valve number, location, fluid and fluid destination for each valve installed and prepared as specified in No. 3 above. All valves in the same piping system shall be grouped together in the schedule. A sample of the valve numbering system to be used will be furnished by the Engineer. Valve numbers may include three or four numerals and a letter.

6. List of electrical relay settings and control and alarm contact settings.

Each copy of the manual shall be assembled in one or more binders, each with title page, typed table of contents, and heavy section dividers with copper reinforced holes and numbered plastic index tabs. Each manual shall be divided into sections headed by the equipment specification section included in "Workmanship and Materials." Binders shall be 3-ring hard-back. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The cover and binding edge of each manual shall have the project title, Division designation and manual title printed thereon, all as furnished and approved by the Engineer.

Where more than one binder is required, they shall be labeled Vol. 1, Vol. 2, and so on. The table of contents for the entire set, identified by volume number, shall appear in each binder.

The four (4) hardcopies of the manuals and data included therein shall be provided in conformance with the subsection headed "Working Drawings" and, in addition, to the requirements of the General Provisions. The costs of the Operation and Maintenance Manual shall be included in the various Contract Items, or in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

Submittals / Request for Information / Shop Drawings

Contractor shall prepare and submit a minimum four (4) hardcopies and one (1) bookmarked, unsecured electronic portable document format (PDF) file for all Submittals, RFI, and Shop Drawings. The City will review the submittals and return one (1) hardcopy and PDF file of the marked up submittal to the contractor. The contractor shall have approved hard copies of all submittals at the job site. Each electronic submission must be in a high resolution color format and shall be original electronic documents from the manufacturer. Hardcopies shall be high quality printed in color. Scanned printouts or poor quality resolution PDF files will not be accepted.

Asset Tracking Form

The Asset Tracking Form (ATF) is a general spreadsheet that is intended to begin

tracking assets and their respective preventative maintenance at an early stage in the project. An ATF shall be prepared and submitted by Contractor (in electronic format) during two phases of the project. The first phase ATF shall be submitted after procurement of each piece of equipment and will include general information and specifications on the equipment such as, but not limited to, model, voltage, amperage, horsepower, material, and preventative maintenance tasks. The second ATF submission shall accompany the final submission of the Operation and Maintenance Manuals. Information included during this submission will include specific information on the equipment such as, but not limited to, serial numbers, equipment number, location, runtime hours, etc.

The City of Tampa Wastewater personnel will provide a blank electronic copy of the ATF in Microsoft Office 2007. Any submission must be in the same format.

SP-53 Disposal of Debris

The Contractor will be permitted to transport and dispose debris at the Howard F. Curren AWT Plant at 2700 Maritime Boulevard between the hours of 6:00 a.m. to 6:00 p.m., as directed by the Engineer. Within 30 days after the completion of the work, the Contractor shall Coordinate with Plant personnel for hauling the stored debris from the Treatment Plant to an approved disposal site.

In addition, the Contractor will have the following responsibilities:

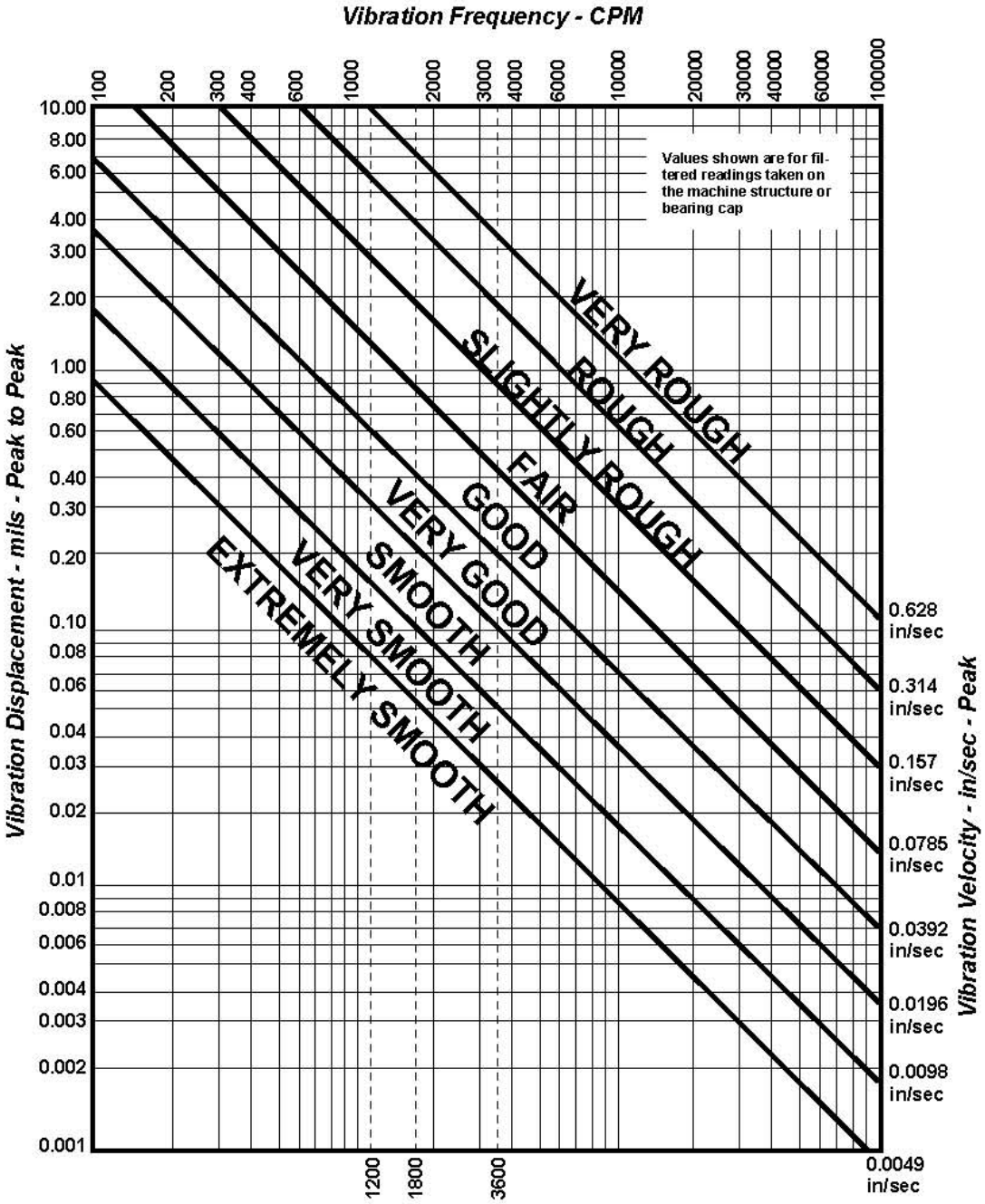
1. Be solely responsible to handle, transport, test, permit, and dispose of debris in accordance with all applicable regulatory requirements.
2. For transportation between project site and the Treatment Plant.
3. To apply for, pay fees, and obtain all required environmental or transportation permits prior to handling debris. Permitting agencies include, but are not limited to, EPA, DER, DOT, Hillsborough County, City of Tampa, and Expressway Authority.
4. To perform all necessary tests as required by permit and all applicable regulatory requirements.
5. The Contractor is responsible to pay all applicable disposal fees.

SP-60 Contingency

The Contractor shall include a One Hundred Thousand Dollar ($100,000) contingency sum, to be included as part of the total bid amount for this contract. The contingency is for the purpose of compensating the Contractor for any incidental work that may arise as construction operations proceed and was not addressed as part of the original work portrayed in the Plans and Specifications.

The One Hundred Thousand Dollar ($100,000) contingency sum is an upset limit. Any amount of the contingency shall be paid only after negotiation.

## GENERAL MACHINERY VIBRATION SEVERITY CHART




**condition management solutions**

* * *

# City of Tampa – DMI Sub-(Contractors/Consultants/Suppliers) Payments

*(FORM MBD-30)*

[ ] Partial [ ] Final

Contract No.: _____ WO#,(if any):_____ Contract Name:_____

Contractor Name:_____ Address:_____

Federal ID:_____ Phone:_____ Fax:_____ Email:_____

GC Pay Period:_____ Payment Request/Invoice Number:_____ City Department:_____

Total Amount Requested for pay period: $_____ Total Contract Amount(including change orders):$_____

-Type of Ownership - (F=Female M=Male), BF BM = African Am., HF HM = Hispanic Am., AF AM = Asian Am., NF NM = Native Am., CF CM = Caucasian S = SLBE

| Type<br>Trade/Work Activity<br>[]Sub []Supplier<br>Federal ID | Company Name<br>Address<br>Phone & Fax | Total Sub Contract Or PO Amount | Amount Paid To Date<br>Amount Pending Previously Reported | Amount To Be Paid For This Period<br>Sub Pay Period Ending Date |
|---|---|---|---|---|
| | | | $ | $ |
| | | | | |
| | | | $ | $ |
| | | | | |
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| | | | $ | $ |
| | | | | |

(Modifying This Form or Failure to Complete and Sign May Result in Non-Compliance)

Certification: I hereby certify that the above information is a true and accurate account of payments to sub – contractors/consultants on this contract.

Signed:_____ Name/Title:_____ Date:_____



**Note: Detailed Instructions for completing this form are on the next page**

# Page 2 of 2 – DMI Payment

## Instructions for completing The DMI Sub-(Contractors/Consultants/ Suppliers) Payment Form (Form MBD-30)

This form must be submitted with all invoicing or payment requests where there has been subcontracting rendered for the pay period. If applicable, after payment has been made to the subcontractor, "Waiver and Release of Lien upon Progress Payment", "Affidavit of Contractor in Connection with Final Payment", or an affidavit of payment must be submitted with the amount paid for the pay period. The following will detail what data is required for this form. The instructions that follow correspond to the headings on the form required to be completed. **(Modifying or omitted information from this form my result in non-compliance).**

- **Contract No.** This is the number assigned by the City of Tampa for the bid or proposal.
- **W.O.#** If the report covers a work order number (W.O.#) for the contract, please indicate it in that space.
- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business.
- **Address.** The physical address of your business.
- **Federal ID.** A number assigned to a business for tax reporting purposes.
- **Phone.** Telephone number to contact business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **Pay Period.** Provide start and finish dates for pay period. (e.g. 05/01/13 – 05/31/13)
- **Payment Request/Invoice Number.** Provide sequence number for payment requests. (ex. Payment one, write 1 in space, payment three, write 3 in space provided.)
- **City Department**. The City of Tampa department to which the contract pertains.
- **Total Amount Requested for pay period.** Provide all dollars you are expecting to receive for the pay period.
- **Total Contract Amount (including change orders).** Provide expected total contract amount. This includes any change orders that may increase or decrease the original contract amount.
- **Signed/Name/Title/Date**. This is your certification that the information provided on the form is accurate.
- **See attached documents.** Check if you have provided any additional documentation relating to the payment data. Located at the bottom middle of the form.
- **Partial Payment.** Check if the payment period is a partial payment, not a final payment. Located at the top right of the form.
- **Final Payment.** Check of this period is the final payment period. Located at the top right of the form.

The following instructions are for information of any and all subcontractors used for the pay period.

- **(Type) of Ownership.** Indicate the Ethnicity and Gender of the owner of the subcontracting business or SLBE.
- **Trade/Work Activity.** Indicate the trade, service, or material provided by the subcontractor.
- **SubContractor/SubConsultant/Supplier.** Please indicate status of firm on this contract.
- **Federal ID.** A number assigned to a business for tax reporting purposes. This information is critical in proper identification of the subcontractor.
- **Company Name, Address, Phone & Fax**. Provide company information for verification of payments.
- **Total Subcontract Amount.** Provide total amount of subcontract for subcontractor including change orders.
- **Amount Paid To Date.** Indicate all dollars paid to date for the subcontractor.
- **Amount Pending, Previously Reported.** Indicate any amount previously reported that payments are pending.
- **Amount To Be Paid for this Period.** Provide dollar amount of dollars requested for the pay period.
- **Sub Pay Period Ending Date.** Provide date for which subcontractor invoiced performed work.

*Forms must be signed and dated or will be considered incomplete. The company authorized representative must sign and certify the information is true and accurate. Failure to sign this document or return the document unsigned can be cause for determining a company is in non-compliance of Ordinance 2008-89.*

If any additional information is required or you have any questions, you may call the Minority Business Development Office at (813) 274-5522.

**SIGN EXAMPLE ONLY GRAPHIC TO BE DEVELOPED BY CONTRACTOR**

3"

scale: 3"

## *Sign Information*

***Building a Better Tampa***

**Downtown Riverwalk**

***Creates a waterfront pedestrian walkway connecting the south edge of the CapTrust building with MacDill Park.***

*$1.5 Million investment*
*Scheduled for completion in October 2012*

*Orion Marine*
*Construction, Inc.*

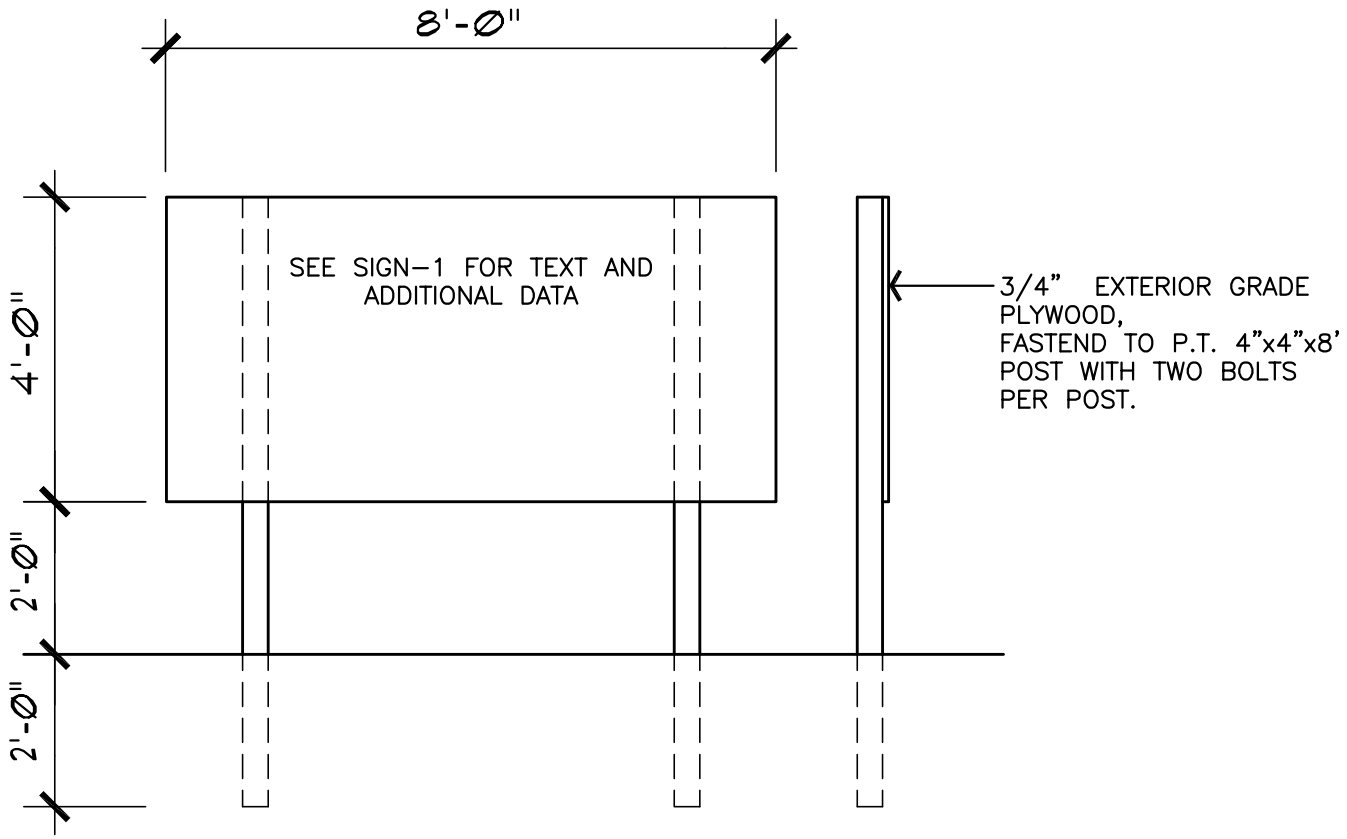
### Colors

Blue: Sherwin Williams Naval SW6244
Green: Sherwin Williams Center Stage SW6920
White: Sherwin Williams Pure White SW7005

### Font

Franklin Gothic

K:\CA\edr\dpw project sign 4-28-04.dwg, 08/22/2005 12:32:38 PM, pw1m



# SECTION 1
# EXCAVATION - EARTH AND ROCK

## W-1.01 General

Open cut excavations shall be made to the widths and depths necessary for constructing all structures, pipelines and other conduits included in the Contract, according to the Plans, and including the excavation of any material which, in the opinion of the Engineer, is desirable to be excavated for any purpose pertinent to the construction of the work. Banks more than 5 feet high, where a danger of slides or cave-ins exists, shall be shored or sloped to the angle of repose.

Where excavations are to be made below groundwater, the Contractor shall submit to the Engineer for approval, in detail, his proposed method for control of groundwater, including a description of the equipment he plans to use and the arrangement of such equipment. No such excavation shall be started until approval of the Engineer has been obtained. Dewatering work shall be included in the Contract Items for pipelines, box culverts, inlets, manholes and other structures, and pumping stations, and no separate payment will be made therefor.

## W-1.02 Clearing

The site of all open cut excavations shall first be cleared of obstructions preparatory to excavation. This includes the removal and disposal of vegetation, trees, stumps, roots and bushes, except as specified under the subsection headed "Trench Excavation."

## W-1.03 Authorized Additional Excavation

In case the materials encountered at the elevations shown are not suitable, or in case it is found desirable or necessary to go to an additional depth, or to an additional depth and width, the excavation shall be carried to such additional depth and width as the Engineer may direct in writing. The Contractor shall refill such excavated space with either Class D concrete, or select sand or crushed stone fill material, as ordered. Where necessary, fill materials shall be compacted to avoid future settlement. Additional earth excavations so ordered and concrete, or selected sand or crushed stone fill material ordered for filling such additional excavation and compaction of select sand or crushed stone fill material will be paid for under the appropriate Contract Items or where no such items exist, as extra work as specified in Article 7 of the Agreement.

## W-1.04 Unauthorized Excavation

Wherever the excavation is carried beyond or below the lines and grades shown or given by the Engineer, except as specified in the subsection headed "Authorized Additional Excavation," all such excavated space shall be refilled with such material and in such manner as may be directed in order to ensure the stability of the various structures. Spaces beneath all manholes, structures or pipelines excavated without authority shall be refilled by the Contractor at his own expense, with Class D concrete, or select sand or crushed stone fill material, and properly compacted, as ordered by the Engineer, and no separate payment will be made therefor.

W-1.05 Segregation and Disposal of Material

Topsoil suitable for final grading and landscaping and excavated material suitable for backfilling or embankments shall be stockpiled separately on the site in locations approved by the Engineer. Excavated and other material shall not be stored nearer than 4 feet from the edge of any excavation and shall be so stored and retained as to prevent its falling or sliding back into the excavation. Surplus excavated material and excavated material unsuitable for backfilling or embankments shall become the property of the Contractor and shall be transported, as approved by the Engineer, away from the site of the work to the Contractor's own place of disposal.

W-1.06 Shoring and Sheeting

All excavations shall be properly shored, sheeted, and braced or cut back at the proper slope to furnish safe working conditions, to prevent shifting of material, to prevent damage to structures or other work, and to avoid delay to the work, all in compliance with the U. S. Department of Labor Safety and Health Regulations for Construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54). The minimum shoring, sheeting and bracing for trench excavations shall meet the general trenching requirements of the safety and health regulations. Before starting excavation for jacking pits and structures, the Contractor shall submit complete design calculations and working drawings of proposed sheeting and bracing arrangements which have been prepared, signed and sealed by a Professional Engineer registered in the State of Florida. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough, in the opinion of the Engineer, to provide ample strength. If the Engineer is of the opinion that at any point the sheeting or supports furnished are inadequate or unsuited for the purpose, he may order additional sheeting or supports to be installed. Whether or not such orders are issued, the sole responsibility for the design, methods of installation, and adequacy of the sheeting and supports shall be and shall remain that of the Contractor.

Tight sheeting shall be used in that portion of the excavation in City collector and arterial streets and in State and County highways below the intersection of a 1 on 1 slope line from the edge of the existing pavement to the nearest face of the excavation.

In general, sheeting for pipelines shall not be driven below the elevation of the top of the pipe. If it is necessary to drive the sheeting below that elevation in order to obtain a dry trench or satisfactory working conditions, the sheeting shall be cut off at the top of the pipe and left in place below the top of the pipe at no additional cost.

The sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures except as otherwise shown or directed. Voids left by the withdrawal of the sheeting shall be carefully filled by ramming or otherwise as directed.

Permission of the Engineer shall be obtained before the removal of any shoring, sheeting, or bracing. Such permission by the Engineer shall not relieve the Contractor from the responsibility for injury or to other property or persons from failure to leave such sheeting and bracing in place.

W-1.07 Sheeting Left in Place

The Engineer may order, in writing, any or all sheeting or bracing to be left in place for the purpose of preventing injury to the structures or to other property or to persons, whether such sheeting or bracing was shown on the Plans or placed at his direction or otherwise. If left in place, such sheeting shall be cut off at the elevation ordered, but, in general, such cutoffs shall be at least 18 inches below the final ground surface. Bracing remaining in place shall be driven up tight.

The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders.

Sheeting and bracing left in place, by written order of the Engineer, will be paid for under the appropriate Contract Item if included in the Proposal or otherwise by provisions of extra work as specified in Section 7 of the Agreement.

W-1.08 Removal of Water

At all times during the excavation period and until completion and acceptance of the work at final inspection, ample means and equipment shall be provided with which to remove promptly and dispose of properly all water entering any excavation or other parts of the work. The excavation shall be kept dry. No water shall be allowed to rise over or come in contact with masonry and concrete until the concrete and mortar have attained a set satisfactory to the Engineer and, in any event, not sooner than 12 hours after placing the masonry or concrete. Water pumped or drained from the work hereunder shall be disposed of in a safe and suitable manner without damage to adjacent property or streets or to other work under construction. Water shall not be discharged onto streets without adequate protection of the surface at the point of discharge. No water shall be discharged into sanitary sewers. No water containing settleable solids shall be discharged into storm sewers. Any and all damage caused by dewatering the work shall be promptly repaired by the Contractor.

W-1.09 Structure Excavation

Excavations shall be of sufficient size and only of sufficient size to permit the work to be economically and properly constructed in the manner and of the size specified. The bottom of the excavation in earth and rock shall have the shape and dimensions of the underside of the structure wherever the nature of the ground will permit.

W-1.10 Trench Excavation

Before starting trench excavation, all obstructions which are to be removed or relocated shall be cleared away. Trees, shrubs, poles, and other structures which are to be preserved shall be properly braced and protected. All trees and large shrubs shall be preserved with damage to the root structure held to a minimum, unless otherwise shown or specified. Small shrubs may be preserved or replaced with equivalent specimens.

The width of trenches shall be such as to provide adequate space for workmen to place, joint, and backfill the pipe properly, but shall be kept to a minimum. Unless otherwise approved by the Engineer, the clear width of the trench at the level of the top of the pipe shall not exceed the sum of the outside diameter of the pipe barrel plus 24 inches.

In sheeted trenches, the clear width of the trench at the level of the top of the pipe shall be measured to the inside of the sheeting.

Should the Contractor exceed the maximum trench widths specified above, without written approval of the Engineer, he may be required to provide, at his own expense, concrete cradle or encasement for the pipe as directed by the Engineer, and no separate payment will be made therefor.

The Contractor shall excavate trenches to the respective depths, below the bottom of the pipe, for the various classes of pipe bedding shown on the Plans so that pipe bedding material can be placed in the bottom of the trench and shaped to provide a continuous, firm bearing for the pipe barrel and bells.

If unstable material is exposed at the level of the bottom of the trench excavation, it shall be excavated in accordance with the subsection headed “Authorized Additional Excavation.” When in the judgment of the Engineer the unstable material extends to an excessive depth, he may advise the Contractor in writing to stabilize the trench bottom with a crushed stone, sand mat or gravel mat to ensure firm support for the pipe by other suitable methods. Payment for such trench stabilization will be made under the appropriate Contract Items or where no such items exist, as extra work as specified in Section 7 of the Agreement.

The open excavated trench preceding the pipe laying operation and the unfilled trench with pipe in place shall be kept to a minimum length causing the least disturbance to traffic and use of adjacent property. Ladders shall be provided and so located as to provide means of exit from the trench without more than 25 feet of lateral travel.

W-1.11 Rock Excavation

The term “rock” as used herein shall include all materials which have compressive strengths in excess of 300 psi in their natural undisturbed state and which, in the opinion of the Engineer, require drilling and blasting, wedging, sledging, barring or breaking with power tools not otherwise required for normal excavating.

Rock shall be excavated, within the boundary lines and grades as shown on the Plans, specified, or given by the Engineer. Rock removed from the excavation shall become the property of the Contractor and shall be removed by him away from the site of the work to his own place of disposal, and no separate payment will be made therefor.

All shattered rock and loose pieces shall be removed.

For trench excavation in which pipelines or other conduits are to be placed, the rock shall be excavated to a minimum depth of 6 inches below the bottom of the pipe and the excavated space refilled with pipe bedding material. Placing, compacting, and shaping pipe bedding material shall be included in the various classified unit price Contract Items for pipelines, and no separate payment will be made therefor.

For manhole excavation, the rock shall be excavated to a minimum depth of 8 inches below the bottom of the manhole base for pipelines 24 inches in diameter and larger, and 6 inches below the bottom manhole base for pipelines less than 24 inches in diameter and the excavated space refilled with crushed stone. Placing, compacting, and shaping crushed stone for manhole bases shall be included in the appropriate Contract Items for manhole bases, and no separate payment will be made therefor.

For cast-in-place structures, the rock shall be excavated only to the bottom of the structure or foundation slab.

Excavated space in rock below structures, pipelines, and manholes which exceeds the depths specified above shall be refilled with Class D concrete, crushed stone, or other material as directed by the Engineer. Refilling of over-excavated rock in rock shall be included as part of the rock excavation, and no separate payment will be made therefor.

Where applicable, the requirements of the subsections on “Trench Excavation” and “Structure Excavation” shall be followed.

Blasting may be performed only when approved by the Engineer and authorized by the Agency having jurisdiction over the subject location and in accordance with all laws, ordinances, and regulations of the Agency.

* * *

# SECTION 2
# BACKFILLING

## W-2.01 General

All excavation shall be backfilled to the original surface of the ground or to such other grades as may be shown or directed. For areas to be covered by topsoil, backfill shall be left 4 inches below the finished grade or as shown on the Plans. The time elapsing before backfilling is begun shall be subject to the approval of the Engineer. In all backfilling, all compressible and destructible rubbish and refuse which might cause later settlement and all lumber and braces shall be removed from the excavated space before backfilling is started, except that sheeting and bracing shall be left in place or removed as the work progresses.

Construction equipment used to backfill against and over cast-in-place concrete structures shall not be permitted to travel over these structures until the designated concrete strength has been obtained as verified by concrete test cylinders. In special cases where conditions warrant, as determined by the Engineer, the above restriction may be modified if the concrete has gained sufficient strength, as determined from test cylinders, to satisfy design requirements for the removal of forms and the application of load.

## W-2.02 Unsuitable Backfill Material

Before backfilling around structures, all rubbish shall be removed from behind the walls.

When the excavated material contains garbage, cinders, glass, tin cans, wood, or other trash or objectionable organic material, as determined by the Engineer, it shall not be used for backfill but shall be disposed of by the Contractor away from the site of the work to his own place of disposal. The unsuitable materials shall be replaced with backfill material which shall be sand, clay, gravel, sandy loam, or other excavated material free of objectionable organic matter, as approved by the Engineer.

## W-2.03 Select Fill Material - General

Select fill material shall be used for pipe bedding, manhole bedding, trench and structure backfill, and other purposes as shown on the Plans, specified, and ordered in writing by the Engineer.

Select fill material shall be sand, conforming to the requirements of the subsections headed “Select Fill Material - Sand” or crushed stone or limestone screenings, conforming to the requirements of the subsection headed “Select Fill Material - Crushed Stone.”

## W-2.04 Select Fill Material - Sand

Sand used for pipe bedding or as select fill material for trench or structure backfill shall consist of job excavated sand or imported sand which can be readily and thoroughly compacted. Sand shall be reasonably well graded and shall fall within the following gradation limits:

Passing No. 4 sieve - 95 percent (minimum)
Passing No. 200 sieve - 10 percent (maximum)

Sand containing more than 10 percent of material passing the No. 200 sieve or sand which, in the opinion of the Engineer, would have a tendency to flow under pressure when wet will not be acceptable for use as pipe bedding or select fill material for trench or structure backfill

Sand shall not be used for bedding for manholes or other structures.

W-2.05 Select Fill Material - Crushed Stone

Crushed stone used for pipe bedding, manhole base bedding, or as select fill material for trench or structure backfill shall consist of clean, durable rock, angular in shape, which can be readily and thoroughly compacted. Crushed stone shall be reasonably well graded and shall be no greater than a No. 57 stone.

W-2.06 Pipe and Structure Bedding

All pipelines shall be bedded in well graded, compacted select fill material. Select fill material shall be sand, conforming to the subsection headed "Select Fill Material - Sand" and/or crushed stone, conforming to the subsection headed "Select Fill Material - Crushed Stone," as shown on the Plans, specified or ordered in writing by the Engineer. Pipe bedding shall be constructed in accordance with the details shown on the Plans.

When shown on the Plans or ordered in writing by the Engineer, pipelines (except PVC) shall be laid in Class D concrete cradle or encasement.

Precast concrete manhole bases shall be bedded on No. 57 stone, conforming to the subsection headed "Select Fill Material - Crushed Stone," as shown on the Plans.

Cast-in-place manhole bases and other foundations for structures shall be cast against undisturbed earth in clean and dry excavations.

Existing underground structures, tunnels, conduits and pipes crossing the excavation shall be bedded with compacted select fill material. Bedding material shall be placed under and around each existing underground structure, tunnel, conduit or pipe and shall extend underneath and on each side to a distance equal to the depth of the trench below the structure, tunnel, conduit or pipe.

W-2.07 Bedding Placement for Pipelines

Select fill material, used as pipe bedding, shall be placed by hand, in uniform layers not greater than 6 inches in loose thickness and thoroughly compacted in place. Select fill material pipe bedding shall extend to one foot over the top of the pipe.

Each layer of select fill shall be thoroughly tamped and compacted in place by hand or with suitable mechanical or pneumatic tools to a dry density not less than 95 percent of the maximum dry density as determined by AASHTO Des: T-180. No large stone fragments shall be placed in the pipe bedding nor closer than two feet to any point on any pipe.

W-2.08 Bedding Placement for Precast Concrete Manholes

No. 57 stone used for bedding beneath precast manhole bases shall be placed in uniform layers not greater than 6 inches in loose thickness and thoroughly compacted in place with suitable mechanical or pneumatic tools.

W-2.09 Structure Backfill

Backfill around manholes, risers, and structures shall be suitable job excavated material, selected fill material, or other material approved by the Engineer. Such backfill shall extend from the bottom of the excavation or top of structure bedding to the bottom of pavement base course, subgrade for lawn replacement, the top of the existing ground surface, or to such other grades as may be shown or given by the Engineer.

The backfill shall be placed in uniform layers not greater than 18 inches in loose thickness and thoroughly compacted in place with suitable mechanical or pneumatic tools to a dry density of not less than 98 percent of the maximum dry density as determined by AASHTO Des: T-180.

W-2.10 Trench Backfill

Trenches shall be backfilled from 1 foot over the top of the pipe to the bottom of pavement base course, subgrade for lawn replacement, to the top of the existing ground surface or to such other grades as may be shown or given by the Engineer. Trench backfill shall be select fill material, suitable job excavated material or other material, as approved by the Engineer.

Except under pavements and railroad tracks, trench backfill shall be placed in uniform layers not greater than 18 inches in loose thickness and thoroughly compacted in place using heavy-duty tampers such as pneumatic jackhammers with tamping foot attachment or vibrating rollers if required. Each layer shall be compacted to a dry density of not less than 95 percent of the maximum dry density as determined by AASHTO Des: T-180.

Where railroad tracks or pavements and appurtenances for streets or highways are to be placed over trenches, the trench backfill shall be placed in uniform layers not greater than 12 inches in loose thickness and thoroughly compacted in place with equipment as specified above. Each layer shall be compacted to a dry density of not less than 98 percent of the maximum dry density as determined by AASHTO Des: T-180. On City of Tampa streets, each layer shall be compacted as specified above to the bottom of the subbase which is defined as 10 inches below the bottom of the base course. The subbase shall be compacted to 98 percent of modified proctor.

Trench backfilling work shall be done in a manner to prevent dropping of material directly on top of any conduit or pipe through any great vertical distance. In no case shall backfilling material from a bucket be allowed to fall directly on a structure or pipe and in all cases, the bucket shall be lowered so that the shock of falling earth will not cause damage.

Lumps shall be broken up and if there are any stones, pieces of crushed rock or lumps which cannot be readily broken up, they shall be distributed throughout the mass so that all interstices are solidly filled with fine material.

W-2.11 Backfill for Short Tunnel

Where pipelines are placed in short tunnels, the annular space between the outside of the pipe wall and the tunnel wall shall be completely filled with select fill material or suitable excavated material. Pipelines in short tunnels shall be suitably supported, to permit placing backfill which shall be suitably tamped in place.

W-2.12 Finish Grading

Finish grading shall be performed to meet the existing contour elevations and grades shown on the Plans or given by the Engineer and shall be made to blend into adjacent natural ground surfaces. All finished surfaces shall be left smooth and free to drain.

Grading outside of pipelines or structure lines shall be performed in such a manner as to prevent accumulation of water within the area. Where necessary or where shown on the Drawings, finish grading shall be extended to ensure that water will be carried to drainage ditches, and the construction area left smooth and free from depressions holding water.

W-2.13 Responsibility for After Settlement

Any depression which may develop in backfilled areas from settlement within one year after the work is fully completed and accepted shall be the responsibility of the Contractor. The Contractor shall, at his own expense, provide as needed additional backfill material, pavement base replacement, permanent pavement sidewalk curb and driveway repair or replacement, and lawn replacement and shall perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved by the Engineer.

W-2.14 Inspection and Testing of Backfilling

All backfill shall be subject to test by the City with the assistance of the Contractor.

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# SECTION 7
# METAL CASTINGS

## W-7.01 General

Metal castings include all miscellaneous ferrous and nonferrous castings.

Wheel guards, valve boxes, manhole frames and covers, stop log grooves, brackets and supports for piping, gutter inlets, floor, roof and gallery drains, stormwater inlets, beehive grates and frames, cleanout covers, and special malleable iron castings and inserts are included in this classification.

## W-7.02 Materials

Metal castings shall meet the requirements of the following standards, except as otherwise specified herein.

| | |
|---|---|
| Gray Iron | ASTM Des: A 48 |
| Malleable Iron | ASTM Des: A 47 |
| Carbon Steel | ASTM Des: A 27 |
| Alloy Steel | ASTM Des: A 148 |
| Aluminum | ASTM Des: B 26 |
| Aluminum Bronze | ASTM Des: B 148 |
| Silicon Bronze | Navy Spec. 46B28 |
| Manganese Bronze | ASTM Des: B 132 or B 147 |
| Ductile Iron | ASTM Des: A 536 |

## W-7.03 Workmanship

Castings shall be made accurately to approved dimensions and shall be planed or ground where marked or where otherwise necessary to secure perfectly flat and true surfaces. Allowance shall be made in the patterns so that the specified thickness shall not be reduced. Manhole and cleanout frames and covers shall conform to the details shown on the Plans and shall be true and shall seat at all points. No plugging of defective castings will be permitted. All castings shall be erected to accurate grades and alignment, and when placed in concrete, they shall be carefully supported to prevent movement during concreting.

## W-7.04 Weights

No castings weighing less than 95 percent of the theoretical weight, based on required dimensions, will be accepted. The Contractor shall provide facilities for weighing castings in the presence of the Engineer, or shall furnish invoices showing true weights, certified by the supplier.

* * *

# SECTION 9
# DUCTILE IRON PIPE AND FITTINGS

## W-9.01 General

All ductile iron pipe shall meet the requirements of AWWA C151. The type and configuration of pipe bedding for buried pipe shall be as shown on the Plans. Coatings and linings for ductile iron pipe and fittings shall conform to the subsection headed "Coatings and Linings," contained herein. Pipe joints shall be bell and spigot, flanged, or mechanical joint as shown on the Plans.

Ductile iron pipe and ductile iron fittings buried in the ground for force mains or installed in pumping stations shall have a minimum thickness of Class 200 unless specified otherwise as shown on the Plans and shall have an interior lining as specified in the subsection "Lining for Ductile Iron Gravity Pipe."

## W-9.02 Flanged Pipe

Flanged pipe shall conform to the requirements of AWWA C115. Flanges shall be ductile iron and shall have long hubs. There shall be no leakage through the pipe threads, and the flanges shall be designed to prevent corrosion of the threads from outside. Flanged ductile iron pipe shall have a minimum thickness of Class 53.

## W-9.03 Fittings

All ductile iron fittings shall meet the requirements of AWWA C110, and have a pressure rating of 250 psi, or as specified, whichever is larger.

## W-9.04 Flanged Joints

Flanged joints shall meet the requirements of ANSI Specification B16.1. Flanges, flange facing drilling, and protecting shall be as specified for flanged pipe. Bolts and nuts for flanged joints shall be Type 316 stainless steel unless otherwise stated on the Plans or directed by the Engineer.

Except where otherwise directed by the Engineer, gaskets for flanged joints shall be of the full-face type, meeting the requirements of ANSI B16.21. Gaskets shall be made of plain rubber (SBR) rubber with cloth insertion, as made by the Garlock Packing Company, U.S. Rubber Company, or equal.

Flange adapters, shall be acceptable only where shown on the pans or directed by the Engineer. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10. Flange adapters shall be capable of deflection during assembly, or permit lengths of pipe to be field cut, to allow a minimum of 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal. The exterior and interior coating shall consist of a minimum of two coats of electrostatically and heat cured shop applied liquid thermoset epoxy.

Flange adapters shall be the Series 2100 Megaflange adapter, as manufactures by EBAA Iron, Inc. or equal.

W-9.05 Mechanical Joints

Mechanical joints shall meet the applicable requirements of AWWA C111.

W-9.06 Push-on Joints

Push-on joints shall be of the bell and spigot type which employs a single, elongated grooved gasket to effect the joint seal. Push-on joints shall meet the applicable requirements of AWWA C111.

W-9.07 Wall Castings, Connecting Pieces, and Special Fittings

Wall castings and connecting pieces, such as bell and bell, bell and spigot, bell and flange, flange and flange, flange and spigot, and flange and flare, shall meet the requirements of ANSI Specification A21.10. Unless otherwise shown or specified, fittings 14 inches and larger shall have a pressure rating of 250 psi.

Where special fittings are required, they shall be of an approved design and shall have the same diameters and thicknesses as standard fittings, unless otherwise required, but their laying lengths and other functional dimensions shall be determined by their positions in the pipelines and by the particular piping materials to which they connect.

Where watertightness is essential and at other locations where indicated, wall castings shall be provided with an integrally cast intermediate collar located at the center of the wall.

W-9.08 Sleeve-Type Couplings

Except where standard solid sleeves or split sleeves are shown or specified, sleeve-type couplings for ductile iron pipe shall be Style 38 couplings as made by Dresser Industries, Inc., or Type 411 as made by Smith-Blair, or equal. Gaskets shall be of molded rubber, Dresser Plain Grade 27, Smith-Blair 003, or equal. Middle rings shall be without a pipe stop and shall be at least 1/4 inch thick and 5 inches wide for 8-inch and smaller pipe, 3/8 inch thick and 7 inches wide for 10-inch through 30-inch pipe, and 1/2 inch thick and 10 inches wide for 36-inch and larger pipe with follower rings of appropriate thickness, unless otherwise shown or specified.

Sleeve-type couplings shall be shop coated with Dresser Red "D" Shop-Coat, Smith-Blair Standard Blue Shop Coat, or equal nontoxic material compatible with the finished coatings specified.

W-9.09 Coatings

Pipe which is to be buried shall have the standard outside coating specified in AWWA C151-8.1.

All ductile iron pipe and fittings shall have Protecto 401 ceramic epoxy lining.

The weight and class designation shall be painted conspicuously in white on the outside of each pipe, fitting, and special casting after the shop coat has hardened.

W-9.10 Harnessing

Ductile iron pipe and fittings with mechanical joints that require harnessing shall be provided with ductile iron retainer glands, Megalug, as manufactured by EBAA Iron, or equal. The glands shall be installed in accordance with the manufacturer's recommendations. Set screws shall be tightened to 75 foot-pounds torque. Where the glands are to be buried or not exposed to view, the assembly shall be given 2 heavy coats of asphalt varnish after installation. Ductile iron pipe and fittings with push-on joints that require harnessing shall be American Cast Iron Pipe "Flex-ring ", U.S. Pipe and Foundry Company "HP LOK", Griffin Pipe "Snap-Lok" or equal.

W-9.11 Lining for Ductile Iron Pipe

Ductile iron pipe and fittings shall be provided with a special interior lining where shown. The lining material shall be "Protecto 401" ceramic epoxy lining as manufactured by Induron Coatings or equal. All pipe joint bells shall be coated on the inside with the same lining material as used in the pipe barrel. All field cuts shall be field coated with the ceramic epoxy lining. The Contractor shall provide a minimum Dry Film Thickness (DFT) of 40 mils for shop lining and filed touch ups. Follow manufacturer's recommendation for maximum film thickness for shop lining and filed touch ups.

W-9.12 Polyethylene Encasement

Polyethylene encasement shall be installed on all ductile iron pipe and fittings within the sections indicated on the Plans or as directed by the Engineer and in accordance with ANSI/AWWA C105/A21.5.

Although not intended to be a completely air-and-water-tight enclosure, the polyethylene shall prevent contact between the pipe and the surrounding backfill.

Polyethylene encasement shall be installed in accordance with the pipe manufacturer's instructions, or in a manner acceptable to the Engineer. Polyethylene encasement shall extend 1 foot beyond the joint in both directions (a total of 2-foot overlap) and shall be adhered to said joint with 2-inch wide green marking tape. The slack width shall be taken up at the top of the pipe to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points. Upon installation of the encasement, any cuts or damaged portions of the polyethylene encasement shall be securely mended with tape or with a short length of polyethylene sheet, or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

Backfill material shall be the same as specified for pipe without polyethylene wrapping; however, extra care should be taken that the backfill be free from cinders, refuse, boulders, rocks, stones, or other materials that could damage the encasement. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

Because prolonged exposure to sunlight will deteriorate polyethylene film, such exposure prior to backfilling the wrapped pipe shall be kept to a minimum.

W-9.13 Ductile Iron Pipe Exterior Coating

All pipe and fittings shall have an exterior asphaltic coating conforming to the following requirements:

| | |
|---|---|
| Viscosity, KU at 25 degrees C | 56-60 |
| Flashpoint, degrees F (TCC) | 40 degrees F Min |
| Dry set to touch, minutes | 6 |
| Dry hard, minutes | 22 |

W-9.14 Force Main Identification

Ductile iron pipe sanitary force main shall be color coded by encasement in green polyethylene encasement, or where encasement is not required, it shall continuously spiral wrapped with 2-inch wide green stick-on vinyl tape prior to installation for permanent identification purposes. The tape shall have a minimum thickness of 6 mils with a minimum tensile strength of 22 pounds per inch and a minimum adhesive factor of 40 ounces per inch. The pipe shall be clean and dry when wrapped.

* * *

# SECTION 10
# PIPE CRADLES AND ENCASEMENT

## W-10.01 General

The Contractor shall furnish and place pipe cradles or pipe encasement, having dimensions as shown on the Plans, when specified in the Contract Items, when shown on the Plans, or when ordered in writing by the Engineer. Pipe cradles and pipe encasement shall be constructed of Class D concrete.

## W-10.02 Concrete Cradle for Pipe

When concrete cradle is to be provided, as shown on the Plans or ordered by the Engineer, the sewer or pipeline shall be laid to grade and supported on concrete blocks near each end. The tops of the blocks shall be shaped to conform to the dimensions of the pipe being laid and shall be set approximately 3/8 inch low. The pipe shall be placed on the blocks on stiff mortar of sufficient thickness to bring the pipes to exact grade. Timber blocking, or a type approved by the Engineer, may be employed in place of concrete blocks. The concrete cradle shall be placed against undisturbed earth on the bottom and sides of the trench. The Class D concrete shall be placed on one side only until it has risen above the invert on the other side, after which the remainder of the concrete shall be deposited on both sides. Suitable means shall be provided to prevent movement of the pipe during the placement of the concrete.

## W-10.03 Concrete Encasement of Pipe

The pipe shall be supported and the Class D concrete encasement shall be placed as specified under concrete pipe cradle. The concrete shall be placed against undisturbed earth on the bottom and sides of the trench and continued over the pipe to provide the required thickness of complete encasement.

* * *

# SECTION 11
# LAYING AND JOINTING PIPE FOR FORCE MAINS AND SEWERS

## W-11.01 General

The installation, delivery, transportation, unloading, and stringing of pipes, fittings, and accessories for force mains and sewers shall be done in accordance with AWWA C600 for ductile iron pipe and ASTM Des: C 12 for clay and concrete pipe and ASTM D 2321 and pipe manufacturer's recommendations for PVC pipe, as modified or supplemented by the specifications of this section and by the details shown on the Plans.

Proper and suitable tools and appliances for the safe and convenient cutting, handling, and laying of the pipe and fittings shall be used.

Suitable fittings shall be used where shown and at connections where grade or alignment changes require offsets greater than those recommended by the pipe manufacturer.

Pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until they are accepted in the completed work.

All lines shall be closed off with bulkheads when pipe laying is not in progress.

Before being laid, all pipe and specials shall be thoroughly examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having being installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor at his own expense.

Pipe shall be thoroughly cleaned before it is laid and shall be kept clean until it is accepted in the completed work. Special care shall be exercised to avoid leaving bits of wood, dirt, and other foreign particles in the pipe. If any such particles are discovered before the final acceptance of the work, they shall be removed and the pipe cleaned at the Contractor's expense.

Pipe laying for sewers shall begin at the low end of a run and proceed upgrade. Generally, all such pipe shall be laid with bells or grooves pointing uphill. Each pipe shall be carefully placed and checked for line and grade.

Adjustments to bring pipe to line and grade shall be made by scraping away or filling in granular material under the body of the pipe, but in no case by wedging or blocking up the barrel. The faces of the spigot ends and the bells shall be brought into fair contact, and the pipe shall be firmly and completely shoved home. As the work progresses, the interior of the pipelines shall be cleaned of all dirt and superfluous materials of every description. All lines shall be kept absolutely clean during construction. Pipelines shall be laid accurately to line and grade.

Gaskets for pipe joints shall be stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed. Any gaskets showing signs of checking, weathering, or other deterioration will be rejected.

Pipe shall be of the types, sizes, and classes shown on the Plans or as listed in the Contract Items.

Each piece of pipe shall be inspected and cleaned before it is lowered in the trench and any lumps or projections on the face of the spigot or tongue end or the shoulder shall be cut away. No cracked, broken, or defective pieces shall be used in the work.

Concrete pipe manufactured with a plastic sheet liner shall be laid so that the liner is on the crown of the pipe and placed symmetrically about the vertical centerline of the pipe.

Pipe laying will be permitted only in dry trenches having a stable bottom. Where groundwater is encountered, the Contractor shall make every effort to secure an absolutely dry trench bottom.

If, in the opinion of the Engineer, the Contractor has failed to obtain an absolutely dry trench bottom by improper or insufficient use of all known methods of trench dewatering, the Engineer may then order the Contractor to excavate below grade and place sufficient selected fill material, crushed stone, or Class D concrete over the trench bottom at the Contractor's own expense.

If all efforts fail to obtain this condition and the Engineer determines that the trench bottom is unsuitable for pipe foundation, he will order in writing the kind of stabilization to be constructed.

W-11.02 Transportation and Delivery

Every precaution shall be taken to prevent injury to the pipe during transportation and delivery to the site. Extreme care must be taken in loading and unloading the pipe and fittings. Such work must be done slowly with skids or suitable power equipment, and the pipe shall be under perfect control at all times. Under no condition shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe or coating. When handling the pipe with a crane, a suitable pipe hook or sling around the pipe shall be used. Under no condition shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends.

If in the process of transportation, handling, or laying, any pipe or special is damaged, such pipe or pipes shall be replaced or repaired by the Contractor at his own expense.

The Contractor shall furnish and install suitable blocking and stakes so as to prevent the pipe from rolling. The type of blocking and stakes, and the method of installation, shall be approved by the Engineer.

W-11.03 Pipe Laying - Trenches

Pipelines shall be laid in trench excavation on bedding material as specified under the Workmanship and Materials section headed "Backfilling," Class D concrete cradle or other foundations as shown on the Plans, specified, or ordered in writing by the Engineer. The pipe shall be properly secured against movement and pipe joints shall be made in the excavation as required.

The pipe bedding shall be carefully graded, compacted, and formed to fit the bottom quadrant of the pipe. Bell holes shall be cut out for each joint as required to permit the joint to be properly made and allow the barrel of the pipe to have full bearing throughout its length.

Where pipelines are laid in Class D concrete cradle or encasement, the installation shall conform to the requirements of the Workmanship and Materials section headed "Pipe Cradles and Encasements."

Pipelines laid on other type foundations shall be installed as specified for such other foundations or as directed in writing by the Engineer.

W-11.04 Lateral Detection Tape

Detectable underground marking tape shall be installed over all laterals from the edge of pavement to the property line. The tape shall be Lineguard encased aluminum foil, or equal. The 2-inch wide tape shall be APWA green and reverse printed bearing the identification of the sewer line below it and a warning such as "CAUTION."

The tape shall be buried 4-6 inches. After trench backfilling, the tape shall be placed in the backfill and allowed to settle into place with the backfill.

W-11.05 Mechanical Joints for Ductile Iron Pipe

In making up mechanical joints, the spigot shall be centered in the bell. The surface with which the rubber gasket comes in contact shall be cleaned thoroughly and the gasket shall be washed thoroughly with soapy water just prior to assembly of the joint. The gasket and gland shall be placed in position, the bolts inserted, and the nuts tightened fingertight. The nuts then shall be tightened by means of a torque wrench in such a manner that the gland shall be brought up evenly into the joint. The following range of bolt torques shall be applied:

| Bolt Size Inches | Range of Torque Foot-Pounds |
|---|---|
| 5/8 | 45 - 60 |
| 3/4 | 75 - 90 |
| 1 | 80 - 100 |
| 1-1/4 | 105 - 120 |

If effective sealing is not obtained at the maximum torque listed above, the joint shall be disassembled and reassembled after a thorough cleaning.

All bolts and nuts shall be field coated with a bituminous coating after assembly of the joint.

W-11.06 Push-on Joints for Ductile Iron Pipe

In making up push-on joints, the gasket seat in the socket shall be cleaned thoroughly and the rubber gasket shall be wiped clean with a cloth. The gasket shall be placed in the socket and a thin film of lubricant shall then be applied to the inside surface of the gasket that will come in contact with the entering pipe. The plain end of the pipe to be entered shall be cleaned thoroughly and placed in alignment with the bell of the pipe to which it is to be joined. The joint shall be made up by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket.

W-11.07 Joining Clay Pipe

The joining of clay pipe with flexible plastic joints shall be done in accordance with the manufacturer's instructions. The joint surface on both the bell and spigot ends shall be wiped clean and coated with a lubricant furnished by the manufacturer to facilitate assembly. The spigot end shall be inserted in the bell and pressure applied sufficient to seat the pipe properly. After the joint has been completed, any voids in the excavation beneath the spigot shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-11.08 Joining of PVC Pipe-Gravity

The assembly of gasketed joints shall be performed as recommended by the pipe manufacturer. In all cases clean the gasket and bell, especially the groove area and the spigot area, with a rag, brush or paper towel to remove any dirt or foreign material before the assembly. Lubricant shall be applied as specified by the pipe manufacturer.

Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Apply firm steady pressure either by hand or by bar and block assembly until the spigot easily slips through the gasket.

If undue resistance to insertion of the pipe end is encountered or the reference mark does not position properly, disassemble the joint and check the position of the gasket. If it is twisted or pushed out of its seat ("rolled"), inspect components, repair or replace damaged items, clean the components, and repeat the assembly steps. Be sure both pipe lengths are in concentric alignment. If the gasket was not out of position, verify proper location of the reference mark.

To join field-cut pipe, first square cut the pipe end. Use a factory-finished beveled end as a guide for proper bevel angle and depth of bevel plus the distance to the insertion reference mark. Bevel the end using a pipe beveling tool or a wood rasp which will cut the correct taper. Round off any sharp edges on the leading edge of the bevel.

W-11.09 Joining Concrete Pipe

Before joining concrete pipe using flexible rubber gaskets, the joint surfaces of both the bell and spigot (tongue and groove) ends shall be wiped clean. Any lumps, projections, burrs, or chips which would interfere with the proper compression of the gasket shall be repaired. The spigot or tongue end with the gasket in place and with all surfaces lubricated as recommended by the manufacturer, shall be inserted into the bell or groove. Pressure shall be applied to seat the pipe properly in the bell or groove. Voids under the pipe shall be tamped full of granular material to provide full bearing for the pipe.

Curves for reinforced concrete pipe sewers shall be constructed with standard pipe where the opening of the joint on the outside of the curve is less than 1/2 inch. Where greater opening of the joint would be required, the curves shall be constructed using beveled or radius pipe with standard joints.

Curves for reinforced concrete pressure pipe or prestressed concrete pipe shall be constructed with standard pipe sections, where the opening of the joint on the outside of the curve is less than 1/2 inch, or with beveled pipe, precast elbows or combination of these methods.

W-11.10 Concrete Pipe Rubber Gasket Joints

Rubber gaskets shall be of the O-ring type or equivalent cross section approved by the Engineer. The composition and properties of the gaskets for gravity flow sewers shall meet the requirements of ASTM Des: C 443.

Composition and properties for concrete pressure pipe gaskets shall meet the requirements of the specifications for the concrete pressure pipe with which the gasket will be used.

In making O-ring rubber gasketed joints, the gasket and the pipe socket shall be lubricated with an approved rubber gasket lubricant, and the gasket shall be stretched over the spigot and placed accurately in position. The tongue or spigot end shall be carefully centered in the socket of the preceding pipe so as to avoid displacement of the gasket, and the pipe shall be drawn home fully compressing the gasket. Adjustments to line and grade shall be made in such a manner that the compressed rubber gasket will not be disturbed. Before proceeding with backfilling, the joint shall be felt completely around to determine whether the gasket is in its proper position. If the gasket can be felt out of place, the pipe shall be withdrawn and the gasket examined for cuts or breaks. If the gasket has been damaged, it shall be replaced with a new one before the pipe is replaced.

Rubber gaskets shall be stored in a cool place and protected from light, sunlight, heat, oil, or grease until installed. Any gaskets showing signs of checking, weathering, or other deterioration will be rejected.

W-11.11 Temporary Bulkheads

At the ends of contract sections, where adjoining pipelines have not been completed, and in connections built into pipelines where adjoining pipelines or structures have not been completed and are not ready to be connected, temporary bulkheads, approved by the Engineer, shall be built. Such bulkheads encountered in connecting sewers or structures included in the Contract, or pipelines or structures previously built, shall be removed by the Contractor when the need for them has passed or when ordered by the Engineer.

W-11.12 Testing

The testing of pipelines shall be done in accordance with the requirements of the Workmanship and Materials section headed "Leakage Tests."

W-11.13 Joining Clay or PVC Pipe to Ductile Iron Pipe

The joining of clay pipe to ductile iron pipe shall be accomplished with flexible compression couplings. Such couplings shall meet the requirements of ASTM DES: C 425 and shall be Series No. 1002 flexible polyvinyl chloride couplings with stainless steel compression bands as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Band-Seal couplings as manufactured by Mission Clay Products Corp., Whittier, California; or approved equal. Installation of flexible couplings shall be done in accordance with the manufacturer's instructions. After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

The joining of PVC pipe to ductile iron pipe shall be accomplished with rigid PVC C900 x SDR-35 adapter couplings. Such couplings shall be molded of PVC material meeting ASTM D-1784 specifications. Joints shall meet ASTM D-3213 requirements with gaskets conforming to ASTM F-477. The adapter couplings shall be manufactured by Harco, Lynchburg, VA, or equal. Installation of rigid couplings shall be done in accordance with the manufacturer's instructions. After the joint has been completed, any voids in the excavation beneath the coupling shall be thoroughly tamped full of granular fill material to provide a full bearing for the pipe and prevent excessive pressure on the bottom of the joint.

W-11.14 Connection to Manholes

The Contractor will be required to submit a shop drawing, detailing the method of connecting the proposed pipe to the manhole and making it watertight:

1. For connecting vitrified clay or ductile iron pipe, the Contractor shall use nonshrink grout to seal the opening between the pipe O.D. and manufactured opening in the manhole or flexible rubber boot, precast into the manhole. The boot shall have stainless steel bands to compress and seal to the proposed pipe or shall be a compression type, such as A-Lock.

2. For connecting PVC pipe, the Contractor shall use a flexible rubber boot, precast into the manhole. The boot shall have stainless steel bands to compress and seal to the proposed pipe or shall be a compression type, such as A-Lock. Should the flexible rubber boot need to be relocated or when connecting to an existing manhole, the Contractor shall perform the connection by one of two methods. The preferred method is to core the manhole and install a rubber boot. The rubber boot shall be manufactured by Kor-n-Seal, or equal. The boot shall be installed and the PVCP connection shall be in accordance with the manufacturer's instructions. If the manhole cannot be cored or if the manhole is constructed of brick, the connection shall be made with a PVC manhole adapter which has an exterior impregnated silica surface layer. The adapter shall be manufactured by GPK Products, Inc., Fargo, ND, or equal. The adapter shall be installed and grouted into the manhole wall in accordance with the manufacturer's instructions with nonshrink grout. The PVCP shall be inserted through the adapter.

W-11.15 Joint Grouting

Joints for concrete pipelines using rubber gaskets and steel end rings shall be grouted on the outside with cement mortar composed of one part Type IA portland cement to one part sand by volume. The materials shall be thoroughly mixed to produce a uniform mortar with all aggregate particles well coated.

The joint grouting shall not advance closer than two pipe lengths to the laying operations. In grouting the joint, a cloth diaper shall be used to encase the outside diameter of the bell of the pipe and adequately straddle the joint recess so as to keep out dirt and to serve as a form for grouting. The joint space shall be filled with cement mortar, just thin enough to run around the joint. The diaper is to be left in place permanently. Before the mortar has taken its initial set, the diaper shall be examined, and if not completely filled, additional mortar shall be forced into the joint.

* * *

# SECTION 12
# DEMOLITION

## W-12.01 General

Demolition includes all work necessary for the removal and disposal of masonry, steel, reinforced concrete, plain concrete, wastewater equipment, piping, electrical facilities, and any other material or equipment shown or specified to be removed. Dust control shall be provided and provision made for safety.

Demolition shall be carried out in such a manner that adjacent structures, which are to remain, shall not be endangered. The work shall be scheduled so as not to interfere with the day to day operation of the existing facilities, all in accordance with the Sequence of Operations specified in the Specific Provisions. Doorways or passageways in existing facilities shall not be blocked.

Care shall be taken to assure that concrete shall be broken and removed in reasonably small masses. Where only parts of a structure are to be removed, the concrete shall be cut along limiting lines with a specially designed saw so that damage to the remaining structure is held to a minimum.

## W-12.02 Requirements Prior to Demolition

The Contractor shall visit the site and inspect all existing structures. Special care shall be taken to observe and record any defects, which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Prior to commencing the demolition, the Contractor shall provide the Engineer with a copy of this inspection.

Drawings of existing structures and equipment will be available for inspection by the Contractor at the office of the Engineer and Owner.

Warning signs, protection barriers and red warning lights shall be provided as necessary adjacent to the work as approved by the Engineer and shall be maintained during the demolition period.

Demolition work shall not be undertaken until all mechanical and electrical services affected by the work have been properly disconnected. Interconnecting piping or electrical services that are to remain in service either permanently or temporarily shall be capped, rerouted or reconnected in a manner that will not interfere with the operation of the remaining facilities.

Where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

W-12.03 Requirements During Demolition

The use of explosives will not be permitted.

All mechanical and electrical equipment shall be carefully protected against dust and debris.

All debris shall be removed from the structures during demolition and not allowed to accumulate in piles.

Safe access to and egress from all working areas shall be provided at all times with adequate protection from falling material.

Adequate scaffolding, shoring, bracing and protective covering shall be provided during demolition to protect personnel and equipment against injury or damage. Floor openings not used for material drops shall be covered with material substantial enough to support any loads placed on it. The covers shall be properly secured to prevent accidental movement.

Adequate lighting shall be provided at all times during demolition.

Areas below demolition work shall be closed to workmen while removal is in progress.

No material shall be dropped to any point lying outside the exterior walls of the structure unless the area is effectively protected.

No workmen shall stand on any wall to remove material except when adequate staging or scaffold protection is provided at a distance not exceeding 12 feet below the top of such walls and other reasonable precautions are taken. Whenever a workman is required to work at a height of more than 12 feet above a floor, platform, scaffold or the ground, he shall be equipped with a safety belt with a life line attached.

W-12.04 Disposal of Materials

All debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition shall become the property of the Contractor and shall be removed from the site, except for the items designated by the Engineer to be salvaged.

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# SECTION 13
# MISCELLANEOUS PIPE AND FITTINGS

## W-13.01 General

Miscellaneous pipe and fittings include polyvinyl chloride (PVC) pipe, copper pipe, steel pipe, and plastic tubing.

## W-13.02 Polyvinyl Chloride Pipe

Polyvinyl chloride (PVC) pipe shall be Schedule 80 minimum meeting the requirements of ASTM Des: D 1785, 1254B. All joints and fittings shall be threaded except where flanged joints are shown or required for connection to other piping. Threaded PVC fittings shall be socket welding type, 150-pound class, conforming to ASTM Des: D 2467 and D 2657.

## W-13.03 Copper Pipe

Copper pipe shall be Type K or L hard-drawn copper tubing and shall meet the requirements of ASTM Des: B 88.

Fittings shall be of the streamlined, solder joint type, and shall meet the requirements of ANSI Specifications B16.22.

## W-13.04 Galvanized Steel Pipe

Steel pipe shall be galvanized, meet the requirements of ASTM Des: A 53 and shall not be less than Schedule 40. Dimensions of steel pipe shall conform to ANSI B36.10.

Fittings for steel pipe shall be galvanized and shall be made to standard dimensions or as shown. Fittings used in pipelines 2- ½" inches in diameter or smaller shall be of the screwed pattern and shall be of malleable iron meeting the requirements of ASTM Des: A 197. The fittings shall conform to ANSI B 16.3. Where galvanized fittings are shown or specified, galvanizing shall meet the requirements of ASTM Des: A 120. Steel flange fittings shall meet the requirements of ANSI B 16.5 for 150-pound standard, except that the flanges shall be plain faced.

All flanges for steel pipe, except blind flanges, shall be of the slip-on welding type with hubs meeting the requirements of AWWA C207 Class B, D, or E suitable for the size of pipe and test pressures specified, and conforming to the requirements of ASTM Des: A 181, Class 1. The flanges shall be attached to the barrel of the pipe with two continuous fillet welds. The flanges shall be attached to the barrel of the pipe with two continuous fillet welds. Blind flanges shall be plain faced and shall conform to ANSI B 16.5, Class 150. All flanges shall be covered and protected during delivery and storage.

Flanged joints shall be made with bolts or bolt studs with a nut on each end. Bolts, stud bolts, and nuts shall meet the requirements of ASTM Des: A 307, Grade B and ANSI B 16.1 unless noted otherwise on the Plans.

Gaskets for flanged joints shall be of rubber with cloth insertion of the full face type meeting the requirements of ANSI B 16.21 and shall be those made by the Garlock Packing Company, Crane Company, U.S. Rubber Company, or equal. Gaskets shall be 1/16 inch thick.

Zinc for galvanizing, zinc coating, and plating shall meet the requirements of ASTM Des: B 6 and shall be at least equal to the grade designated as "Prime Western."

Wrought metals and castings shall be sandblasted or ground smooth. When a smooth coat is required, castings shall be tumbled and all high spots ground flush. Castings shall be normalized to prevent cracking.

Base metal shall be thoroughly cleaned, using only approved solvents and wire brushes, after which it shall be pickled.

Products to be galvanized shall be safeguarded against embrittlement in accordance with ASTM Des: A 143 and against warpage and distortion in accordance with ASTM Des: A 384.

Galvanizing shall be done by the hot-dip process after fabrication, unless otherwise specified in conformance with the appropriate ASTM and American Hot Dip Galvanizers Association, Inc. specifications. The dipping shall not come in contact with or rest upon the dross during the operation.

Galvanizing and coating shall be done in a plant having sufficient facilities to produce the quality of coatings herein specified and ample capacity for the volume of work required. Galvanized material shall be shipped and handled in a manner which will avoid damage to the zinc coating.

Galvanizing shall meet the requirements of ASTM Des: A 120.

W-13.05 Instrumentation Tubing

Instrumentation tubing for the for the bubbler shall be 316L stainless steel tubing conforming to ASTM A240 and ANSI B36.19. Pipe and fittings shall be manufactured in accordance with ASTM A 778 and A774 and rated for at least 35 psi.

W-13.06 Workmanship

Working drawings, delivery, erection, testing, insulation, and disinfection of miscellaneous pipe and fittings shall meet the applicable portions of similar requirements for ductile iron pipe specified under the respective sections of Workmanship and Materials.

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# SECTION 14
# HANGERS AND SUPPORTS

## W-14.01 General

Hangers and supports shall include all hanging and supporting devices of metallic construction shown, specified, or required for pipelines, apparatus, and equipment other than electrical equipment. The Contractor's working drawings, as required by the General Provisions hereof, shall show the quantity, type, design, and location of all hangers and supports required.

## W-14.02 Materials

All hangers and supports shall be stainless steel 316L unless noted otherwise. In addition all channel erector systems, threaded rod, fittings and hardware used for the electrical installation shall be also Stainless Steel 316L.

## W-14.03 Design

Hangers and supports not detailed on the Drawings shall be adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating conditions with due allowance for expansion and contraction, and shall have springs where necessary. Hangers and supports shall be of standard design where possible, and be best suited for the service required, as approved by the Engineer. Where required, they shall be screw adjustable after installation.

Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Sufficient hangers and supports shall be installed to provide a working safety factor of not less than five for each hanger.

All supporting devices shall be designed as to minimize interference with access and movement. The injury hazard shall be considered and minimized in all protruding supporting devices.

On pipes which are covered with heating insulation, hangers and supports shall include proper pipe protection saddles.

Overhead hangers shall be supported by threaded rods properly fastened in place by suitable screws, clamps, inserts, or bolts, or by welding.

Brackets for the support of piping from walls and columns shall be made of welded steel and shall be designed for three maximum loads classified as follows:

| | |
|---|---|
| Light . . . . . | 750 pounds |
| Medium . . . . . | 1,500 pounds |
| Heavy . . . . . | 3,000 pounds |

When medium or heavy brackets are bolted to walls, backplates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. When the use of backplates is not practicable, the brackets shall be fastened to the wall in such a manner that the safe bearing strength of the wall will not be exceeded.

Pipe rolls or chairs shall be of the cast-iron type. Pipe rolls shall be provided with threaded nuts or with sockets to take threaded rods.

Saddle stands shall be of the adjustable type. Each stand shall consist of a length of steel pipe fitted at the base with a standard threaded cast-iron flange and at the top with an adjustable saddle or roll. The base flanges shall be bolted to the floor foundation or concrete base.

Stanchions shall be of similar construction to the saddle stand, except that they shall be fitted at the top with cast-iron pipe saddle supports or with pipe stanchion saddles with yokes and nuts.

Where adjustable supporting devices are not required, pipelines 3 inches in diameter and smaller may be supported on cast-iron, malleable iron, or steel hook, hook plates, rings, or ring plates.

W-14.04 Anchors

Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of all anchors shall be subject to approval by the Engineer.

Anchors for piping shall be of the cast-iron chair type with steel straps, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

W-14.05 Inserts

Inserts for concrete shall be galvanized and shall be installed in the concrete structures where required for fastening supporting devices. They shall be designed to permit the rods to be adjusted horizontally in one place and to lock the rod nut or head automatically. Inserts shall be recessed near the upper flange to receive reinforcing rods. Inserts shall be so designed that they may be held in position during concrete placing operations. Inserts shall be designed by the rod which they engage.

W-14.06 Painting

Hangers, supports, anchors, and similar devices shall be painted in accordance with the Workmanship and Materials section headed “Painting.”

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# SECTION 15
# DIRECT BURIAL VALVES AND OPERATORS

## W-15.01 General

All valves shall be manually operated, unless otherwise shown, specified, or directed.

All direct burial valves shall be provided with adjustable type cast-iron valve boxes and extension stems to grade. All direct burial valves and valves in manholes shall have operating nuts and extended operating shafts to grade or as shown. Two tee wrenches shall be provided for each size and type of operating nut.

## W-15.02 Direct Burial Plug Valves

Plug valves shall be of the eccentric valve design and shall meet or exceed the requirements of AWWA C517 and shall be designed at 150 PSI. Manufacturer's Name shall be cast in body and Valve shall be serialized for future parts identification. Port area shall be 100% of standard pipe area. The Plug shall be Rectangular with associated Rectangular Port and shall provide dead tight shutoff when seated in the closed position. Body material shall be Cast Iron ASTM A126 Class B. Seats shall be 1/8" thick 95% Nickel and 1/2" wide for proper plug seating. Plug shall be Ductile Iron ASTM A536 and Chloroprene Faced. Bearings shall be sintered, oil impregnated permanently lubricated type 316 stainless steel, include upper and lower grit excluders to prevent grit and foreign solids from entering the bearings. Shaft seals shall be multiple V-ring type and shall be externally adjustable via an air gap and re-packable under pressure without removing the actuator or bonnet from the valve. Valves shall have interior and exterior epoxy coating.

Plug valves shall be nut operated (1/4 turn) 4" to 8" and gear operated 10" and larger. Both nut and gear operated valves shall have a 2-inch square nut for operation. On pump stations where the valve is 7 feet or more above the floor level, a chain and wheel shall be provided for operation.

Plug valves shall be Dezurik PEF Eccentric Plug Valve. A Letter of Standardization has been executed for this valve. The letter states that no other valve shall be considered an "or equal" in accordance with the City's standardization program. The "or equal" clause applies to all other equipment, unless specifically excluded by a Single Source Certificate or Letter of Standardization.

## W-15.03 Tapping Valves

Tapping valves shall be resilient seat type with bodies and bonnets made of ductile iron for 250 psig working pressure.

The valve shall be furnished with a flange-end connection on one end and a mechanical joint end on the opposite end. The flange shall be furnished with an alignment ring conforming to MSS SP-60 to help ensure true alignment of the valve and tapping sleeve. The mechanical joint end shall be furnished in accordance with ANSI/AWWA C153/A21.53 and MSS SP-113.

All tapping valves shall include a minimum 3/8" NPT pipe plug on the bonnet of the valve body to aid in the field testing of the valve.

All wedges shall be fully encapsulated with EPDM rubber.

All wedges shall be provided with guide covers.

All interior and exterior ferrous surfaces shall be protected against corrosion by fusion-bonded epoxy coating. Coating shall be applied prior to assembly to assure coverage of all exposed areas, including bolt holes. All valves 16" and larger shall be supplied with a bevel gear for reduction of torque and to facilitate depth of bury.

Tapping valve shall be AMERICAN 4"-48" Series 2500 ductile iron 250 psig rating (accepts full-size shell cutter), or equal.

W-15.04 Valve Boxes

Direct burial valves shall be provided with adjustable type cast-iron valve boxes with covers.

Valve boxes shall be of proper dimensions to fit over valve bonnets and extend to such elevation, at or slightly above finished ground surface, as shown or directed. Valve boxes shall be set vertical and concentric with valve stems. Any valve box which has moved from its original position so as to prevent application of the valve wrench shall be satisfactorily reset by the Contractor at his own expense.

Valve box covers shall have an identification 2" bronze nameplate identification tag mounted on the interior that indicates the manufacturer, serial number, size, type of valve; and the direction and number of turns to open.

* * *

# SECTION 16
# PUMP CHECK VALVES, KNIFE GATE VALVES AND ACTUATORS

## W-16.01 General

This section includes the knife gate valves and pump-check (plug) valves to be provided and installed. Knife gate valves shall be provided with flanges drilled and tapped to ASME B16.5/150. Pump-check valves shall be provided with flanges.

The Contractor shall prepare and submit for approval complete detail drawings of all valves which shall include submittals for interior and exterior coatings.

All valves shall be carefully erected in their respective positions, free from all distortion and strain, and shall be packed and left in satisfactory operating condition. All valves shall be operated as shown or specified. Operators include electric motor operators with manually operated handwheels and pneumatic cylinder operators, as shown and specified.

Valve operators shall be provided complete with all appurtenances necessary for the equipment to perform its intended function. Such appurtenances include, but are not limited to, anchor bolts and other mounting hardware, limit switches, pressure switches, gauges, control switches and control valves, electrical supply connections, air supply piping, control valves and regulating controls, solenoid valves, extension stems, local and remote indicators, torque switches, operating nuts, purge water service with all associated piping valves and controls, push-button controls, indicating lights, floor boxes, direct burial valve boxes, and other such items.

Worm gear type operators shall include a worm gear and matching drive worm. Bearings shall be provided for each rotating member.

Traveling nut type operators shall include a threaded steel screw and a bronze nut. A slotted lever or link lever system shall be provided to transfer the applied torque to the disc shaft. All rotating shafts, screws, and links shall have separate bearings. Thrust bearings shall be provided.

## W-16.02 Flanges

Flanges shall be cast solid and faced accurately at right angles to the axis of the casting. Flanges shall be faced and drilled and shop coated with a rust preventive compound before shipment.

Dimensions and drillings of flanges shall meet the requirements of ANSI B16.1 for working pressures of 125 pounds per square inch. Special drillings shall be provided where required.

W-16.03 Pump-Check Eccentric Plug Valve

Plug valves shall be provided and installed for pump-check service and shall be of the eccentric valve design and shall meet or exceed the requirements of AWWA C517 and shall be designed for 175 PSI 3'-12" and 150 PSI 14"-36". Manufacturer's name shall be cast in the body of the valve and shall be serialized for future parts identification. Port area shall be 100% of standard pipe area. The plug shall be rectangular with associated rectangular port and shall provide dead tight shutoff when seated in the closed position. Body material shall be Cast Iron ASTM A126 Class B, Seats shall be 1/8" thick 95% Nickel and 1/2" wide for proper plug seating. Plug shall be Ductile Iron ASTM A536 and Chloroprene Faced. Bearings shall be sintered, oil impregnated permanently lubricated type 316 stainless steel, include upper and lower grit excluders to prevent grit and foreign solids from entering the bearings. Shaft seals shall be multiple V-ring type and shall be externally adjustable via an air gap and re-packable under pressure without removing the actuator or bonnet from the valve. Valves shall have interior and exterior epoxy coating.

Pump-check valves shall be a DeZurik PEF Eccentric Plug Valve and shall be equipped with a Rotork Fluid Systems pneumatic submersible double acting actuator series SGP/D that is properly sized and that shall be operated by instrument air at 80 psig. . DeZurik plug valves are standardized equipment and no "or equal" will be considered. Pump-check valve and corresponding pneumatic actuator shall be provided to operate under temporary submergence for a minimum of 15 feet of head.

Each pneumatic cylinder-operated actuator shall include an engineered hydraulic two-speed actuator packaged control system. Provide 4-way pilot solenoid valve in the pneumatic circuit for normal open/close control and a 2-way emergency close solenoid valve in the hydraulic circuit to close the valve rapidly on power failure or pump trip. Provide limit switches for valve open and closed remote status indication. Design the air/hydraulic control circuits to open the valve at normal speed when the 4-way and 2-way valves are energized simultaneously. Close the valve at normal speed when the 4-way pilot valve is de-energized (but 2-way valve is still energized). Close the valve at rapid-close speed when both solenoids are de-energized. Accessories and connection to the pump station air system shall be as shown, specified, and required.

The operation of the automatic pump check valves shall be as follows:

Open Cycle

1. Pump motor starts, use a delay timer to trigger valve opening at a preset speed.

2. Valve reaches 100 percent capacity at predetermined time.

3. Initial setting for opening cycle is two minutes.

Close Cycle

1. When a pump stop signal is initiated for any particular control sequence shown, begin the closing cycle at a preset speed, while pump motor continues to run.

2. As the valve moves towards the closed position, the limit switch contacts open at a preset point, de-energizing the motor starter coil. The motor starter contacts open at a preset point, de-energizing the motor starter coil. The motor starter contacts open and the pump motor stops.

3. The valve continues to close as the pump slows down, the valve closing completely just as forward flow from the pump stops. Initial setting for closing cycle shall be 30 seconds.

4. The system is ready for another open cycle.

Manual Functions

1. A manual override button shall be furnished to allow manual, local operation of the check valve.

2. For manual operation, a manual-automatic selector valve shall be provided. In the manual position, manual operation of the valve is accomplished by a wrench on the manual nut.

Rapid Closing Operation

1. Upon power failure to the pump motor (or pump trip due to emergency or alarm shutdown), the check valve shall close immediately.

The actuators and control system shall be designed and built for valve operation at the pressure of the pipeline in which the valve is located when operated by a compressed air supply of 80 psig. The actuators shall provide timing control in each direction of movement.

W-16.04 Knife Gate Valves

Knife gate valves shall be furnished and installed at the pump suction for Pumps No. 1, 2, 3 and 4 as shown. The knife gate valve for these locations, including the proper sealing face shall be suited for operation on a horizontal alignment. Contractor shall also furnish and install 24-inch knife gate valves downstream of the pump check valve for isolation of the discharge lines, as shown. Knife gate valves shall be of the bonnetless knife gate bi-directional flow type with wafer face-to-face flanged connections and shall have a round port equal to or greater than 100 percent of the area of the connecting pipe. Flanges shall be drilled to the ANSI 125/150 pound standard. The valve shall have a pressure rating of 150 psi and shall have a metal-to-metal seat. The valves shall be an L&M Model M145 Performance Plus Knife Gate Valve, Model # 24M145C110-BG4-X as made by Tyco Valve and Controls, or shall meet Tyco Valve & Controls published specifications for this unit. For larger diameter, the Contractor shall provide L&M M345 Performance Plus Knife Gate Valves.

The wetted parts of the valve shall be constructed of 316 stainless steel conforming to ASTM A240. The exterior parts of the valve and the valve superstructure shall be constructed of cast iron, ASTM A126, Class B and ASTM A36 carbon steel, respectively. The valve stem shall be stainless steel and have single lead threads. The yoke sleeve shall be constructed of acid-resistant bronze in accordance with ASTM B30, Alloy 84400. The sleeve shall be equipped with a grease fitting for lubrication of the sleeve and threads. The valve body shall incorporate gate guides and jams to assist the seating.

The valve packing shall consist of multiple layers of square or chevron, braided flax and shall be impregnated with marine or petroleum-based lubricants. The packing gland shall be plastic coated or constructed of stainless steel to prevent corrosion. The gate shall have a knife edge and both sides of the gate shall be finished ground.

A hand wheel or crank shall be provided for manual operation of the 24-inch knife gate isolation valves in the discharge header pipe. Electrical motor actuators in accordance with subsection W-16.05 shall be provided for operation of the pump suction knife gate valves for Pumps No. 1, No.2, No.3 and No.4.

W-16.05 Electric Motor Actuator

Electric motor actuators for knife gate valves shall be the close-coupled electric motor-driven screw type. Electric motor actuators shall operate the valves from full closed to full open in 120 seconds. Additional limit switches, indicating lights, position transmitters and remote position indicators, remote operating controls and other accessories and controls shall be provided as shown, specified, or required.

1. GENERAL:

The actuators shall be suitable for use on a nominal 480 volt three-phase 60 Hertz power supply and are to incorporate motor, integral reversing starter, local control facilities, terminals for remote control and indication connections, and a backlit LCD display with digital position indication and alarm icons. It shall be possible to carry out the setting of the torque, turns, and configuration of the indication contacts without the necessity to remove any electrical compartment covers. Actuators shall be 'O' ring sealed, watertight to IP68, NEMA 4, 4x and 6, and shall at the same time have an inner watertight and dustproof 'O' ring seal between the terminal compartment and the internal electrical elements of the actuator fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal cover is removed on site for cabling. Electrical actuators shall be suitable for temporary submergence up to 15 feet of head. A quantity of 35 feet of power cable shall be provided for the power leads of the actuator, attached by either a sealable water tight gland or a potted hub.

The actuator shall include an on-board data logger to store operational data such as valve torque profiles, actuator events, and statistics that can be viewed locally on the LCD screen or downloaded via infrared port. A PDA shall be furnished by the actuator manufacturer and include actuator diagnostic software to download, review, analyze, and reconfigure the actuator. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator.

2. ACTUATOR SIZING:

The actuator shall be sized to guarantee valve closure at the specified differential pressure. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall be such as to give valve closing and opening at approximately 10-12 inches per minute unless otherwise stated in the job specification.

3. AMBIENT TEMPERATURE:

The actuator shall be capable of functioning in an ambient temperature ranging from minus 22°F (-30°C) to +158°F (+70°C).

4. MOTOR:

The electric motor for open/close service shall be Class F insulated with a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is the longer, at an average load of at least 33% of maximum valve torque. The electric motor for Modulating service shall be Class H insulated with a time rating of 30 minutes at 104°F (40°C) or twice the valve stroking time, whichever is longer, at an average load of at least 33% of the maximum valve torque. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase. Plugs and sockets are not acceptable as a means of electrical connection for the motor. Motor temperature shall be sensed by a thermostat to protect against overheating.

Each actuator shall be arranged for 480-volt, 3-phase, 60-hertz electrical supply. All controls shall be 120-volt, single-phase, 60-hertz and shall be provided with an integral 480/120-volt control transformer with fused secondary.

Motors shall be of the high starting torque, ball bearing, squirrel-cage type designed for intermittent operation on 480-volt, 3-phase, 60-hertz electrical current, except as otherwise shown, specified, or required. The electric motor for open/close service shall be Class F insulated with a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is the longer, at an average load of at least 33% of maximum valve torque. The electric motor for Modulating service shall be Class H insulated with a time rating of 30 minutes at 104°F (40°C) or twice the valve stroking time, whichever is longer, at an average load of at least 33% of the maximum valve torque. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase. Plugs and sockets are not acceptable as a means of electrical connection for the motor. Motor temperature shall be sensed by a thermostat to protect against overheating.

The motor shall be capable of operating the valve against the maximum differential line pressure when voltage at the terminals is within 15 percent of nominal voltage.

Drive units shall be arranged to permit the motor to attain full speed before the load is energized. Overload relays shall be provided in each phase of the motor.

A handwheel or crank shall be provided for manual operation. The operator must be responsive to manual operation at all times, except when being electrically operated. The handwheel shall not rotate during electric operation. The motor shall not rotate during handwheel operation nor shall a fused motor prevent manual operation. When in manual operating position, the operator shall automatically return to electric operation when the motor is energized and remain in the motor position until manual operation is desired. The movement from motor to manual operation shall be accomplished by a positive declutching mechanism which will disengage the motor mechanically but not electrically. Failure of motor gearing shall not render hand operation impossible. Handwheels shall be removable and adaptor keys provided to permit operation by a portable operator. Electrical operation of the motor shall be as shown or specified.

The controller shall be a NEMA rated reversing controller, complete with mechanical interlocks and overload relays, and be an integral part of the operator. Contacts shall be provided for indicating lights as shown, specified, or required. One light on shall indicate that the valve is fully open; the other light on shall indicate that it is fully closed; and both lights on shall indicate that it is in an intermediate position. The internal wiring in the valve actuator shall be arranged so that the opening and closing coils cannot be energized simultaneously at any time, regardless of external wiring connections.

Power gearing shall consist of generated gears of heat-treated steel and worm gearing. The worm shall be of hardened alloy steel with the threads ground and polished after heat treating. The worm gear shall be of chilled nickel bronze. Antifriction bearings shall be used throughout and the operator shall be grease or oil bath lubricated. Lubricants shall be suitable for ambient temperatures from 40 to 150 degrees F.

5. TORQUE AND TURNS LIMITATIONS:

An inexpensive setting tool shall be included for non-intrusive set-up, calibration, and interrogation of the actuator. Using the vendor-supplied setting tool, torque and turns limitation shall be adjustable as follows:

a. Position setting range: 2.5 to 100,000 turns, with resolution to 7.5° of actuator output.
b. Torque setting: 40% to 100% rated torque.
c. Torque sensing must be affected directly electrically or electronically. Extrapolating torque from mechanically measured motor speed is not acceptable due to response time. Torque measurement shall be independent of variations in frequency, voltage or temperature.
d. "Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during starting in mid-travel against high inertia loads.

The electric circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

6. LOCAL POSITION INDICATION:

The actuator must provide a local LCD display of the position of the valve, even when the power supply is not present. The display shall be able to be rotated in 90-degree increments so as to provide easy viewing regardless of mounting position.

The actuator shall include a digital LCD position indicator with a numeric display from fully open to fully closed in 1% increments. Red, green, and yellow lights corresponding to Open, Closed, and Intermediate positions shall be included on the actuator. The digital display shall be maintained even when the power to the actuator is isolated.

The local display should be large enough to be viewed from a distance of six feet (6') when the actuator is powered up.

7. INTEGRAL PUSH BUTTONS AND SELECTOR:

Integral to the actuator shall be local controls for Open, Close, and Stop, and a local/remote selector switch, padlockable in any one of the following three positions:

a. Local Control Only
b. Off (No Electrical Operation)
c. Remote Control plus Local Stop Only.

It shall be possible to select maintained or non-maintained local control.

The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

Motor operators shall be Model IQ as manufactured by Rotork, Inc. or equal.

W-16.06 Valve Limit Switches

Valves shall be provided with suitable mechanical cam gear type limit switches for remote operation, indication and other control as shown, specified, and required. Each limit switch shall be compatible with its associated operation and suitable for the service intended. Limit switches shall be furnished with valves by the valve manufacturer.

Mechanical limit switches for the discharge valve actuators shall be 4-pole gang-mounted in required multiples and with necessary mechanical linkage, as shown on the limit switch contact development chart provided with the sewage pump control Contract Drawings. Switch contact ratings shall be 120-volt a-c, 20 amperes at 75 to 100 percent power factor, and 124-volt d-c, 5 amperes minimum. Mechanical limit switches shall be Series SL2, 3, of 4HC for normal use, as manufactured by National Acme, Cleveland, Ohio, or equal. Explosion-proof type shall be Series SL2, 3, or 4XC, or equal. All enclosures shall be watertight and oiltight for normal service and of cast aluminum for explosion-proof type. Operating levers shall be National Acme Series D-1260, or equal. Switches shall be complete with all racks, gears, cam, linkages, mountings, and accessories as required.

W-16.07 Testing

All valves shall be given hydrostatic shop pressure tests at twice the working pressure specified. The valves shall be tested, first by applying the hydrostatic pressure with the valve open and then with the valve closed. The valves shall be tight and secure under the test pressure.

Valves shall be tested in place by the Contractor, as far as practicable, and any defects in valves or connections shall be corrected to the satisfaction of the Engineer.

W-16.08 Painting and Coating

The exteriors of the knife gate valve and the pump-check plug valve shall receive the coating system as indicated for steel pipe and fittings in the Workmanship and Materials section titled “Painting”.

The iron or steel interior surfaces of the pump-check plug valve shall be factory coated with an approved system.

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# SECTION 17
# SEWAGE PUMPING EQUIPMENT

## W-17.01 General

The sewage pumping equipment shall include pump, motor, adjustable frequency drive and all control equipment to provide a complete pumping system for Pump Nos. 1, 2, 3 and 4. Refer to a related specification section titled "Adjustable Frequency Drives". Vibration monitoring sensors shall be provided and installed on all pumps and all motors. Vibration testing for the pump and motor assembly shall be performed as specified in the Specific Provisions section titled "Vibration Requirements for Rotating Equipment".

Pumps shall be manufactured by Fairbanks Nijhuis Pump (Pentair). The Fairbanks Nijhuis Pump supplier (Sanders Company, Inc. – (772) 285-5483) shall be responsible for the following:

1. Furnishing the pump(s) complete with immersible motor, adjustable frequency drives, motor high ring base with guard, intermediate shafting, necessary guards and all other specified accessories and , and vibration monitoring equipment for the non-clog immersible, closed-coupled style dry pit sewage pumps. Pumps are to be connected to drivers by suitably sized solid type intermediate shafting with steady bearings and shaft guards as required.

2. Providing guidance and inspection for the installation of the new pumping equipment.

3. Testing and training for the new sewage pumping system.

It is the intent of these specifications that all pumping equipment for Pump Nos. 1, 2, 3, and 4 be functionally identical.

Shop drawings and product data, shall include the following:

1. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished.

2. Certified foundation, pump support, and anchor bolt plans and details.

3. Schematic electrical wiring diagram and other data as required for complete pump installation.

4. Literature and drawings describing the equipment in sufficient detail, including parts list and materials of construction, to indicate full conformance with the detail specifications.

5. Total weight of pumping unit, separately identifying the weight of the pump and the drive.

W-17.02 Quality Assurance

To assure unity of responsibility, the pumps, drives, immersible motors, motor high ring base and sole plates, shall be furnished and coordinated by the pump manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pumps, motors, and sole plates, and controls as specified.

The equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by concerns having extensive experience in the production of such equipment. A single manufacturer shall furnish units specified herein. The equipment furnished shall be designed, constructed, and installed to operate satisfactorily when installed as shown on the drawings.

Pumps shall be manufactured in accordance with the Hydraulic Institute Standards, except where otherwise specified herein.

The pump manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components, including soleplate(s), if any, of the assembled pumping unit mounted on a fabricated steel base plate, to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.

W-17.03 Delivery, Storage and Handling

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 unit and equipment are ready for operation.

All equipment and parts must be properly protected against any damage during shipment. Store equipment in accordance with the manufacturer’s instruction.

Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built, and securely bolted thereto.

Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

No shipment shall be made until approved by the Engineer in writing.

For protection of bearings during shipment and installation, the bearing shall be properly processed. Anti-friction bearings, if prelubricated, shall be protected in accordance with the bearing manufacturer's recommendations against formation of rust during a long period of storage while awaiting completion of installation and start-up of the machine in which they are used. Anti-friction bearings, which are not prelubricated, shall be properly treated in accordance with the bearing manufacturer's recommendation against formation of rust during a long period of storage while waiting completion of installation and start-up by the application of Exxon Rust-Ban No. 392, or equal treatment.

W-17.04 Pump Characteristics

The pump shall be a vertical closed-coupled, dry pit, single stage, split case centrifugal pump with a single bottom suction and a side discharge with a counterclockwise rotation. The pump shall be a Fairbanks Morse 24-inch Model 2434IWD with an L20E1A impeller. A Letter of Standardization for the pump manufacturer has been included in the Contract documents and no other pump manufacturer will be considered.

The pumping unit shall be variable speed and designed for operating under the following conditions:

| | |
|---|---|
| Service: | Raw Sewage |
| Model: | 20" 2434IWD |
| No. of pumps: | 4 (3 operating, 1 standby) |
| Maximum liquid temperature (degree F): | 80 |
| Maximum speed (rpm): | 585 |
| Minimum shut-off head at max speed (ft): | 95 |
| Design capacity (gpm): | 15,000 |
| Design total head (TH) (ft): | 68 |
| Minimum efficiency at design point (percent): | 84% |
| Minimum sphere solid size (in): | 6.60 |
| Minimum capacity at run out head (gpm): | 22,000 |
| Minimum head at run out (ft): | 39 |
| Minimum efficiency at run out capacity: | 70% |
| NPSHR at maximum run out capacity (ft): | 21 |
| Maximum NPSHR at design capacity (ft): | 15 |
| 2nd design point capacity (gpm): | 10,000 |
| 2nd design point head (ft): | 82 |
| 2nd design point efficiency (%); | 73% |
| Motor HP | 400 |
| Pump suction diameter (in): | 24 |
| Pump casing discharge diameter (in): | 20 |

Where total head (TH) is referred to in conjunction with the specified discharge requirements, it shall be understood to consist of the sum of the pressure head plus the velocity head, in feet, at the discharge nozzle of the pump minus the pressure head and the velocity head at the suction nozzle of the pump. The efficiency of the pump shall be understood to be based upon total head as just defined.

The pumps shall operate throughout the entire operating range, within the vibration limits specified herein. The pump and its driving equipment shall be designed and constructed to successfully withstand a maximum turbining speed of the unit resulting from backflow through the pump of 100 percent of the design operating speed.

W-17.05 Rotation

The pump shall have counterclockwise rotation when viewed from the driver end looking at the pump.

W-17.06 Impeller

The impeller shall be balanced non-clogging type made of ASTM –A748-CA-6NM class B cast stainless steel. The impeller shall be of one-piece, single-suction, enclosed, three-vane, mixed flow design with well-rounded leading vanes and then tapered toward the trailing edge for a circular flow pattern. The waterways through the impeller will have extremely smooth contours, devoid of sharp corners so as to prevent rags or stringy, fibrous material from catching or clogging. The impeller shall be balanced and secured to the shaft by means of a bolt, washer, and key. The arrangement shall be such that the impeller cannot be loosened from torque in either forward or reverse rotation. Impeller shall be supplied with axial removable stainless steel wear ring. Wear ring shall be approximately 50 Brinell softer than the fronthead wear ring.

W-17.07 Volute/Casing

The volute shall be matched to the impeller and made of close-grained cast iron conforming to ASTM A48 Class 30. The volute is to be of one-piece circular constant flow, equalizing pressure design with smooth fluid passages large enough to pass any size solid that can pass through the impeller. The casing and impeller geometry shall be such that the rated size solid capability of the pump will pass the same size solid between the full diameter impeller and the cutwater passage. The volute shall be side flanged tangential discharge and capable of rotation in 45$^{o}$ increments to accommodate piping orientation. Diffusion vanes are not permitted. The volute shall be furnished with large cleanout openings located at the impeller centerline, to allow access to the impeller. Volute priming, drain, and 1/2” minimum gauge connections shall be provided. A 2” priming connection shall be located at the top of the volute, above the centerline. Flanges shall be 125 pounds flat-faced flanges per ANSI drilling. The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction or discharge piping. The pump casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head, whichever is greater. The minimum case wall thickness shall be 1.125”.

The pump suction shall be supplied with a 24” fronthead connection. The discharge shall be a 20” connection, and the minimum case wall thickness shall be 1.125 inches.

The pump shall be supplied with a sole plate, minimum 2” thick, spanning concrete pier supports designed by the owner. The pump shall mount to the sole plate via 4 equally spaced mounting pads.

W-17.08 Fronthead

The front head shall be made of close-grained cast iron conforming to ASTM A48 Class 30. The front head shall be cast separately and be connected to the suction elbow. Front head casing shall be protected from grit erosion by a 'Grit Shield" combination 600 Brinell high chrome iron wear ring and angular cast plate. The "Grit Shield" shall utilize "speed bumps" on the circumference to break up the half speed grit and sand rotation occurring in the front head area.

W-17.09 Backhead

A separately cast close-grained cast iron back head with large access openings and integral sealing box conforming to ASTM A48 Class 30 shall be provided. The sealing box shall be cast integrally with the backhead and be designed to accommodate either packing or mechanical seal without re-machining. The sealing box shall be drilled and tapped for external flushing with seal cage. A ¾" minimum backhead drain tap shall be provided. Sealing box leakage will be collected by the backhead drain trough and piped directly to drain, eliminating any drippage to the floor. A minimum of two rings of graphite-impregnated synthetic packing and a split Teflon water seal ring shall be furnished. Glands shall be two-piece split interlocking, made of cast iron (bronze), held in place by studs and nuts.

W-17.10 Bearing Frame Assembly

The bearing housing shall be close-grained cast iron conforming to ASTM A48 CL30 and of heavy, rugged design for carrying the bearings and machined for accurate and permanent bearing alignment completely enclosing the shaft between the bearings. Bearing supports are to be of heavy-duty construction providing for self-centering fit with the casing for proper alignment. The bearing housing shall be of dust-proof design, incorporating lip-type grease seals in contact with the shaft to prevent the entrance of contaminants. Zerk-type grease fittings for bearing lubrication shall be supplied at the bearing housing.

The pump shaft shall be made from type 4140 alloy steel, of sufficient diameter to carry the maximum loads imposed and to prevent vibration and fatigue. The shaft shall be accurately machined along its entire length. Keyways shall be provided at both ends.

A renewable shaft sleeve, positive adhesive sealed to prevent leakage between the shaft and the sleeve, shall protect the shaft through the sealing box area. The shaft sleeve shall be stainless steel with Brinell hardness of 300-350.

Radial (inboard) bearings shall be grease-lubricated spherical roller type, self-aligning, designed to carry the hydraulic radial loads encountered in the service conditions. Thrust (outboard) bearings on the 12" pumps shall be grease-lubricated angular contact, duplex mounted, designed to carry the pump hydraulic axial and dead load thrust. The 16" & 20" pumps thrust bearings shall be grease-lubricated tapered roller type.

Bearings shall be designed for an L10 life of 100,000 hours per AFBMA at best efficiency point. Grease relief ports with plugs shall be provided.

W-17.11 Mechanical Seal

The pump sealing box mechanical seal shall be a Chesterton 442-50, 6.25" Seal, CR/CB-Viton or shall meet Chesterton's published specifications for this unit.

A throat bushing shall be used in conjunction with the mechanical seal. The throat bushing shall be a Spiral Trac Adaptor bushing, CWS version and shall be designed for use without flush water, or shall meet EnviroSeal's published specifications for this unit.

W-17.12 Fits and Hardware

The volute/casing, fronthead, backhead, and frame shall be manufactured with concentric shoulder fits to assure accurate alignment. All machined bolts, nuts, and cap-screws shall be of the hex-head type and will not require the use of any special tools.

W-17.13 High Ring Base

The motor high ring base shall be cast iron or fabricated steel of adequate height to permit access to the coupling and furnished with a shaft guard.

W-17.14 High Thrust Immersible Electric Motors

A. SCOPE: This specification details the electrical and mechanical requirements for totally enclosed blower cooled immersible squirrel cage induction motors.

B. GENERAL:

1. All motors defined under this specification shall conform to the latest applicable requirements of NEMA, ISO, ANSI, IEEE and NEC.
2. Motors shall be designed for continuous duty for three phase, 60 Hz, 460-volt operation.
3. Ratings shall be based on a 40-degree C ambient, 1000-meter altitude or lower operation with a maximum winding temperature rise of 85-degree C by resistance at 1.0 service factor.
4. Motors to be furnished with Class F insulation. All motors covered under this specification shall be capable of operating at 1.15 service factor with Class F rise, but shall be selected for operation within their full load rating without applying the service factor.
5. Motors shall be Tatung Electric Premium Efficiency design and shall be inverter rated.
6. Motors shall be evaluated on conformance to this specification and the total costs including initial costs and operating life cycle costs.
7. Low voltage motors shall be equipped with space heaters appropriate for the frame size and winding Resistance Temperature Detectors (RTDs), 2 per phase.

C. MECHANICAL

1. BEARINGS AND LUBRICATION

a. Bearings shall be either deep groove, angular contact, roller, or spherical roller.
b. Bearings shall be selected to provide L10 life for flexible direct coupled applications of 100,000 hrs minimum.
c. Bearing temperature rise shall not exceed 50 degrees C.
d. Bearing ISO identification shall be on the motor nameplate.
e. Drive end motor lubrication system is to be re-greasable. Opposite drive end bearing system will allow for re-lubrication with oil.
f. Motor to be lubricated by manufacturer with a premium polyurea grease, Chevron SRI #2 or equivalent, containing rust inhibitors and suitable for operation between -25 degrees C to 120 degrees C.

2. ENCLOSURE

a. Motor enclosure, including frame, end brackets, fan shroud, and cover shall be fabricated steel or cast iron type JIS G 5502 or better.
b. A quantity of 30 feet of power cable shall be provided for the power leads of the motor, attached by either a sealable water tight gland or a potted hub. The motor shall be equipped with a moisture detector external to the motor, allowing for field servicing. Contact of the moisture detectors are to interlock the pump control circuit.
c. Motor shall be blower cooled such that when the motor is submerged, the blower shall disable without overloading the main motor. The blower fan shall be corrosion resistant, non-sparking bi-directional. The main motor shaft will not protrude through the opposite drive end bracket and there will be no running fit to allow entrance of water into the motor. Once the motor is submerged, the blower motor and/or fan may require servicing or replacing following a return to a non-flooded state.
d. Motor rotor construction shall be of cast aluminum or fabricated copper and their alloys. Rotors shall be dynamically balanced to NEMA or ISO standards.
e. The motor shall be designed to prevent infiltration of water along the shaft by utilizing Varilip type B seal arrangement requiring no grease or utilizing the mechanical seal of the pump in closed coupled applications. Seals shall be capable of withstanding submergence of 30 feet for a period of 2 weeks.
f. All mounting hardware shall be hex head, ISO 4.6 grade or above. Screwdriver slot fasteners are prohibited on all frames.
g. Corrosion resistant stainless steel nameplate shall be affixed to the motor frame with stainless steel or brass drive pins. Nameplate information shall include all required NEMA data and ISO bearing numbers.
h. All mating frame fits shall have rabbet joints with O-rings to ensure a watertight design.

i. All motor parts, including frame, bracket, fan cover and terminal box are to receive severe duty, high grade epoxy paint. All motor parts shall be primed with an epoxy primer. These parts include the stator/frame assembly, rotor assembly, end brackets, and fan cover. Completed motor assembly must successfully withstand salt spray tests for corrosion per ASTM B-117 for 96 hours.

D. ELECTRICAL

1. All motors shall successfully operate under power supply variations per NEMA Part 20.
2. All motors shall be designed with torque starting requirements in accordance with NEMA-MG1-1998 20.10.1, unless high torque starting is required than shall be in accordance with 20.10.2.
3. Motors shall have copper windings.
4. Motor insulation shall be class F minimum.
5. Motor leads shall be non-wicking type, Class F temperature rating or better and permanently numbered for identification.
6. Each completed and assembled motor shall receive a routine factory test per NEMA standards.
7. Provide insulated bearings and motor shaft grounding as specified in Section 11 05 13.

W-17.15 Vibration Monitoring Equipment

The Vibration Monitoring Equipment shall be as specified with the Contract Drawings and as specified in Section 11 05 13 Electric Motors.

W-17.16 Gauges

Each pump shall be provided with glycerin-filled suction and discharge pressure gauges with a 1/4-in NPT inlet and 4.5-in dials. A 316 stainless steel, oil filled, diaphragm with a 1/2-in NPT inlet, and 1/4-in flushing tap, with T-cock, shall be installed on each gauge. The suction gauges shall be of the compound type to indicate both vacuum and pressure and be graduated to read 15-psi positive pressures and 30-in mercury negative pressures. The discharge gauges shall be graduated from 0 to 60 psi. The pressure gauges shall be equal to Figure 1980 Solfrunt standard gauges, Model 150000-4 series, manufactured by Amtek, U.S. Gauge Division. The diaphragm seals shall be equal to Model MGSG0103102 seals manufactured by Amtek, Mansfield & Green Division. The gauges shall be connected to the pump suction and discharge. All fittings, bolting, and cocks shall be 316 stainless steel.

W-17.17 Shop Testing

A certified factory hydrostatic and performance test shall be performed on each new pumping (Pump Nos. 1, 2, 3, and 4) in accordance with Hydraulic Institute Standards, latest edition. Tests shall be conducted with the pump in a vertical position. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

The Engineer shall have the right to witness the factory tests and inspect any equipment to be furnished under this Section prior to their shipment from place of manufacture. Notification of such test and a list of test equipment and procedures shall be furnished to the Engineer at least ten working days before the schedule test date.

Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment. A complete test report for each pump, including certified characteristic curves of the pump and certified copies of the hydrostatic test report, shall be submitted and approved by the Engineer before the pumps are shipped.

The pumping equipment and drive shall be tested in the field over the range of operation specified. The testing shall consist of operation of each adjustable frequency drive, motor, and pump. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

Vibration testing shall be performed as described in the Specific Provisons.

W-17.18 Spare Parts

Furnish the following spare parts for each size pump.

| | Quantity | Item |
|---|---|---|
| 1. | 1 per pump | Impeller locknut |
| 2. | 1 set per pump | Blower motor assembly |
| 3. | 1 set per pump | Radial and thrust bearings |
| 4. | 1 set per pump | Pump casing gaskets |
| 5. | 1 per size of pump | Impeller with ring |
| 6. | 1 per pump | Mechanical seal |
| 7. | 1 per size of pump | Grit shield |

* * *

# SECTION 18
# STEEL PIPE AND FITTINGS

## W-18.01 General

Steel pipe and fittings include all wrought and fabricated steel pipe, stainless steel pipe, and fittings therefor. Steel pipe shall be used only where specifically shown or specified.

Completely detailed working drawings shall be submitted by the Contractor for approval in conformance with the requirements of the General Provisions. Such drawings shall show piping layouts and contain schedules of all pipe, fittings, valves, expansion joints, hangers and supports, and other appurtenances. When any of the steel pipeline work is of special design, such work shall be shown in large detail and be completely described and dimensioned.

## W-18.02 Pipe Standards

Dimensions of steel pipe shall conform to ANSI B36.10, unless otherwise specified, shown, or required. Pipe 12 inches and smaller shall be not less than Schedule 40. Pipe 14 to 18 inches inclusive shall be not less than Schedule 30. Pipe 20 through 36 inches shall have a wall thickness of not less than 3/8 inch. Pipe larger than 36 inches shall have a wall thickness of not less than 1/2 inch.

Steel pipe 24 inches in diameter and smaller shall meet the requirements of ASTM A 53. Steel pipe larger than 24 inches in diameter shall meet the requirements of AWWA C200, unless otherwise specified, shown, or required. Pipe conforming to AWWA C200 fabricated from plates shall meet the requirements of ASTM A 283 Grade B with not more than two longitudinal seams and with girth seams not less than 7 feet apart. Pipe conforming to AWWA C200 mill pipe shall be made with Grade B steel and spiral welded with inside and outside (double) fusion butt welds. All pipe shall be hydrostatically shop tested in accordance with AWWA C200 to the test pressure determined by the formula in Subsection 3.5 of AWWA C200. The Contractor shall provide an affidavit of compliance for all pipe and fittings furnished under AWWA C200. Stainless steel pipelines shall not be painted.

Steel pipe, including fabricated pipe, shall be furnished in the longest lengths commercially available unless otherwise shown, specified, or required. Pipe shall have the manufacturer's name, initials, or trademark rolled into the surface and the year of manufacture shall be suitably marked on the pipe.

## W-18.03 Welding

Welding of pipe joints where shown, specified, permitted, or required shall meet the requirements of ANSI B31.1, Code for Pressure Piping, unless otherwise specified. Pipe and fittings with a wall thickness of 3/16 inch and greater shall have ends beveled for welding. All welding on steel pipelines shall be performed by certified welders having current certificates conforming to requirements of the ANSI Code. Such certification shall be submitted to the Engineer before proceeding with any pipe welding.

Steel pipelines, with interior lining, shall be shop welded. Steel pipelines shall be shop welded and fabricated complete which includes fittings, lugs, anchors, supports, flanges, and like items, ready for field assembly before linings, as specified, are applied. Pipeline lining, where specified, shall include pipe, fittings, and specials. Field welding on existing steel pipelines will be permitted where shown in the Contract Drawings or authorized in writing by the Engineer. Field shall be in accordance with AWWA standards. Linings and coating of steel pipe shall be repaired to the satisfaction of the Engineer, and in accordance with subsection 18.10 herein, prior to placing the pipe in service.

W-18.04 Sleeve-Type Couplings

Except where standard solid sleeves or split sleeves are shown or specified, sleeve-type coupling for steel pipe shall be Style 38 couplings as made by Dresser Industries, Inc., or Type 411 as made by Smith-Blair, or equal. Gaskets shall be of molded rubber, Dresser Plain Grade 27, Smith-Blair 003, or equal. Middle rings shall be without a pipe stop and shall be at least 1/4 inch thick and 5 inches wide for 8-inch and smaller pipe, 3/8 inch thick and 7 inches wide for 10-inch through 30-inch pipe, and 1/2 inch thick and 10 inches wide for 36-inch and larger pipe with follower rings of appropriate thickness, unless otherwise shown or specified.

Sleeve-type couplings shall be shop coated with Dresser Red “D” Shop-Coat, Smith-Blair Standard Blue Shop Coat, or equal, nontoxic material compatible with the finished coatings specified.

The ends of pipe and fittings which are to have sleeve-type couplings shall be left free of shop coat or field coat for a distance of 12 inches, until after installation, when the pipe and couplings exposed to view shall be field painted as specified or directed.

W-18.05 Harnessing

The steel pipe joint harness shall consist of two or more steel tie rods set diametrically opposite, generally on the horizontal diameter of the pipe, extending across the joint from fabricated bent steel plate lugs welded to the pipe at either side of the joint. Steel plates used in the fabrication of bent plate lugs shall conform to ASTM A 242. Lugs and welds shall be designed to develop the full strength of the tie rods.

Harness tie rods and nuts shall be of mild steel meeting the requirements of ASTM A 307 Grade B. Nuts shall be hexagonal and have a standard chamfer on the back face.

W-18.06 Expansion and Flexible Couplings

Ample provision shall be made for flexibility in all pipelines to compensate for expansion. Expansion devices shall be adequate to allow the lines to expand and contract freely without injury to any part of the piping system. The devices may be in the form of expansion joints, expansion couplings, swivel or swing joints or pipe bends, and include such anchors as may be shown, specified, or required to make the devices effective. If expansion devices are not required, all runs of pipe subject to change in length shall be fabricated shorter than their theoretical length to the extent that there may be freedom to expand without increasing the stresses imposed when cold.

Expansion joints shall be provided with adequate tie rods to limit the axial movement at the specified test pressures, except where otherwise noted or specified.

W-18.07 Handling

During loading, transportation, and unloading, extraordinary care shall be taken to prevent injury to the pipes and coating. Loading and unloading shall be done slowly with each pipe under perfect control at all times. Under no circumstances shall a pipe be dropped. Suitable skids or blocks shall be placed under each pipe in the shop and the pipe shall be securely wedged during transportation to ensure the least possible injury to pipe, lining, and coating.

Pipe shall be handled with equipment such as stout canvas slings and wide padded skids, designed to prevent damage to the coating. The use of bare cables, chains, hooks, metal bars, or narrow skids in contact with the coating will not be permitted. All pipe handling and hauling equipment shall meet the approval of the Engineer before use. The ends of coated pipe shall be protected with roofing paper to prevent damage to the coating during transit. Abrasions and injuries shall be promptly and efficiently repaired.

Pieces shall be examined for defects and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor at his own expense.

W-18.08 Erection

Steel pipelines shall be furnished, fabricated, erected, and otherwise installed to the lines, elevations, locations, and dimensions shown, specified, and required for a complete installation. In all existing structures and new structures as applicable, the Contractor shall verify all dimensions shown on the Plans and shall take such field dimensions that may be necessary to properly fabricate, locate, erect, connect to existing work, and otherwise install all steel pipelines, pipe supports, pipe anchors, and structural frames required for steel pipelines. Where temporary supports are used, they shall be sufficiently rigid to prevent shifting or distortion of the pipe. Expansion devices shall be properly adjusted so that pipelines will be tight during expansion and contraction.

For sleeve type couplings, diametrically opposite bolts shall be equally tightened on the connection so that the gaskets will be brought up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.

W-18.09 Hangers and Supports

All steel pipelines shall be permanently erected and supporting devices shall be furnished and installed as specified on the construction plans.

W-18.10 Linings and Coatings - General

In general, all linings and coatings, except coatings applied as field painting, shall be shop applied.

Linings and coatings, where such are specified, shall be applied to all pipe and fittings.

All bolts, nuts, couplings, and the like shall be well coated after the joint has been made.

Painting shall conform to the Workmanship and Materials section headed “Painting”.

* * *

# SECTION 19
# SURFACE RESTORATION

## W-19.01 General

The various street surfaces disturbed, damaged, or destroyed during the performance of the work under this Contract shall be restored and maintained as shown, specified, and directed. Included in this classification are permanent pavement surfaces of all types, pavement bases, curb, curb and gutter, alleys, driveways, and sidewalks.

The quality of workmanship and materials used in the restoration shall produce a street surface equal to or better than the condition before the work began.

Service boxes, manhole frames and covers, and similar structures not conforming to the new work shall be set to established grade at the Contractor's expense, and no separate payment will be made therefor.

All portland cement and asphaltic concrete pavements shall be removed in rectangular sections with sawed vertical cuts, or to existing joints, as directed by the Engineer. Concrete pavements shall be cut with a concrete saw. Asphaltic concrete pavements one-inch thick or greater shall be cut with a tool having a square neat edge. The edges of adjacent pavement shall be trimmed to straight lines which a roller can follow. Where reinforced concrete pavement is removed, one foot of existing reinforcement on each side of the excavation shall be left exposed and tied to the replaced reinforcing steel.

The equipment necessary for the proper performance of pavement replacement shall be on the site in satisfactory working condition and shall be subject to approval of the Engineer before the work is started.

All replaced concrete pavements shall have a minimum bearing on undisturbed earth outside the line of excavations of at least nine (9) inches.

## W-19.02 Standards

The restoration of street pavement shall be performed in strict conformance with the standards relating to equipment, materials, and methods of construction of the authority having jurisdiction over the pavements, unless otherwise specified herein. Pavements to be restored are under the jurisdiction of the several agencies as follows:

1. State Highways are under the jurisdiction of the State of Florida Department of Transportation. Work on such pavements shall conform to the Department of Transportation Standard Specifications for Road and Bridge Construction.

2. City Streets are under the jurisdiction of the City of Tampa Department of Public Works. Work on such pavements shall conform to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, except that densities (including for subgrade) and other testing requirements shall follow current Department of Public Works specifications. The type and thickness of pavement, base and stabilization shall be as shown, specified, and directed by the Engineer.

3. County Roads are under the jurisdiction of the Hillsborough County Engineering Department. Work on such pavements shall conform to County specifications.

All specifications of the several agencies having jurisdiction over pavement restoration work shall be the current issue of such specifications as of the date of the "Notice to Bidders," except as specified otherwise herein.

W-19.03 Temporary Restoration

Upon completion of backfilling, the street or sidewalk surface damaged or destroyed shall be promptly placed in condition for safe temporary use. Temporary work shall be maintained in a suitable and safe condition for traffic until the permanent pavement is laid, or until final acceptance of the work.

Where the area over which existing pavement has been disturbed is to be repaved as part of an overall project by the agency having jurisdiction, any special temporary pavement replacement shall be as specified in the "Specific Provisions."

Pavement surfaces shall be temporarily restored by placing thereon, to proper line, grade and transverse profile, a layer or layers of compacted base material, as specified, conforming to all requirements regarding configuration, thickness, and density as detailed in the Plans, specified, and directed by the Engineer. When the compacted thickness of the base layer is greater than 6 inches, the base shall be constructed in multiple courses. Each course shall not exceed 6 inches in compacted thickness. Where the existing pavement has a permanent wearing surface, the temporary pavement shall be finished with a suitable grade of asphalt and sand to provide a temporary wearing course and to eliminate dust nuisance.

Curbs, where possible, shall be temporarily reset in place, as part of the work of temporary restoration of pavement.

Damaged or destroyed sidewalks shall be temporarily restored, immediately upon placing of the backfill, by placing a compacted layer of fine crushed concrete, choked with concrete screenings, which shall have a minimum thickness of three inches below the existing finished sidewalk grade.

The temporary pavement shall be maintained by the Contractor and all holes and depressions filled until the permanent pavement is placed.

Limerock or shell placed in areas where the existing pavement is shell, limerock, crushed stone, or other similar material and is classed as nonpermanent pavement, will not be measured for separate payment. Placement of limerock or shell as nonpermanent pavement replacement will not be measured for payment.

Temporary sand and asphalt wearing courses placed on base on which a permanent pavement surface will be constructed shall be incidental to the permanent pavement base work, and no separate payment will be made therefore.

Crushed concrete for temporary sidewalk surface shall be incidental to sidewalk replacement, and no separate payment will be made therefor.

W-19.04 Preparation of Temporary Pavement for Permanent Pavement Replacement

After due notice and within the time specified, the temporary pavement shall be prepared as the base to receive the new permanent pavement surface.

Prior to construction of the pavement base, the City will furnish the Contractor with the preconstruction survey notes for the streets disturbed by construction. The Contractor shall use these notes in bringing the base installed to grade allowing for the permanent pavement surface to be constructed.

The preparation of the base shall consist of bringing the area to be replaced to a grade conforming to the required grade and cross section, of uniform density, ready to receive the permanent pavement. This is to be accomplished by excavating or backfilling as needed, shaping, watering as required, or permitting to dry to proper consistency, and rolling the entire area with an approved self-propelled roller weighing not less than eight tons. Shaping and rolling shall be continued until the base has been properly prepared and shows that no further compaction of any practical benefit would result from continued rolling. The base shall be tested as to cross section, crown, and elevation. After being properly prepared, it shall be so maintained until the permanent pavement is constructed. Any part of the base area not accessible to the roller shall be thoroughly compacted by hand or by mechanical compaction in a manner acceptable to the Engineer. Preparation shall include sawing, cutting and trimming edges of existing pavements to provide a neat, uniform edge to abut the new pavement.

After completion of the base, the Contractor shall furnish the Engineer with survey notes verifying the base has been constructed to grade.

W-19.05 Certification for Pavement Base

The Contractor shall furnish notarized certifications from all suppliers of base material stating that all material supplied for use as pavement base conforms to the requirements of the applicable sections of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

W-19.06 Permanent Pavement Base Densities

Permanent base material shall be installed and compacted to the required densities (98% modified proctor) in layers not exceeding six inches.

W-19.07 Permanent Pavement Surface Restoration

Permanent restoration of pavement shall be pavement of the type and thickness detailed in the Plans, Specific Provisions, or as directed by the Engineer.

If the existing type of pavement is classified as nonpermanent pavement, the temporary restoration shall be reworked and completed and left in a condition at least equivalent to the existing nonpermanent pavement.

W-19.08 Replacement of Curb, Curb and Gutter, Sidewalk and Driveways

All permanent restoration of street curb or curb and gutter shall be of the same type and thickness as the curb or curb gutter which abuts. The grade of the restored curb and curb and gutter shall conform with the grade of the existing adjacent curb or curb and gutter.

Except as otherwise specified herein or detailed in the Plans, all permanent restoration of driveways and sidewalks shall conform to the manner of construction as originally placed and to the lines and grades as given by the Engineer. No patching of concrete driveway areas will be allowed between joints or dummy joints.

Where sidewalks are replaced, the replacement shall be the full width of the walk and minimum lengths shall be 60 inches. Restoration of adjacent lawn is incidental to sidewalk replacement, and no separate payment will be made therefor.

W-19.09 Replacement of Traffic Markings and Signalization Loops

The Contractor shall furnish all labor, equipment and materials to replace, test and maintain all traffic markings (temporary and permanent) and signalization loops removed or damaged by pipeline construction and appurtenance work as shown on the Plans, specified and directed by the Engineer.

The replacement of traffic markings (temporary and permanent), signalization loops and all appurtenant work shall be replaced by the Contractor in kind.

It shall be the Contractor’s responsibility to field verify before construction begins all markings and signalization loops to be replaced.

All traffic markings and signalization loops shall conform to the Workmanship and Materials standards set forth in the latest edition of the Florida Department of Transportation Standard and Supplemental Specifications.

Payment for the replacement of temporary and permanent traffic markings, signalization loops and all appurtenant work shall be included in the lump sum price for this project, and no separate payment shall be made therefor.

W-19.10 Hot Bituminous Mixtures (Section 330) Type S Asphaltic Concrete (Section 331)

This Subsection shall Replace and/or Modify Portions of F.D.O.T. Standard Specifications for Road and Bridge Construction (1991) Sections 330 and 331.

330-10.3 Density Control

330-10.3.1 Density Control Nuclear Method:

The inplace density of each course of asphalt mix construction, with the exceptions of patching courses, leveling and intermediate courses less than 1 inch thick or a specified spread rate less than 100 pounds per square yard, overbuild courses where the minimum thickness is less than 1 inch, and open-graded friction courses, shall be determined by the use of the Nuclear Density Backscatter Method as specified by FM 1-T238 (Method B). The required density of a completed course shall be at least 95% of the job mix design laboratory density submitted by the Contractor and approved by the construction engineer or 96% of the laboratory density which results from a sample of the same day's productions and determined by the City laboratory performing all acceptance testing.

330-10.3.2 Control Strips:

Control strips may be constructed by the Contractor for the purpose of determining the necessary pattern of compacting procedures to achieve the density requirements specified. However, control strips are not used for the validity of acceptance testing.

330-10.3.3 Acceptance:

The completed pavement will be accepted with respect to density on a lot basis. Partial payment for the unit price in listed in the schedule of values for this lump sum project, will be made for those lots that have an average density less than the specified 95% of the approved job mix design laboratory density or 96% of the same day sampled laboratory density based on the following table:

City of Tampa Revised Table 330-3
Payment Schedule for Density

| Percent of Control Strip Density | Percent of Payment |
|---|---|
| 95.0 (job mix design)$_1$ or 96.0 (lab density sample)$_2$ & above | 100 |
| 94.0 to < 95.0$_1$ or 96.0$_2$ | 95 |

| Percent of Control Strip Density | Percent of Payment |
|---|---|
| 93.0 to < 94.0 (Applies to both $_1$ & $_2$) | 90 |
| < 93.0 (Applies to both $_1$ & $_2$) | 75 |

330-10.3.4 Density Requirements for Small Projects:

For projects less than 500 linear feet in length including intersections, turnouts, patches, crossings, etc., the requirements for specified densities are the same as a standard lot. For the purpose of acceptance and partial payment determination, the project less than 500 linear feet will be considered as a lot in its entirety and payment will apply accordingly with Table 330-3. The Contractor will use standard rolling procedures in 330-10.

331-5 Acceptance of the Mixture

331-5.1 General:

The bituminous mixture will be accepted at the site with respects to a gradation and asphalt content on a lot to lot basis. The material will be tested for acceptance in accordance with the provisions of 6-8.2 and the following requirements. However, any load or loads of mixture which, in the opinion of the City representative, are found unacceptable for reasons of being excessively segregated, aggregates improperly coated, or of excessively high or low temperature shall be rejected for use in the work. The composition and physical test properties for all mixes must meet the specification ranges provided in Tables 331-1 and 331-2.

A standard size lot at the site shall consist of one day's placement or equivalent to a standard quantity of 1,000 tons. The number of samples required to evaluate the lot will be divided into one or two sublots as indicated below. Testing for acceptance of the lot will be performed by the City material testing laboratory or by a licensed private testing laboratory of the City's choice. Quantities between 500 tons and 1,000 tons shall have 2 sublots; quantities between 50 tons and 500 tons shall have 1 sublot; quantities up to 50 tons will be accepted by the City representative on the basis of visual inspection.

331-5.2 Acceptance Procedures:

Sample selection for acceptance tests will be by random sampling of loaded trucks on site at the discretion of the City testing technician in accordance with FM-T168. The use of a random sample chart may be used but it is not required. Sampling shall not be taken in any of the following circumstances:

1) First load produced that day.
2) Last load produced that day.
3) Near end of quantity reached because of an underrun.

The Contractor and/or the plant quality control technician (Q.C.T.) will be notified of the time of sampling and may:

1) Observe the sampling.
2) Take a sample at the same time and run the tests.
3) Ask for a split sample and run the tests.
4) Observe the City testing technician run the tests.

The five acceptance determinations made from the sample are:

1) The % bitumen content per F.M.I. - T164.
2) The % passing the No. 4 sieve per F.M.I. - T030.
3) The % passing the No. 10 sieve per F.M.I. - T030.
4) The % passing the No. 40 sieve per F.M.I. - T030.
5) The % passing the No. 200 sieve per F.M.I. - T030.

For each acceptance sample taken, the technician will box and keep two split portions for referee tests. If the lot receives 100% payment, the referee sample will be discarded. If the lot sample shows a pay reduction, then one or both of the referee samples will be submitted for a second analysis to determine the validity of the acceptance test results. Referee samples will be tested by a licensed private laboratory of the City's choice. This second analysis will only be done at the request of the Contractor and will be paid for by the Contractor in the event that the original analysis results requiring a pay reduction is confirmed.

In the event that the second analysis does not confirm the pay reduction, the City will pay for the second analysis.

Acceptance of the mixture shall be on the basis of test results on consecutive random samples from each lot. One random sample shall be taken from each sublot. The bituminous mixture will be sampled at the site in accordance with FM 1-T168, except that samples may be collected from the paving machine at the receiving hopper. The percent bitumen content of the mixture will be determined in accordance with FM 1-T164 (as modified by DOT test procedures). The percents passing the No. 4, No. 10 and No. 200 sieves will be determined in accordance with FM 1-T030.

Calculations for the acceptance test results for bitumen content and gradation (percent pass No. 4, percent pass No. 10, percent pass No. 40 and percent pass No. 200) shall be shown to the nearest hundredth (0.01). Calculations for arithmetic averages shall be carried to the thousandths (0.001) and rounded to the nearest hundredth (0.01) in accordance with the Department's rules of rounding.

When the Contractor or producer chooses to use a storage bin for mix storage overnight or longer, the material processed in this manner will be sampled and tested for acceptance after the mix has been removed from the storage bin. The City representative may reject a mix at any time that is obviously defective due to asphalt content, insufficiency of mixing, inadequacy of coating, improper proportions of fine and coarse aggregates, temperature, contamination, etc. The Contractor and/or the L.Q.C.T. will be given the option of not placing the mix and sampling the following truck, or if it has been placed, sample it. The City reserves the right to test or have the mix tested by a licensed private testing laboratory of their choice. Payment will be made on the basis of the City's revised Table 331-6 "Acceptance Schedule of Payment."

City of Tampa Revised Table 331-6
Acceptance Schedule of Payment
(Asphalt Plant Mix Characteristics)

Deviation of the Arithmetic Average of the
Lot Acceptance Tests from Job Mix Formula

| Characteristics | Factor | One Test | Two Tests |
|---|---|---|---|
| Asphalt Cement | 1.00 | 0.00 - 0.55 | 0.00 - 0.43 |
| Content (Extraction) | 0.95 | 0.56 - 0.65 | 0.44 - 0.50 |
| | 0.90 | 0.66 - 0.75 | 0.51 - 0.57 |
| | 0.80* | Over 0.75 | Over 0.57 |
| No. 4 Sieve** | 1.00 | 0.00 - 8.00 | 0.00 - 5.95 |
| | 0.95 | 8.01 - 9.00 | 5.96 - 6.66 |
| | 0.90 | 9.01 -10.00 | 6.67 - 7.36 |
| | 0.80 | Over 10.00 | Over 7.36 |
| No. 10 Sieve** | 1.00 | 0.00 - 6.50 | 0.00 - 5.04 |
| | 0.95 | 6.51 - 7.50 | 5.05 - 5.74 |
| | 0.90 | 7.51 - 8.50 | 5.75 - 6.45 |
| | 0.80* | Over 8.50 | Over 6.45 |
| No. 40 Sieve** | 1.00 | 0.00 - 5.50 | 0.00 - 4.62 |
| | 0.95 | 5.51 - 6.50 | 4.63 - 5.33 |
| | 0.90 | 6.51 - 7.50 | 5.34 - 6.04 |
| | 0.80* | Over 7.50 | Over 6.04 |
| No. 200 Sieve** | 1.00 | 0.00 - 2.00 | 0.00 - 1.71 |
| | 0.95 | 2.01 - 2.40 | 1.72 - 1.99 |
| | 0.90 | 2.41 - 2.80 | 2.00 - 2.04 |
| | 0.80* | Over 2.80 | Over 2.04 |

* If approved by the City, the Contractor may accept the indicated partial pay. The City may require removal and replacement at no cost. The Contractor has the option to remove and replace at no cost to the City at any time.

** When there are two or more reduced payments for these items in one lot of material, only the greatest reduction in payment will be applied. CAUTION: This rule applies only to these four gradation test results.

Note: 1) The No. 40 sieve applies only to Types S-I, S-II, S-III, FC-1, and FC-4.
2) Deviations are absolute value with no plus or minus signs.

* * *

# SECTION 20
# ERECTING AND JOINTING INTERIOR PIPING

## W-20.01 General

Erecting and jointing interior piping includes furnishing of supports and hangers and installation of all interior and exposed exterior piping. Piping materials, coating, and linings shall be located and installed where shown on the Plans or as specified. The work shall include providing working drawings required by the General Provisions, showing the type, quantity, design, calculations, arrangement, and location of all hangers and supports.

## W-20.02 Materials

Structural and miscellaneous steel, metal castings, ductile-iron pipe, and steel pipe used for hangers and supports shall meet the requirements of the applicable Workmanship and Materials sections.

## W-20.03 Design

Hangers and supports not detailed on the Plans shall be adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating conditions with due allowance for expansion and contraction, and having springs where necessary. Hangers and supports shall be of standard design where possible, and be best suited for the service required, as approved. They shall be screw adjustable after installation. Perforated straps will not be accepted.

All supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. The injury hazard shall be considered and minimized in all protruding supporting devices.

Hangers and supports shall be supported by threaded rods properly fastened in place by suitable screws, clamps, insets, bolts, or by welding.

Brackets for the support of piping from walls and columns shall be made of welded steel and designed for three maximum loads classified as follows:

| | |
|---|---|
| Light | 750 pounds |
| Medium | 1,500 pounds |
| Heavy | 3,000 pounds |

When medium or heavy brackets are bolted to walls, backplates of adequate size and thickness shall be furnished and installed to distribute the load against the wall. When the use of backplates is not practicable, the brackets shall be fastened to the wall in a manner that the safe bearing strength of the wall will not be exceeded.

Pipe rolls or chairs shall be of cast iron. Pipe rolls shall be provided with threaded nuts or with sockets to take threaded rods.

Saddle stands shall be of the adjustable type. Each stand shall consist of a length of steel pipe fitted at the base with a standard threaded ductile-iron flange and at the top with an adjustable saddle or roll. The base flanges shall be bolted to the floor, foundation, or concrete base.

Stanchions shall be of similar construction to the saddle stand, except that they shall be fitted at the top with an adjustable saddle or roll, ductile-iron pipe saddle supports, or with pipe stanchion saddles with yokes and nuts. The base flanges shall be bolted to the floor, foundation, or concrete base.

Where adjustable supporting devices are not required, pipelines 3 inches in diameter and smaller may be supported on ductile-iron, malleable iron, or steel hooks, hook plates, rings, or ring plates.

W-20.04 Anchors

Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines, tanks, apparatus, and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets. The design of all anchors shall be subject to approval.

Anchors for piping shall be of the ductile-iron chair type with steel straps, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

Anchors detailed on the Plans shall be provided as shown and specified.

W-20.05 Inserts

Inserts for concrete shall be stainless steel and installed in the concrete structures where required for fastening supporting devices. They shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically. Inserts shall be recessed near the upper flange to receive reinforcing rods and be designed so that they may be held in position during concreting operations. Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

W-20.06 Painting

Hangers, supports, anchors, and similar devices shall be painted in accordance with the Workmanship and Materials section headed “Painting.”

W-20.07 Transportation and Delivery

Every precaution shall be taken to prevent damage to the pipe during transportation and delivery to the site. Extreme care shall be taken in loading and unloading the pipe and fittings. Such work shall be done slowly with skids or suitable power equipment, and the pipe shall be under perfect control at all times. Under no condition shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe or coating. When handling the pipe with a crane, a suitable pipe hook or sling around the pipe shall be used. Under no condition shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends.

If any pipe or special is damaged in the process of transportation, handling, or laying, such pipe or pipes shall be replaced or repaired by the Contractor at his own expense.

The Contractor shall furnish and install suitable blocking and stakes to prevent the pipe from rolling.

W-20.08 Flanged Joints

Flanged joints shall be made with bolts or bolt studs with a nut on each end. Bolts, stud bolts, and nuts shall meet the requirements of ASTM A 307 Grade B, and ANSI B16.1.

W-20.09 Screwed Joints

Threads for screwed joints shall be thoroughly cleaned after reaming. All threads shall be coated with a suitable pipe dope, mastic metallic compound as manufactured by James K. Harbinson & Co., graphite and engine oil, or equal, before jointing. Joints shall be screwed on until a tight metal-to-metal joint is produced without evidence of heat in the threaded portion. Once a joint has been screwed up, it shall not be backed off unless the threads are recleaned and new compound applied before rejointing.

For pipe fitted with screwed flanges, the flanges shall be fitted to the pipe in the shop unless otherwise permitted. The pipe flanges shall be accurately threaded to the American Briggs gauge, after which the flanges shall be screwed on by heavy machinery until the end of the pipe projects beyond the face of the flange and a tight metal-to-metal joint is produced without evidence of heat in the threaded portion. The projecting end of the pipe shall then be cut off flush with the face of the flange. A light refacing cut shall be taken across the end of the pipe and the face of the flange at right angles to the centerline of the pipe and the pipe shall then be reamed.

W-20.10 Mechanical joints

In making up mechanical joints, the spigot shall be centered in the bell. The surfaces with which the rubber gasket come in contact shall be thoroughly brushed with a wire brush just prior to assembly of the joint. Lubricant shall be brushed over the gasket just prior to installation. The gasket and gland shall be placed in position, bolts inserted, and nuts tightened fingertight. The nuts shall be tightened by means of a torque wrench in a manner that the gland shall be brought up toward the pipe evenly. The following range of bolt torques shall be applied:

| Size Inches | Range of Torque (ft. lbs.) |
|---|---|
| 5/8 | 45-60 |
| 3/4 | 75-90 |
| 1 | 85-100 |
| 1-1/4 | 105-120 |

If effective sealing is not obtained at the maximum torque listed above, the joint shall be disassembled and reassembled after thorough cleaning.

All bolts shall be primed by dipping with a bituminous coating, except the threads, which shall be coated immediately prior to installation of the nuts.

W-20.11 Sleeve Type Couplings

For sleeve type couplings, diametrically opposite bolts shall be equally tightened on the connection so that the gaskets will be brought up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.

W-20.12 Welding

Field welding of pipe joints where shown, specified, permitted, or required shall meet the requirements of ANSI B31.1 - Power Piping, Chapter VI (Section 136.4.2 Visual Examination) (Section 137.4 Hydrostatic Tests) or (Section 137.5 Pneumatic Tests). Pipe and fittings with wall thickness of 3/17-inch and larger shall have ends beveled for welding. Parts to be welded shall be securely held in place and in proper alignment during welding. The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping. Welding shall be continuous around the joint and completed without interruption. Welds shall be of the single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee. Welds shall be free from cold shuts, pinholes, oxide inclusions, or other defects. All welding of steel pipe done off site shall conform to the requirements of the Workmanship and Materials section headed “Steel Pipe and Fittings.”

W-20.13 Testing

All pipelines shall be watertight and shall be tested for leakage by the Contractor under the direction of the Engineer. Air and gas lines shall be tested with compressed air and all other pipelines shall be tested with water under the pressures specified herein.

All tests shall be conducted in a manner to minimize as much as possible any interference with the Contractor's work or progress.

The Contractor shall notify the Engineer when the work is ready for testing, and tests shall be made as soon thereafter as possible. Personnel for reading meters, gauges, or other measuring devices, will be furnished by the Engineer, but all other labor, equipment, air, water, and materials, including meters, gauges, smoke producers, blower, fuel, bulkheads, and accessory equipment, shall be furnished by the Contractor.

Pressure tests of pipelines shall be made by maintaining water in the pipe at a minimum of 125 psi for a period of 30 minutes. The pipelines shall show no leakage.

* * *

# SECTION 22
# TAPPING PRESTRESSED CONCRETE CYLINDER PIPE (PCCP)

## W-22.01 General

The Contractor shall install a tap at the location shown on the Plans to bypass the flow from the existing gravity interceptor, as shown and specified. The tapping of the 54-inch diameter ECP PCCP force main and tapping valve shall be in accordance with Price Brothers Company's most current published literature on tapping concrete pressure pipe, and AWWA M9 Manual (latest edition). The tap shall serve as the permanent connection for the new meter and bypass configuration, as shown.

The Contractor shall retain a subcontractor to accomplish the work. The subcontractor shall have a minimum 5 years experience in performing taps on similar size and type pipelines.

The Contractor shall take all precautions necessary to protect the existing force main and shall be solely responsible to maintain continuous sewage flow during construction.

Prior to ordering any tapping saddles, the Contractor shall carefully excavate the existing force main at the location where the 36-inch tapping saddle will be installed, and shall make precise measurements of the outside diameter at a sufficient number of locations around the pipe to define its exact cross-sectional configuration and size, all as recommended by the tapping saddle manufacturer to assure proper fit of the saddles to the pipe. The Contractor shall be solely responsible for the correctness of fit of the saddles to the existing force main so that no leakage occurs.

## W-22.02 Construction Schedule

The Contractor shall submit to the Engineer, in advance of construction, a detailed step by step schedule for accomplishment of the tap, including supports of existing pipe and tapping equipment as required. The plan shall be revised as directed by the Engineer as required for coordination with other contractor's operations and construction.

## W-22.03 Shop Drawings

The Contractor shall submit to the Engineer for review, shop drawings detailing the valves, tapping saddle, tapping machine, procedures and temporary supports as required.

* * *

# SECTION 23
# LEAKAGE TESTS

## W-23.01 General

All pipelines will be tested and inspected for infiltration or leakage by the Engineer with the assistance of the Contractor prior to final acceptance of the work. All tests and inspections will be conducted in a manner to minimize as much as possible any interference with the Contractor's work or progress.

The Contractor shall notify the Engineer when the work is ready for testing and inspecting, and tests and inspections shall be made as soon thereafter as practicable under the direction of the Engineer. Personnel for reading meters, gauges, or other measuring devices will be furnished by the Engineer. The Contractor shall furnish all other labor, materials, services, and equipment, including power, fuel, meters and gauges, pumps, bulkheads, backflow preventers, water, and other items and apparatus necessary for making leakage tests, preparing pipelines for testing, assembling, placing, and removing testing equipment, and placing pipelines in service, all to the satisfaction of the Engineer. Only City water shall be used for testing unless otherwise approved by the Engineer.

The water shall be obtained and metered from sources approved by the Engineer. After testing, the water shall be disposed of by the Contractor into storm sewers or drainage courses approved by the Engineer.

## W-23.02 Tests of Sewer - General

All sewers shall be tested for infiltration or leakage after completion of backfilling. All wyes, house connections, and stubs shall be suitably plugged or bulkheaded to the satisfaction of the Engineer prior to testing. All sewers shall be cleaned and pumped out as necessary prior to testing.

Sewers shall be tested for infiltration, unless otherwise ordered by the Engineer. If the Engineer determines that groundwater conditions are not suitable for infiltration testing, sewers shall be tested for leakage. Sewers may be tested for leakage by measuring leakage out of the sewer or by air testing. The length of sewer to be tested shall be subject to prior approval by the Engineer.

The length of house connections, if any, will be included in the total length of sewer under test when computing infiltration or leakage.

All testing equipment and the arrangement of such equipment shall be subject to the prior approval of the Engineer. Sections of sewers under test shall be arranged to prevent the internal pressure on any joint from exceeding 10 psi.

Refer to Section 11 - PVC Pipe Gravity for specific requirements for infiltration and leakage testing for PVC gravity pipe.

W-23.03 Infiltration Test of Sewers

Infiltration tests shall be performed when the groundwater level is a minimum of 2 feet above the crown of the sewer at the highest point in the test section. No such tests shall be started until the infiltration conditions are established in the work to be tested. The Contractor shall provide suitable observation wells along the line of the work or other approved means to determine the groundwater level.

Infiltration tests will be made by measuring the infiltrated flow of water over a measuring weir set up in the invert of the sewer a distance, as approved by the Engineer, from a temporary bulkhead or other limiting point of infiltration. Testing shall be for a minimum period of 4 hours. The quantity of infiltration for any section of the sewer shall not exceed 50 gallons/mile/day/inch of pipe diameter.

W-23.04 Leakage Test of Sewers

Leakage tests shall be performed by bulkheading the section of sewer under test at the manhole, at the lower end, and filling the sewer with clear water until the water level is up a minimum of 2 feet above the crown of the sewer or a minimum of 2 feet above the groundwater level, whichever is greater, in the manhole at the highest point in the section. Leakage will be the measured amount of water added to maintain the level in the higher end manhole. Tests shall be carried on a minimum of 4 hours with readings at 30-minute intervals. The quantity of leakage for any section of the sewer shall not exceed the limits specified for infiltration in the subsection headed “Infiltration Test of Sewers.”

W-23.05 Air Leakage Test of Sewers

Air pressure leakage tests shall be limited to sewers 30 inches in diameter and smaller. The maximum allowable air leakage is based on prewetted pipe walls. The contractor may, therefore, fill the pipe with clear water and then empty the pipe prior to air testing. When pipe walls are prewetted, air leakage tests shall be completed within 24 hours after filling the sewer section to be tested.

Air pressure tests shall be made by placing the sewer under 3.0 psig air pressure and measuring the volume of air required to maintain this pressure. The rate of air leakage shall be determined when the system reaches an equilibrium state and air flow shall be read by means of an approved rotameter.

The maximum rate of air loss shall be 0.003 cfm per square foot of interior pipe surface, and the maximum air flow shall not exceed 2.0 cfm when the total pressure on the sewer is maintained at 3.0 psig. When the groundwater level is above the invert of the sewer, but below a level adequate for infiltration testing, the maximum air loss shall be reduced 6 percent for each foot of groundwater above the sewer invert.

Air testing equipment shall be arranged so that compressors, valving, gauges, and other test devices are located at the ground surface. Air testing equipment shall have an approved air relief arrangement to prevent the sewer from being pressurized to greater than 10.0 psig.

W-23.06 Leakage Tests of Force Mains

Force mains shall be tested as a whole or in sections valved or bulkheaded at the ends. The mains shall be tested under an average hydrostatic pressure of not less than 100 pounds per square inch, unless otherwise indicated in the Specific Provisions. The pressure shall be applied to the pipeline through a tap in the pipe by means of a hand pump or other method and shall be maintained for a minimum of 2 hours. Air shall not be used for testing force mains.

The leakage for all force mains, as determined by the above test, shall not exceed the allowable leakage for iron water mains as given by the following formula in Section 4.2.2. of AWWA Specification C600:

$$L = \frac{SD/P}{133{,}200}$$

in which L is the allowable leakage, in gallons per hour, S is the length of force main tested in feet, D is the nominal diameter of the pipe in inches, and P is the average test pressure in psi gauge.

During the test, each valve shall be operated through several complete cycles of closing and opening. In addition, each valve, when in the closed position, shall have the test pressure applied to one end of the valve only. Each end of the valve shall be tested in this manner. There shall be no visible leakage through the valves, and the valves shall not show any evidence of structural distress.

All harnessed sections of the buried force main shall be completely backfilled before such sections are tested.

Closure segments shall be visually inspected for leaks under normal operating pressures.

W-23.07 Repairing Leaks

When infiltration or leakage occurs in excess of the specified amount, defective manholes, pipe, pipe joints, or other appurtenances shall be located and repaired at the expense of the Contractor. If the defective portions cannot be located, the Contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a sewer or force main within the allowable infiltration or leakage limits upon such retesting as necessary and directed by the Engineer.

* * *

# SECTION 24
# PAINTING

## W-24.01 General

Painting includes furnishing all labor, materials, and services to paint all structures and equipment specified and required to complete the work, including, but not limited to, the following: preparation of surfaces; field painting of existing and proposed structures, piping, conduit, ductwork and equipment as specified, and the marking of existing piping and electrical conduit. The work shall include furnishing samples of paints and color charts.

Paint and other materials shall be of the type and quality of the manufacturer on which the coating schedule is based. All coats of paint for any particular surface and thinners used shall be from the same manufacturer. The treatment of the surface to be painted and the application of paint shall be in accordance with the instructions of the manufacturer and as approved by the Engineer. The colors of paints shall be as approved by the Engineer. Specimens, approximately 8 by 10 inches in size, shall be prepared and submitted to the Engineer. The minimum number of specimen custom mixed colors submitted shall be 6 not including color coding colors. Only paint of approved manufacturers shall be delivered and stored at the site.

All painting shall be in accordance with the schedules included in this specification. A supplementary schedule of paint products shall be submitted, with mil thickness, to cover all paint applied. The schedule shall be in accordance with the recommendations of the manufacturer of the paint. The total mil thickness of all coatings shall be not less than the schedule included in this section.

## W-24.02 Delivery and Storage

Paints, stains, varnish, or ingredients of paints to be mixed on the job shall be prepared, packed and labeled, and guaranteed by an approved manufacturer. All material shall be delivered to the site in original, unbroken containers.

The manner of and place for storing the painting materials at the site shall be as approved by the Engineer. The storage space shall be kept clean at all times. Every precaution shall be taken to eliminate fire hazards.

## W-24.03 Surface Preparation

Prior to painting, all surfaces shall be prepared and cleaned in strict accordance with the paint manufacturer's recommendations and as directed by the Engineer. Surfaces shall be dry before any paint is applied. Special surface preparation work shall be as directed by the manufacturer of the paint specified to be applied to the surface.

**Metal Surfaces:**

This includes all exterior and interior steel surfaces and all nonferrous metals. This applies to structural and miscellaneous steel, motors, designated housings and protective guards, piping, valves, stairs, and in general, all surfaces to be painted as designated in these specifications.

All surfaces shall be cleaned in accordance with Steel Structures Painting Council standards SSPC - SP1 Solvent Cleaning for removal of grease and oil. This standard allows for pressure washing, detergent cleaning, etc. Additional rust, loose paint, loose mill scale, etc., shall be removed in accordance with SSPC - SP2 Hand Tool Cleaning or SSPC - SP3 Power Tool Cleaning. All welds, beads, blisters or protuberances, other than identification markings shall be ground smooth. Pits and dents shall be filled with a suitable product as approved by the Engineer, and other imperfections shall be removed. Painted edges shall be sanded smooth with adjacent bare metal surfaces.

Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, these areas shall be given two coats of asphalt varnish conforming to Fed. Spec. TT-V-51F.

**Concrete and Wood Surfaces:**

Surface preparation of all exterior concrete and wood surfaces shall be pressure washed to remove cobwebs, dirt, dust, and other surface contaminations. Mildew shall be treated with a 22% chlorine solution or otherwise by mixing equal parts solution bleach and water to the affected area. Loose paint and other defects shall be removed by hand; brushing, sanding, chipping or other hand tools or by power; brushes, impact tools, grinders, sanders or other power tools or by any combination thereof. Painted edges shall be sanded smooth to match adjacent bare surfaces.

All interior concrete and wood surfaces including ceilings, walls, and floors shall be cleaned similar to SSPC - SP1 Solvent Cleaning standards. Loose paint and other defects shall be removed by hand; brushing, sanding, scraping, chipping or other hand tools or by power; brushes, impact tools, grinders, sanders or other power tools or by any combination thereof. Painted edges shall be sanded smooth to match adjacent bare surfaces.

Priming shall be performed with Porter International Pigmented Bonding Coat 898, or equal. Concrete, concrete masonry, and wood shall be thoroughly dry prior to painting.

W-24.04 Coatings

All paints and similar materials shall be mixed in galvanized iron pans or pails or other approved containers of adequate capacity. All paint shall be stirred thoroughly before being taken from the containers, shall be kept stirred while using, and all ready-mixed paint shall be applied exactly as received from the manufacturer without addition of any kind of drier or thinner, except as specified or as permitted or directed by the Engineer. Successive coats of paint shall be tinted to make various coats easily distinguishable. Undercoats of paint shall be tinted to the approximate shade of the final coat of paint. The paint shall be a minimum temperature of 60 degrees F before application.

Only skilled painters shall be used on the work, and specialists shall be employed where required. Paint shall be applied by brush, roller, or sprayer in accordance with the manufacturer's recommendation. Finished surfaces shall not show brush marks or other irregularities. Top and bottom edges of doors shall be painted. Undercoats on hollow metal work shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal abrasive to remove all surface defects and provide a smooth, even surface.

Painting shall be a continuous and orderly operation to facilitate adequate inspection. All paint application methods shall be in accordance with the instructions of the paint manufacturer and as approved by the Engineer. Access panels, pipes, pipe covering, ducts, and other building appurtenances built into or adjoining walls to be painted shall be painted the same color as adjacent walls, unless otherwise directed by the Engineer. Hardware and accessories, fixtures, and similar items placed prior to painting shall be removed or protected during painting and replaced on completion of painting. All wall surfaces to be concealed by equipment shall be painted before installation of the equipment.

Areas under and adjacent to painted work shall be fully protected at all times and dripped or splattered paint shall be promptly removed. Painting shall not be done when the temperature is below 60 degrees F, or in dust-laden air, or until moisture on the surface has completely disappeared. If necessary, sufficient heating and ventilation shall be provided to keep the atmosphere and all surfaces to be painted dry and warm until each coat of paint has hardened. Any painting found defective shall be removed and repainted or touched up as directed by the Engineer.

Coatings must be allowed to cure before being recoated or placed into service. Drying time requirements recommended by the manufacturer should be followed exactly.

The final colors shall be as selected by the Engineer from the manufacturer's color charts.

Coverage shall be complete. When color on undercoats shows through the final coat of paint, the work shall be covered by additional coats until the paint is of uniform color and appearance and coverage is complete, at no additional cost.

Rooms or areas being painted shall be supplied with sufficient temporary ventilation during painting operations to keep the atmosphere safe from harmful or dangerous fumes and harmful dust levels for personnel.

All application tools and equipment shall be in good working order and suitable for proper applications. It shall be the Contractor's responsibility to ensure that no paint mist or spatter falls or blows to other objects, vehicles, equipment, buildings, etc.

**Coating Schedule:**

All painting shall be in accordance with the following schedule, unless otherwise directed by the Engineer. The number of coats shall not be less than the number shown on the schedule.

| COATING SCHEDULE | | | | | |
|---|---|---|---|---|---|
| | | | Coats | | |
| **Class of Work - Metal Surfaces** | **Pretreatment** | **Primer** | **1ST** | **2ND** | **3RD** |
| Steel Pipe, Valves, and Fittings | N | N | K | K | |
| Ductile Iron Pipe, Valves, and Fittings (Not Buried) | | E | K | K | |
| Miscellaneous Steel and Ironwork | N | N | K | K | |
| Machinery, Interior, and Nonsubmerged | | C | K | K | |

The designations in the following list are given solely for the purpose of indicating the type and quality of materials desired. Approved equivalent material of other manufacturers may be substituted. All coats of paint for any particular surface shall be from the same manufacturer.

| ALPHABETICAL DESIGNATIONS OF PRODUCTS | | |
|---|---|---|
| **Symbol** | **Product Name and Number** | **Minimum Dry Film Thickness Mils per Coat** |
| A | Porter Guard Industrial Aluminum PP293 | 1.5 |
| C | Porter Guard Alkyd Metal Primer PP272/276 | 2.0 |
| E | International Protective Coatings Interzinc 215 | 1.5 |
| K | International Protective Coatings Intergard 475 | 5.0 |
| N | ZRC Cold Galvanizing Compound | 1.5 |

This paint schedule may vary to suit the current product recommendations of the manufacturer's technical representative. All products shall be suitable for industrial application at an urban stormwater pumping facility.

W-24.05 Safety

The Contractor shall be responsible for exercising all necessary precautions to ensure that no accidents or damage to personnel, equipment, or buildings shall occur. The Contractor shall further determine any special operations which could influence the safe workmanship of his personnel with respect to electrical, mechanical, or chemical fumes or fire hazard situations.

When painting in confined areas or otherwise in areas where explosive fumes or gases need to be ventilated, the Contractor shall use suction type fans designated specifically for the safe removal of explosive fumes or gases, and all equipment involved shall meet all OSHA (Occupational Safety Hazard Act) requirements and MSHA (Mine Safety and Health Administration) approved. The Contractor shall be responsible in all respects for the safe conduct of his personnel when using any of the rigging or equipment involved in the accomplishment of the work specified herein.

W-24.06 Cleaning

The Contractor shall touch up and restore any damaged finish. Paint or other finishes spilled, splashed, or splattered shall be removed from all surfaces. Care shall be taken not to mar any surface finish or item being cleaned.

* * *

# SECTION 25
# LAWN REPLACEMENT

## W-25.01 General

The Contractor shall replace all lawn areas which have been removed or damaged due to construction or bypass pumping operations. Lawn replacement includes fine grading the areas to be restored and furnishing and placing topsoil, fertilizer, sod, sprigs, seeding, and maintaining all areas. Grassing and mulching or sodding lawn areas will be required as directed. Grassing shall be accomplished by seeding.

Sod shall be Argentine Bahia, St. Augustine, or other approved native grass sod, and shall be well matted with grass roots. It shall be sufficiently thick to secure a dense stand of live grass, with a minimum thickness of 2 inches. The sod shall be live, fresh and uninjured, and shall contain sufficient moisture at the time of planting to induce growth. The type and quality of sod shall be approved by the Engineer before placing.

Grass seed shall be Argentine Bahia, 60 #/acre from March 1 to November 1; 50 #/acre with 20 #/acre of rye grass seed from November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.

Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda or Bahia grass hay.

## W-25.02 Topsoil

Where areas are to be restored by sodding, topsoil shall be placed to a minimum compacted depth of 2 inches over the subgrade. Where areas are to be restored by grassing, topsoil shall be placed to a minimum compacted depth of 4 inches over the subgrade. All topsoil shall be suitable excavated topsoil which has been segregated or other topsoil material approved by the Engineer. Topsoil shall be free from stones, roots, sticks, or other foreign substances.

## W-25.03 Water

The Contractor shall furnish at his own expense all water required for lawn replacement and maintenance of the work until final acceptance.

## W-25.04 Construction Methods

Prior to sodding or grassing, the Contractor shall fine grade the subgrade to 4 inches below finished grade. Topsoil shall be spread over the subgrade to a uniform depth and density. Topsoil shall be uniformly compacted by a light hand roller weighing between 250 and 750 pounds to the specified depths for sodding or grassing.

Immediately before sodding, 14-4-14 or 15-0-15 fertilizer shall be applied at the rate of approximately 600 pounds per acre, either in the furrows or by broadcasting and raking, into the planting area. After the surface has been properly prepared, the sod shall be placed and firmly embedded by light tamping. Additionally, dolomite (lime) shall be applied at a rate of 2 tons per acre.

Immediately after the sod has been planted, if the soil does not contain sufficient moisture to ensure growth, water shall be applied twice daily for the first week, once in the morning or late evening and once at approximately 2:00 P.M. Water shall then be applied once a day over the next 2 weeks and alternating days for an additional 2 weeks. If rooting has not taken place by the end of the third week, 1 daily watering shall continue until sod is firmly rooted.

One week after the sod has been planted, a complete fertilizer with minor elements shall be applied weekly at the rate of 1# nitrogen per 1,000 square foot in a 2-1-2 or 4-1-2 formula for a period of 4 weeks, and thereafter every 2 weeks for an additional 30 days. The ground shall not be wet when the fertilizer is applied but will be immediately watered after application of the fertilizer to remove it from the leaf area.

Prior to grassing, 14-4-14 or 15-0-15 fertilizer shall be applied to the soil at the rate of approximately 300 pounds per acre. Grass seed at the specified rate per acre shall then be raked into the soil and covered with mulching material. The area shall then be thoroughly rolled with approved equipment.

After the grass has been planted, if the soil does not contain sufficient moisture to ensure growth, water shall be applied as directed by the Engineer. After the grass has started growing, fertilizer shall be applied uniformly over the area weekly, at a rate of 0.5# nitrogen and potash per 1,000 square feet, until turf cover the area. The fertilizer shall not be applied unless the surface of the ground or sod is sufficiently moist to quickly dissolve the fertilizer.

W-25.05 Caretaking

The Contractor shall keep all replaced lawn areas in good, healthy, insect free, moist condition by watering, replanting or resodding, weeding, fertilizing, and cutting as specified, and directed by the Engineer.

* * *

# SECTION 52
# MANHOLE AND STRUCTURE REHABILITATION

## W-52.01 General

It is the intent of this specification to provide for the rehabilitation of the existing brick and concrete manholes, junction chambers and structures shown on the drawings, specified and directed by the Engineer. The rehabilitation shall consist of a 100% solids epoxy system, or polymorphic resin rehabilitation system as specified herein. All aspects of the rehabilitation shall be done in strict accordance to the manufacturer's instructions.

It is the Contractor's responsibility to comply with OSHA standards and all regulations pertaining to work in confined space entry.

## W-52.02 Submittals

Prior to the commencement of any rehabilitation work, the Contractor shall submit the following to the Engineer for approval:

1) A rehabilitation plan detailing the methods, materials and procedures proposed for the rehabilitation of all manholes and junction chambers.

2) Mortar and hydraulic cement mix designs detailing the compressive strengths, cement/water ratios, slump, etc.

3) Written certification by the protective coating manufacturer stating that the proposed repair material is compatible and acceptable as a substrate for the protective coating to be applied.

4) Detailed method of 100% containment requirement for all sandblasting.

5) Description of all the equipment to be used for the rehabilitation.

6) Safety plan describing all safety equipment to be utilized in compliance with OSHA standards pertaining to work in confined space entry.

## W-52.03 Surface Preparation

Surface preparation shall be in strict accordance with the approved coating manufacturer's instructions. All surfaces to be coated shall be cleaned with a high pressure water spray (minimum 10,000 psi) or other method as required by the approved material's manufacturer. The use of acid for cleaning purposes will not be allowed. All deteriorated concrete and loose or protruding brick and mortar shall be removed from the wall and benches in order to obtain a smooth and even substrate suitable for the proposed coating system. If sand blasting is utilized to achieve the necessary substrate, 100% of the material shall be contained

and disposed of as approved by the Engineer. Surfaces shall be cleaned and abraded to produce a sound and uncontaminated surface with adequate profile and porosity to provide a strong bond between the proposed material and the substrate. All corroded materials shall be disposed of at an off-site location in accordance with all Federal, State, and local regulations. All infiltration shall be stopped with hydraulic cement or other approved means before installation of the coating system. Any voids in the manhole walls shall be sealed with hydraulic cement.

Repair materials shall be applied in strict accordance with the manufacturer's instructions and shall be finished as recommended by the protective coating manufacturer. At minimum, the repair material shall be troweled or brushed to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating.

The moisture content of the substrate shall be measured using an on-site concrete moisture meter to record the percent moisture levels in at least one location per every 300 square feet of surface to be rehabilitated. The moisture content shall be at a level acceptable to the manufacturer before applying concrete repair or protective coating materials. If moisture content levels are unacceptable, additional curing time or other means as approved by the engineer will need to be implemented to achieve the proper moisture content.

The Contractor shall install bulkheads or plugs in order to prevent extraneous material from entering the sewer lines.

W-52.04 Epoxy Coating System

The sprayed applied epoxy coating system shall be as manufactured by Raven Lining Systems, Broken Arrow, Oklahoma, Sherwin Williams Cor-Cote SC, Cleveland, Ohio or equal. The product shall be a 100% solids, solvent-free ultra high-build epoxy. The finished epoxy shall be resistant to sulfuric acid attack associated with domestic sewage. The epoxy shall be manually sprayed onto the structures or manholes to provide a uniform smooth and even surface.

The minimum finished thickness shall be as specified on the plans. The coating system shall be capable of being applied over wet surfaces without degrading the final product.

The existing manhole and junction chambers shall be prepared for the application of the epoxy system by cleaning and stoppage of infiltration as specified above. Prior to applying the epoxy liner, the entire manhole surface and benches shall be patched and grouted to the extent needed to provide a smooth and even surface to which the liner will adhere.

The cured epoxy system shall conform to the minimum physical standards, as listed below:

| CURED EPOXY | STANDARD | LONG-TERM DATA |
|---|---|---|
| TENSILE STRENGTH | ASTM D-638 | 7,500 psi |
| FLEXURAL MODULUS | ASTM D-790 | 600,000 psi |
| FLEXURAL STRESS | ASTM D-790 | 13,000 psi |
| COMPRESSIVE STRENGTH | ASTM D-695 | 18,000 psi |

The Contractor shall provide certified independent, third party test results verifying the minimum physical properties listed above. The tests shall be in conformance with the ASTM specifications listed.

The finished liner shall be cured in strict accordance with the manufacturer's instructions.

Composite systems containing layers of different materials or cured-in-place resin systems that are inflated in the manholes will not be considered as equal.

W-52.05 Contractor Qualifications

The manufacturer and installer of the rehabilitation system shall be specialized in the design and installation of the rehabilitation system for at least 5 years. The installer shall be approved and certified in writing by the manufacturer and shall be completely trained in leak repair, surface preparation, and installation of the rehabilitation system. References shall be provided upon request to demonstrate that the installer has successfully used the rehabilitation system in Florida on a minimum of 5 projects, one of which must be at least 5 years old.

W-52.06 Thickness Verification and Inspection

The Contractor shall provide a method of verifying the actual coating thickness installed to ensure it meets or exceeds the minimum values specified. The proposed liner thickness verification method shall be submitted to the Engineer for approval.

The Contractor may utilize a wet film thickness gage meeting ASTM D4414 to ensure monolithic coating and uniform thickness during application. A minimum of three readings per 200 square foot area shall be recorded. Documentation on thickness readings shall be conveyed to the Inspector on a daily basis when the coating application occurs.

All phases of the manhole rehabilitations such as surface preparation, bench reconstruction, liner installation, annulus sealing, grouting, curing, testing, etc., will be inspected by the Department's Field Engineering personnel for conformance to the specifications, construction drawings, and liner manufacturer's instructions. The Contractor shall, therefore, coordinate his schedule for the installation of the structural coating system with the field office, and with due regard for site and weather conditions prevailing at the time.

The final manholes shall be completely free of defects.

The Contractor shall inspect all rehabilitated manholes utilizing closed circuit television 24 hours after coating system is complete. The intent of the inspection is to find any deficiencies to the finished liner. Contractor shall repair deficiencies within 1 week of notification. All television inspection videos to be provided to the City shall be in DVD format. One copy of the DVD shall become the property of the City.

W-52.07 Spark Testing

The coating system shall be spark tested prior to acceptance. The holiday testing shall be in strict accordance with NACE SPO188. After the coating has set hard to touch, it shall be inspected with high-voltage holiday detection equipment. An induced holiday shall be made onto the coated concrete surface and will serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of minimum specified (not average) film thickness applied but may be increased if it is insufficient to detect the induced holiday. All detected holidays shall be marked and repaired per the manufacturer's recommendations. All costs associated with the testing shall be borne by the Contractor. Testing equipment shall be in good working condition and evidence of certified calibration within the last year shall be provided before the detection test equipment shall be used.

W-52.08 Warranty

The Manhole Rehabilitation Contractor shall furnish the City of Tampa with an unconditional 5-year warranty for materials and workmanship. This warranty shall be a guarantee against failure for the warranty period. Failure shall be defined to occur if the rehabilitation system fails to:

1. Prevent the internal damage or corrosion of the structure.
2. Prevent groundwater infiltration.
3. Adhere to existing structure wall.

If any failures occur within the specified warranty period after final acceptance, the Contractor shall repair or restore the structure to its previously accepted state including all materials, labor, and at no additional cost to the City. Repair shall be completed within 30 days of written notification of the failure.

* * *

SECTON 03 30 00

CAST IN PLACE CONCRETE

1.0 GENERAL

1.01 Scope

A. This section specifies cast in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

B. The extent of the concrete work is specified in the drawings. Cast in place concrete work includes, but is not limited to, foundations and footings, slabs on grade and structural slabs, beams, and columns.

1.02 Quality Assurance

A. Codes and Standards: Comply with the provisions of the latest editions of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI):

a. ACI 301 “Specifications for Structural Concrete for Buildings”
b. ACI 318, ACI 318R “Building Code requirements for Reinforced Concrete and Commentary”
c. ACI 117 “Standard Tolerances for Concrete Construction and Materials”
d. ACI 211.1 “Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete”
e. ACI 304 “Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”
f. ACI 305R “Hot Weather Concreting”
g. ACI 306R “Cold Weather Concreting”
h. ACI 308 “Standard Practice for Curing Concrete”
i. ACI 309 “Standard Practice for Consolidation of Concrete”
j. ACI 315R “Manual of Engineering and Placing Drawings for Reinforced Concrete Structures”
k. ACI 347 “Recommended Practice for Concrete Formwork”
l. ACI 302 “Guide for Floor and Slab Construction”

2. American Society for Testing and Materials (ASTM) – latest editions of the following standards:

a. ANSI/ASTM D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

b. ASTM C31 Method of Making and Curing Concrete Test Specimens in the Field.
c. ASTM C33 Concrete Aggregates
d. ASTM C94 Ready-Mixed Concrete
e. ASTM C143 Test Method for Slump of Portland Cement Concrete
f. ASTM C150 Portland Cement
g. ASTM C171 Specification for Sheet Materials for Curing Concrete
h. ASTM C173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
i. ASTM C230 Specifications for the Flow Table for Use in Tests of Hydraulic Cement
j. ASTM C231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
k. ASTM C260 Air Entraining Admixtures for Concrete
l. ASTM C330 Lightweight Aggregates for Structural Concrete
m. ASTM C494 Chemical Admixtures for Concrete
n. ASTM C618 Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
o. ASTM C939 Test Method for Flow of Grout for Preplaced-Aggregate Concrete
p. ASTM C469 Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
q. ASTM E1155 Standard Test Method for Determining Floor Flatness and Levelness Using the F-number System

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

1.03 Submittals

A. Product Data for Proprietary Materials and Items: Reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, etc.

B. Product Data for Concrete

1. Mix design for each class of concrete

a. Fully document proposed materials and mix designs.
b. Submit mix design for review.
c. Submit mix design and documentation 28 days, minimum, prior to use in the field.

2. Manufacturer's recommendations for use of admixtures and curing compound.
3. Provide maximum expected amount of chloride ions in the mix.

C. Shop Drawings; Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Provide one sepia and additional prints as required for distribution. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangements of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Shop Drawings – Formwork: Submit shop drawings for fabrication and erection of formwork. The formwork shop drawings shall bear the signature and seal of the licensed engineer in responsible charge of their production.

E. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

F. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests as specified.

## 2.0 PRODUCTS

### 2.01 Form Materials

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct form work for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

B. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

C. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

D. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 Reinforcing Materials

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Weld Wire Fabric: ASTM A 185, welded steel wire fabric.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications, unless otherwise acceptable.

D. For foundation work, including slab on grade, use supports with sand plates or horizontal runners, or concrete bricks where base materials will not support chair legs.

E. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI Class 2).

F. Moisture Barrier: Provide moisture barrier cover over prepared base material where indicated. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

1. A multi-layer sheet membrane waterproofing system consisting of a self-healing, expandable layer of granular bentonite laminated at the rate of up to one pound per square foot to an impermeable, high density polyethylene (HDPE) “Paraseal LG” by Tremco, Inc.

2. Water resistant barrier paper consisting of heavy craft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. “Moistop” by Fortifiber or approved equal.

2.03 Concrete Materials

A. Concrete design mixes, ASTM C 94, 28-Day Compressive Strength:

| | | |
|---|---|---|
| 1. | Foundations: | 4000 psi |
| 2. | CMU Grout - Filled cells & Wall cavities: | 3000 psi |
| 3. | Slabs on grade: | 4000 psi |
| 4. | Pump Pedestals and Pipe Supports: | 4000 psi |
| 5. | Exterior Transformer Platform and Stairs: | 4000 psi |

B. Water-to-Cementitious Ratio: 0.40 maximum. Water content of admixtures shall be included in the water-to-cementitious ratio.

C. Portland Cement: ASTM C 150, Type I, unless otherwise acceptable to Architect and/or Engineer. Use one brand of cement throughout project, unless otherwise acceptable to Architect and/or Engineer.

D. Use one brand of cement throughout project, unless otherwise acceptable to Architect and/or Engineer.

E. Fly Ash (ASTM C618): Type C or Type F is acceptable, but not to exceed 20 percent by weight of total cement content.

F. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

G. Water: Clean, potable and free from deleterious amounts of acids, alkalies or organic materials.

H. Air-Entraining Admixture: ASTM C 260. Certified by manufacturer to be compatible with other required admixtures.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"AEA-92" and "AIR MIX 200"; Euclid Chemical Company
"MB-VR or MB-AE; Master Builders (BASF)
"Sika AEA-14"; Sika Corp.
"Darex AEA"; W.R. Grace

I. Water-Reducing Admixture: ASTM C 494, Type A, and contain not more than 0.1% chloride ions.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Eucon WR-75"; Euclid Chemical Co.
"Pozzolith 322 N"; Master Builders (BASF)
"Plastiment NS"; Sika Corp.

J. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G and contain not more than 0.1% chloride ions.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Eucon 37"; Euclid Chemical Co.
"Glenium 3000 NS"; Master Builders (BASF)
"Sikament 300"; Sika Corp.
"ADVA 100"; W.R. Grace.

K. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1% chloride ions.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Accelguard 80"; Euclid Chemical Co.
"Pozzolith 122 HE"; Master Builders (BASF)
'Lubricon NCA"; W.R. Grace

L. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and contain not more than 0.1% chloride ions.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Eucon Retarder 75"; Euclid Chemical Co.
"Pozzolith 300-R"; Master Builders

M. Certification: Provide admixture manufacturer's written certification that chloride ion content complies with specified requirements.

1. Calcium chloride or admixtures containing more than 0.1% chloride ions are not permitted.

N. Corrosion Inhibitor Admixture: ASTM C 494, calcium nitrite (30% plus or minus 2%) based liquid corrosion inhibitor admixture for the protection of reinforcing steel and accessories against chloride induced corrosion.

1. Contractor shall adjust the quantity of concrete mix water to account for the water contained in the corrosion inhibitor admixture. The mix water adjustment shall be as per the manufacturer's published documentation.
2. The corrosion inhibitor admixture shall be compatible with all other ingredients and admixtures utilized in the concrete mix.

3. The corrosion inhibitor admixture shall be placed into the concrete mix as per the manufacturer's published documentation. Application rate shall be 4 gallons per cubic yard.
4. Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following: DCI; Grace Construction Products or approved equal.

O. Synthetic Fiber Reinforcement: ASTM C 1116, 100% polypropylene fibers in microfilament form for control of plastic shrinkage cracking and improved durability.

1. The fiber reinforcement shall be compatible with all other ingredients and admixtures utilized in the concrete mix.
2. Fiber reinforcement shall be alkali resistant, non-absorptive, and non-corrosive.
3. The fiber reinforcement shall be placed into the concrete mix per the manufacturer's published documentation. Application rate shall be 1 lb. per cubic yard.
4. Approved Products: Subject to compliance with applicable instructions to bidders and submittal requirements, products which may be incorporated in the work include, but are not limited to, the following: Grace MicroFiber; Grace Construction Products or approved equal.

2.04 Related Materials

A. Expansion Joint Material: Preformed sections of bituminous impregnated fiberboard.

B. Expansion Joint Filler: ASTM D 1751

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

J & P Petroleum Products, Inc.
Anti Hydro Company
W.R. Meadows, Inc.

C. Non-Shrink, Non-Metallic Grout: CRD-C 621, factory pre-mixed grout.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Euco-NS Grout"; Euclid Chemical Co.
"Construction Grout" or "Masterflow 555"; BASF Building Systems

"Crystex"; L & M Const. Chemical Co.
"1107 Advantage Grout" - Dayton Superior Corp.

D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

F. Liquid Membrane Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq ft./gal.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Ecocure, Rez-Seal, Aqua-Cure, Diamond-Clear -VOX"; Euclid Chem. Co.
"J-22 Day Chem Cure & Seal", Dayton Superior
"Kure-N-Seal 30", Sonneborn
"Dress & Seal 30", L & M Construction Chemicals.

G. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"EucoWeld"; Euclid Chemical Co.
"J-41 Bonding Agent", Dayton Superior.
"Weld-Crete"; Larsen Products.
"Lambco Primer or Bond"; Lambert Corp.
"Everweld"; L & M Construction Chemicals.

H. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

Approved Products: Subject to compliance with applicable Instructions to Bidders and Submittal Requirements, products which may be incorporated in the work include, but are not limited to, the following:

"HIT HY 150"; Hilti

"Power-Fast+"; Powers Fasteners
"AC1000+"; Powers Fasteners
"ET Epoxy Tie"; Simpson
"SET Epoxy Tie"; Simpson
"Ultrabond 1100"; U.S. Anchor
"Ultrabond 2100"; U.S. Anchor

I. Reglets: Galvanizes sheet steel reglets, minimum 26 gage.

J. Water stops: Rubber or PVC water stops.

K. Moisture Barrier: Provide moisture barrier cover over prepared base material where indicated. Use only materials which are resistant to decay when tested in accordance with ASTM 154, as follows:

1. A multi-layer sheet membrane waterproofing system consisting of a self-healing, expandable layer of granular bentonite laminated at the rate of up to one pound per square foot to an impermeable, high density polyethylene (HDPE). "Paraseal LG" by Tremco, Inc. or approved equal.

2. Water resistant barrier paper consisting of heavy craft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. "Moistop" by Fortifiber or approved equal.

3. Polyethylene sheet, 6 mils. Place under all slab on grade in enclosed space.

2.05 Proportioning and Design of Mixes

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect and/or Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect and/or Engineer.

B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect and/or Engineer.

C. Design mixes to provide concrete with the 28-day compressive strength, unit weight and aggregate sizes as indicated in the specifications or on the drawings.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect and/or Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

E. Admixtures:

1. Use water-reducing admixture or high range water-reducing admixture (super plasticizer) in concrete as required for placement andworkability.

2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 degrees F (10 degrees C).

3. Use air-entraining admixture in all concrete, unless otherwise indicated. Add Air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within following limits:

| Max. Agg. Size | Total Air Content |
|---|---|
| 1 1/2 inch | 2.5 % |
| 1 | 3.0 |
| 3/4 | 3.5 |
| 1/2 | 4.0 |
| 3/8 | 4.5 |

4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.

F. Minimum Cement Content: Provide cement content as required for strength, but not less than these guidelines:

| Max. Agg. Size | Cement, lb/cy |
|---|---|
| 1-1/2 | 470 |
| 1 | 520 |
| 3/4 | 540 |
| 1/2 | 590 |
| 3/8 | 610 |

G. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement between 3 and 5 inches.

H. Slab on Grade:

1. Maximum slump at point of delivery, 5 inches
2. Maximum aggregate size, 1 inch.

3. Entrained air content, 4.5%.
4. Contractor's option to use superplasticizer to increase workability (8 inch maximum slump, 0.45 maximum water cement ratio).

2.06 Concrete Mixing

A. Job-Site Mixing: Shall be used only with prior written consent of the Architect and for small amounts.

Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1 ½ minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.

Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes.

When air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

3.0 EXECUTION

3.01 Forms

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set time to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Exposed edges of beams and columns shall be chamfered 3/4 inch, unless otherwise noted, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Form Ties: Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is 1” inside concrete and will not leave holes larger than 1” diameter in concrete surface.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement to eliminate mortar leaks and mortar proper alignment.

3.02 Placing Reinforcement

A. Comply with Concrete Reinforcing Steel Institute’s recommended practice for “Placing Reinforcing Bars”, for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

1. Minimum Cover:

a. Footings, 3 inches to bottom and unformed sides, 2 inches to formed sides.

b. Other, 2 inches to main reinforcing, 1-1/2 inches to ties and stirrups.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least two full meshes and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction. Welded wire fabric for slab on grade shall be WWF 6x6-W1.4xW1.4, unless otherwise noted. Place welded wire fabric 1-1/2 inches in from the top of slab on grade unless noted otherwise. Interrupt typical slab reinforcement at all construction and expansion joints. See specific details for any dowels required for shear transfer. Cut alternate wires along the line of saw cut control joints prior to placing concrete.

F. Provide minimum lap splice per ACI 318-95 for all reinforcing bars, unless noted otherwise. Stagger splices in adjacent bars at least 24 inches, except in beams and columns.

G. In wall footings, grade beams and bond beams, provide bent bars at corners and intersections of the same number and size as the straight bars.

3.03 Joints

A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as approved by the Architect/Engineer.

B. Provide key ways in construction joints in walls and continuous footings, and where shown on the drawings.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints.

D. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on- ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams and elsewhere as indicated. Provide 1/2 inch preformed expansion joint material where slab abuts vertical surfaces.

E. Contraction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown.

1. Contraction joints shall be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate or raveling.

2. It is recommended that the slabs be cast in long strips, and saw cut transversely, in order to minimize shrinkage cracking.

3.04 Installation of Embedded Items

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.05 Preparation of Form Surfaces

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer’s directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer’s instructions.

D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 Concrete Placement

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete, where form coatings are not used.

B. Water shall not be added to the concrete max at the job site without prior approval by the engineer.

C. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

D. General: Comply with ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”, and as herein specified.

E. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

F. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24” and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

G. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

H. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6” into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

I. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

J. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

K. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27 degrees C) at point of placement.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

L. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F (32 degrees C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor’s option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Fog spray forms, reinforcing steel and subgrade just before concrete is placed.

4. Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

M. The placement of partially hardened concrete, contaminated concrete, re-tempered concrete, and concrete remixed after its initial set shall be prohibited.

N. The placement of concrete shall be done at a rate such that poured concrete remains plastic and flows readily into spaces between reinforcement.

3.07 Finish of Formed Surfaces

A. Refer to architectural drawings as applicable to determine extent of exposed concrete and the finish desired.

B. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes, defective areas repaired and patched and fins and other projections exceeding 1/4” in height rubbed down or chipped off.

C. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum number of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.08 Monolithic Slab Finishes

A. Floor slabs shall be constructed to have a Minimum Flatness of Ff = 35, and a Minimum Levelness of Fl = 25, except for ramps and intentionally sloped slabs, which shall be constructed to have a Minimum Flatness of Ff = 20.

B. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

C. After placing slabs, plane surface so that depressions between high spots do not exceed ½” under a 10’ straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

D. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane so that depressions between high spots do not exceed 5/16" under a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

E. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

After floating, begin first trowel finish operation using a power- driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8" under a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

F. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, the immediately follow with slightly scarifying surface by fine brooming.

G. Non-Slip Broom Finish: Apply non-slip broom finish to all ramps, exterior concrete platforms and steps, and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.09 Concrete Curing and Protection

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days at a temperature of 50 degrees F minimum.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

D. Curing Methods: Perform curing of concrete by liquid membrane curing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified. The Contractor may choose the method of curing compatible with project requirements and site conditions.

E. Provide moist curing by one of the following methods:

1. Keep concrete surface continuously wet by covering with water.

2. Continuous water-fog spray.

3. Cover concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4” lap over adjacent absorptive covers.

F. Provide moisture-cover curing as follows:

1. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3” and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

G. Provide liquid membrane curing compound to interior slabs with resilient flooring, carpet over cushion, or left exposed; and to exterior slabs, walks, and curbs, as follows:

Apply specified curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer’s directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp-proofing, membrane roofing, flooring, (such as ceramic or quarry tile, glue-down carpet), painting, and other coatings and finish materials, unless otherwise notified in writing by Architect that coating material is compatible with membrane curing compound.

H. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

I. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

1. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

J. Sealer and Dust-proofer: Apply a second coat of specified curing compound only to surfaces given a first coat.

3.10 Removal of Forms

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F (10 degrees C) for 24 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.

B. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

C. 80% of the design concrete strength shall be attained prior to form removal.

3.11 Re-Use of Forms

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to Architect and/or Engineer.

3.12 Miscellaneous Concrete Items

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Slabs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

1. Grout base plates and foundations as indicated, using specified non-shrink grout.

D. Reinforced Masonry: Provide concrete grout for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

3.13 Concrete Surface Repairs

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect and/or Engineer.

1. Cut out honeycomb, rock pockets, voids over 1/4” in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1”. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

1. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect and/or Engineer.

D. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete, and apply concrete bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

E. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

F. Perform structural repairs with prior approval of Architect/Engineer for method and procedure, using specified epoxy adhesive and mortar.

G. Repair methods not specified above may be used, subject to acceptance of Architect/Engineer.

3.14 Quality Control Testing During Construction

A. The CONTRACTOR will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during placement of concrete will include the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test at point of discharge for each strength test; additional tests when concrete consistency seems to have changed.

3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

4. Concrete Temperature: Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and every thirty minutes when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens made.

C. Compression Test Specimen: ASTM C 31; one sample set of 4 standard cylinders (6 inches by 12 inches) for each compressive strength test, unless otherwise directed. The contractor may require additional cylinders. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

D. Compressive Strength Tests: ASTM C 39; one sample set for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards, or fraction thereof, of concrete nor less than once for each 5,000 square feet of surface area for slabs and walls; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

1. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

2. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

3. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.

E. Test results will be reported in writing to Architect, Engineer and Contractor within 24 hours that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for 7 and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

G. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTON 03 30 00

# SECTION 05 10 00

# STRUCTURAL STEEL

## 1.0 GENERAL

### 1.01 Related Documents

Drawings and general provisions of Contract, including general and supplementary conditions and other Specification sections applicable to the work of this section.

### 1.02 Summary of Work

A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in AISC “Code of Standard Practice” and as otherwise shown on drawings.

C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

### 1.03 Submittals

In compliance with all Project Specification as applicable and as specified herein.

A. Product Data: Submit producer’s or manufacturer’s specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications including specified standards.

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts (each type), including nuts and washers.

3. Structural steel primer paint.

4. Shrinkage-resistant grout.

B. Shop Drawings: Submit shop drawings prepared under supervision of a registered professional engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams. Structural steel shop drawings shall be signed and sealed by the professional engineer who supervised their production.

1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.

3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type (s) of tests conducted and test results.

1.04 Quality Assurance

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

2. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings".

3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" of Supplements thereto as issued.

4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Structural Connections of the Engineering Foundation.

5. AWS D1.1 "Structural Welding Code".

6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.

D. If recertification of welders is required, retesting will be Contractor's responsibility.

1.05 Delivery, Handling and Storage

A. Deliver materials to site at such intervals to insure uninterrupted progress of 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 work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged material or structures as directed.

2.0 PRODUCTS

2.01 Materials

A. Metal Surfaces, General: For fabrication of work 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.

B.

| | |
|---|---|
| Hot-Rolled Steel Beams and Columns: | ASTM A992 Grade 50. |
| Plates, Bars, Channels, Rods, Anchor Bolts and Angles: | ASTM A36 |
| S-Series (Hoist Beam): | ASTM A36 |

C. Cold-Formed Steel Tubing: ASTM A 500, Grade B, Fy=46 ksi.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B, Fy=35 ksi.

E. Finish: Black, except where indicated to be galvanized.

F. All structural steel that is exposed to the exterior environment shall be galvanized as per ASTM A123.

G. Anchor Bolts shall be furnished with heavy hex nuts and flat washers, and shall be ASTM F1554, with a nut at the embedded end. Tac weld nut to bolt or strike threads.

H. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325, 3/4 inch diameter, unless otherwise noted.

2. Direct tension indicator washers may be used at Contractor's option.

I. Electrodes for Welding: E 70 XX

1. Provide electrodes, welding rods and filler metals equal in strength and compatible in appearance with parent metal joined.

2. Welds not otherwise designated shall be 1/4 inch minimum fillet.

J. Structural Steel Primer Paint: All structural steel, including joists, shall receive two shop coats of rust inhibiting primer paint conforming to the performance requirements of Federal Specification TT-P-636, SSPC-Paint 13 or equal.

K. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

L. Available Products: Subject to compliance with Instructions to Bidders and Section 01630 (if applicable), products which may be incorporated in the work include the following. All other manufacturers must request approval.

NS Grout; Euclid Chemical Co.
Masterflow 713; Master Builders.
Five Star Grout; U.S. Grout Corp.

2.02 Fabrication

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.

B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.

D. Ends of columns shall be milled to bear at all splices and attachment of base plates.

E. Connections: Weld or bolt shop connections, as indicated.

1. Bolt field connections, except where welded connections or other connections are indicated.

2. Framing connections shall be AISC Type 2 double-angle bolted connections, unless otherwise noted. Select connections to support one-half the total uniform load capacity shown in the uniform load constants, part 2 of the AISC manual, for the span and grade of steel specified.

F. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A 490 Bolts".

G. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

H. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 Shop Painting

General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

A. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

B. Do not paint surfaces which are scheduled to receive sprayed- on fireproofing.

C. Apply two coats of primer to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. SP-1 "Solvent Cleaning".

2. SP-2 “Hand Tool Cleaning”.

E. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer’s instructions and at a rate to provide dry film thickness of not less than 1.0 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

## 3.0 EXECUTION

### 3.01 Erection

A. Temporary Shoring and Bracing: Contractor shall provide adequate temporary bracing, shoring and guying of the framing against wind, construction loads or other temporary forces until such protection is no longer required for the safe support of the structure. Provide temporary shoring and bracing members 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 structures as erection proceeds.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

2. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

4. For proprietary grout materials, comply with manufacturer's instructions.

E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.

2. Splice members only where indicated and accepted on shop drawings.

F. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

G. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

H. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same materials as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

I. Return all welds at corners twice the normal weld size minimum.

J. All copes, blocks, cutouts and other cutting of structural members shall have all reentrant corners shaped notch-free to a radius of 1/2 inch minimum.

K. All beams shall be fabricated and erected natural camber up.

L. Structural openings, supports, anchors, etc., around or affected by mechanical, electrical and plumbing equipment shall be verified with the equipment purchased before proceeding with structural work affected.

M. Unless detailed elsewhere in the drawings, openings in roof decking larger than 1 square foot shall be framed by angles 4 x 4 x 1/4 leg down, bearing on a joist at each end. Cope vertical leg 4 inches each end. Weld additional angles of the same size to form a rectangle of the appropriate size.

3.02 Quality Control

A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.

1. High strength bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints using ASTM A325 or A490 Bolts.

2. Welded connections will be inspected and tested according to AWS D1.1 procedures.

B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment; however, Architect/Engineer reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

E. Correct deficiencies in structural steel work which inspections and/or laboratory test reports have indicated to be not in compliance with contract document requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any noncompliance of original work, and as may be necessary to show compliance of corrected work.

END OF SECTION 05 10 00

# SECTION 08 91 00

# EXTRUDED ALUMINUM STATIONARY WALL LOUVERS

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract and Division 01 shall apply to the work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work specified herein with that of other trades affecting, or affected by work of this Section. Cooperate with those trades to assure steady progress of work under contract. Promptly notify Project Superintendent of any issues that may affect the work under this Section.

### 1.02 SECTION INCLUDES

A. Wind-Driven Rain Resistant Stationary Louver.

### 1.03 REFERENCES

A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

D. AMCA 511 - Certified Ratings Program for Air Control Devices.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

I. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

J. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.

K. USGBC LEED: United States Green Building Council LEED Rating System.

1.04 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.05 ACTION SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: For each product to be used, including:

1. Manufacturer’s product data including performance data.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods.

C. Shop Drawings:

1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

D. Product Schedule: For louvers. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of louver, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.
2. Manufacturer shall be International Organization for Standardization (ISO) 9001 accredited.

B. Product Qualifications:

1. Florida Building Code (FBC) High Velocity Hurricane Zones: Test Application Standard (TAS) 100(A)-95.

   a. Test procedure for wind and wind-driven rain resistance and/or increased wind speed resistance of soffit ventilation strip and continuous or intermittent ventilation system installed at ridge area.

2. Miami-Dade County Code Compliance Office: Checklist #0240 for the approval of louvers (including gable end louvers).
3. Louver shall be certified to FBC standards TAS 201 (Large Missile Impact), TAS 202 (Uniform Static Air Pressure) and TAS 203 (Cyclic Wind Loading).
4. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 500-L and AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

1.09 WARRANTY

A. Manufacturer shall provide standard limited warranty for louver systems for a period of one year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

B. Manufacturer shall provide 20 year limited warranty for floropolymer-based finish on extruded aluminum substrates.

1. Finish coating shall not peel, blister, chip, crack or check.
2. Chalking, fading or erosion of finish when measured by the following tests:

a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
c. Finish coating shall not erode at a rate in excess of .01 mils/year as determined by Florida test sample.

2.0 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Ruskin Company; 3900 Dr. Greaves Road, Kansas City, Missouri 64030. Tel: (816) 761-7476.

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 MIAMI-DADE COUNTY APPROVED STATIONARY LOUVER

A. Model: EME6325D as manufactured by Ruskin Company.
1. Miami-Dade Notification Number: PRI09011.
2. Miami-Dade County, Florida Notice of Acceptance Number: 10-0672.01 (Expires 08/25/2015).

B. Fabrication: Extruded aluminum stationary louver style.

1. Frame:

   a. Frame Depth: 6 inches (152 mm).
   b. Wall Thickness: 0.095 inch (2.4 mm), nominal.
   c. Material: Extruded aluminum, Alloy 6063-T5.

2. Blades:

   a. Style: Vertically mounted
   b. Material: Extruded aluminum, Alloy 6063-T5.
   c. Wall Thickness: 0.062 inch (1.6 mm), nominal.
   d. Centers: 0.75 inches (19 mm), nominal.

3. Sill: Sill Flashing: Formed aluminum, 0.063 inch (1.6 mm), upturned sides to prevent water leakage.
4. Minimum assembly size: 12 inches (305 mm) length by 12 inches (305 mm) high.
5. Maximum assembly size: Unlimited length by 120 inches (3048 mm) high.
6. Recycled Content: 10% Post Consumer. 30% Pre Consumer, Post Industrial.

C. Performance Data:

1. Performance Ratings: AMCA licensed.

   a. Based on testing 39.4 inches by 39.4 inches (1000 mm by 1000 mm) size unit in accordance with AMCA 500.

2. Free Area: 42 percent, nominal.
3. Maximum Recommended Air Flow through Free Area: 1604 feet per minute (8.15 m/sec).
4. Air Flow: 14,591 cubic feet per minute (413 cu. m/min).
5. Maximum Pressure Drop (Intake): 0.40 inches w.g. (0.10 KPa).
6. Louver shall be certified to FBC standards TAS 201 (Large Missile Impact), TAS 202 (Uniform Static Air Pressure) and TAS 203 (Cyclic Wind Loading).
7. Wind load Test Performance: Maximum wind load of +112.5 PSF (5.39 KPa) and -225 PSF (10.77 KPa) design wind loads tested per Miami-Dade County Uniform Wind Pressure Test PA 202.
8. Wind-driven Rain Performance: 99.9 percent effective at preventing water penetration through louver when tested at 50 miles per hour (81 km/h) wind with 8 inches per hour (203 mm/h) rainfall and 2155 feet per minute (11 m/sec) airflow through the free area. Penetration Class ‘A’ with Discharge Class (Intake) ‘3’ in accordance with AMCA 500-L Wind Driven Rain Test.

D. Design Load:

1. Designed Wind load: +150 PSF (7.18 KPa) and -150 PSF (-7.18 KPa).
2. Designed Wind load: Per Code.
3. Louvers shall be provided with rear mounted blade supports as required to comply with wind load criteria.
4. Louvers shall be factory engineered to withstand the specified seismic loads.

a. Minimum design loads shall be calculated to comply with ASCE - 7, or local requirements of Authority Having Jurisdiction (AHJ).

2.03 ACCESSORIES

A. Bird Screen:

1. Aluminum: Aluminum, 5/8 inch by 0.040 inch (16 mm by 1 mm), expanded, and flattened.
2. Frame: Removable, rewireable.

B. Extended Sills:

1. Extruded aluminum, Alloy 6063-T5. Minimum nominal thickness 0.081 inch (2.1 mm).

2.04 FINISHES

A. 70 percent Floropolymer-Based Painted Finishes: Finish shall be applied at 1.2 mil total dry film thickness.

1. Coating shall conform to AAMA 2605. Apply coating following cleaning and pretreatment. Cleaning: AA-C12C42R1X.
2. Standard 2-coat.
3. Pearledize 70 (2-coat mica).
4. 3-coat metallic.
5. 3-coat exotic.

B. Color for Fluoropolymer Coating:

1. Color: Custom. Refer to Drawings.

3.0 EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive louvers. Notify the Engineer of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

B. If opening preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants.

3.04 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

# SECTION 11 05 13

# ELECTRIC MOTORS

## 1.0 GENERAL

### 1.01 Scope of Work:

A. Furnish all labor, materials, equipment and incidentals required for supplying electrical induction motors, complete with the necessary testing and necessary appurtances, as shown on the Drawings and 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 application. It is, however, intended to cover the furnishing, shop testing, delivering and installing and field testing of all materials, equipment and appurtenances for the induction motors as herein specified.

C. For all motors, there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries, whether specifically mentioned in these specifications or not, as required for an installation of this type of equipment.

D. The electric motor specification and requirements contained in this section are not applicable to the 400 horsepower wastewater pump motors. These motors are specified elsewhere in these Specifications.

### 1.02 Description of Systems: The equipment supplier shall assume unit responsibility for the proper operation of the equipment as a system, including motors and the driven loads.

### 1.03 References:

A. Codes and standards referred to in this Section are:

1. AFBMA 10 - Metal Balls.
2. NEMA CP1 - Shunt Capacitors.
3. NEMA MG1 - Motors and Generators.
4. NFPA 70 - National Electrical Code.

B. Motors shall conform to the latest ANSI Standards for rotating electrical machinery and in matters not covered therein, the latest NEMA Standards for motors and generators shall apply.

1.04 Qualifications:

A. To assure unit responsibility, the motors and its driven load shall be furnished and coordinated by the equipment supplier. The CONTRACTOR shall assume responsibility for the satisfactory installation and operation of the entire system, including motor, driven load and controls as specified. The motor supplier shall have a guaranteed parts stock program in the State of Florida.

B. The motors covered by these specifications are intended to be manufactured by a reputable manufacturer having long experience in the production of such equipment. The motor furnished shall be designed, constructed and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

C. All equipment furnished under this specification shall be new and unused.

1.05 Submittals:

A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the provisions of the Contract Documents. Submittals shall include at least the following:

1. Certified shop 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 each motor. Data shall include:

a. Horsepower
b. Voltage
c. Number of phases
d. Full load speed
e. Full load amperage
f. Frequency
g. Locked rotor amperage
h. Temperature rise
i. Service factor
j. Class of insulation system
k. Type of enclosure
l. Frame size
m. Maximum number of starts permitted per hour
n. Torque - speed curves

4. Complete wiring diagrams, elementary or control schematics including coordination with other electrical control devices and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Standard pre-printed sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

5. A list of the manufacturer's recommended spare parts to be supplied with the manufacturer's current price for each item. List bearings by the bearing manufacturer's number only.

B. Upon receipt of approval of submitted material, provide six (6) certified prints.

C. Submit to the Engineer Operating and Maintenance data.

1.06 Operating Instructions:

A. Operating and Maintenance instructions and manuals shall be furnished to the Engineer and shall include:

1. General - equipment function, description and normal and limited operating characteristics.
2. Installation instruction - assembly procedures and alignment and adjustment procedures.
3. Operation instruction - assembly procedures and alignment and adjustment procedures.
4. Maintenance instructions.
5. Trouble-shooting guide.
6. Parts list and predicted life of parts subject to wear.
7. Drawings - cross sectional view, assembly and wiring diagrams.

1.07 Product Handling:

A. All motors 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 ready for operation.

B. All motors must be properly protected against any damage during a prolonged period at the site.

C. Finished surfaces of all exposed motor openings shall be protected by wooden planks, strongly built and securely bolted thereto.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

1.08 Warranty:

A. All motors shall be warranted for a period of one (1) year, unless otherwise specified, commencing at the time of final acceptance by the OWNER.

B. Motors 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 restored to service at no expense to the OWNER.

C. The manufacturer's warranty period shall run concurrently with the CONTRACTOR's warranty period. No exception to the provision shall be allowed.

## 2.0 PRODUCTS

2.01 General:

A. Electric motors shall be of the high energy efficient and high power factor type mounted on the equipment being driven. Motor characteristics shall be as specified under the Workmanship and Materials sections for equipment.

B. All motors shall be built in accordance with the latest NEMA, IEEE, ANSI and AFBMA standard, where applicable.

C. Motors shall be as manufactured by:

1. General Electric Company
2. Magnetek
3. Baldor
4. Reliance Electric
5. Siemens
6. U.S. Electrical Motors
7. Or approved equal.

2.02 Performance Requirements:

A. Unless otherwise noted, motors shall be rated 460 volts, 3-phase, 60 Hertz.

B. Each motor shall have a 1.15 service factor.

C. Motors shall have horsepower and full load output speed rating as required for the driven equipment and for the application.

D. Motors shall have suitable output torque and speed characteristics to operate the driven equipment under design load conditions without exceeding the nameplate ratings. Definite purpose motors shall be used on specialized equipment requiring them.

E. All motors, except where the driven equipment presents unusual requirements, shall have torque and locked rotor characteristics as outlined in the NEMA Standards for Design B.

F. Locked rotor currents shall not exceed NEMA code G for motors rated 15 HP and above.

G. Motors supplied for use with adjustable frequency drives (AFD's) and solid-state soft starters shall be rated for inverter duty.

H. Motors shall conform to the efficiencies as required by the Energy Policy Act of 1992. Motors shall be premium efficiency type as derived from the latest edition of NEMA Standard MG1, Table 12-6C. Motors shall be efficiency tested and labeled in accordance with NEMA Standard MG1-12.53. Nominal efficiencies shall be printed on nameplate. Efficiency shall be determined by the preferred NEMA test method IEEE-112 Method B-Dynamometer. The minimum efficiency shall be the guaranteed value for the motor.

I. Motors shall be free of objectionable noise and vibration. Motor sound pressure level shall not exceed 90 dBA at 5' under no load conditions and in accordance with IEEE Standard 85. Vibration level measured on the bearing housing shall be in accordance with values shown in NEMA and Hydraulic Institute Standards.

J. Motor ratings shall be based on NEMA Class B, 80°C temperature rise, measured by resistance, when operated continuously at rated conditions in an ambient of 40°C. Motor shall have a Class F moisture resistant insulation. This temperature rise shall be for continuous operation unless otherwise specified or approved.

K. Motors shall have copper windings, unless otherwise specified.

2.03 Operating Types:

A. Motors of 1/2 HP or larger shall be of the squirrel-cage induction type, designed for 3-phase, 60-Hertz, 460-volt operation, unless shown or specified otherwise. Smaller motors shall be of the capacitor induction type designed for single-phase, 115-volt, 60-Hertz operation unless otherwise noted or approved.

B. All motors, except where the driven equipment presents unusual requirements, shall have torque and locked rotor characteristics as outlined in the NEMA Standards for Design B.

C. All gear motors and speed reducers shall be designed for correct mounting position and rated in accordance with the application practice outlined in the Standards of the American Gear Manufacturers Association, for Class II service.

2.04 Bearings: All motor bearings shall be of the antifriction type except where otherwise shown or specified. All antifriction bearings shall have a minimum rating life of 100,000 hours, based on a reliability of 90% in accordance with ANSI B3.15. All motor bearings shall be oil or grease lubricated with convenient provisions for inspecting and servicing.

2.05 Motor Grounding Shaft Protection for Adjustable Frequency Drive Driven Motors and Sewage Pump Motors:

A. New motors shall have the bearing protection installed by the motor manufacturer.

B. Motors operated on adjustable frequency drives (AFD's) shall have the bearing protection installed by the manufacturer.

C. Provide protection for AFD operated motors as follows:

1. Top Bearing (NDE): Bearing journal installed must be insulated or insulated ceramic or hybrid ceramic.

2. Drive End (DE): Install one AEGIS SGR Bearing Protection Ring on drive end.

3. AEGIS SGR can be installed internally on the back of the bearing cap or externally on the motor end bracket.

4. Colloidal Silver Shaft Coating (PN CS015) is required for this type of application.

D. Manufacturers' Certificate of Compatibility: Submit certificate of compatibility signed by both the motor manufacturer and the ground ring manufacturer. Indicate the ground ring is installed per manufacturers' requirements.

2.06 Mechanical Protection:

A. Indoor Locations:

1. For motors located in dry, clean and well ventilated areas provide open drip-proof type.

2. For motors located below grade, provide totally-enclosed, fan-cooled type with removable drain plug.

3. For motors located in wet, damp or dusty areas, provide totally-enclosed, fan-cooled type with removable drain plug.

4. In corrosive areas or as shown, provide totally-enclosed, fan-cooled motor featuring cast iron construction, cast iron fan cover and cast iron T-box, usually referred to as “severe” or “mill and chemical duty”.

A. Outdoor Locations: For motors located outdoors, provide a totally-enclosed, fan-cooled type with removable drain plug.

B. Hazardous Locations: In hazardous areas or as shown or required by the NEC.

1. Class 1, Division 1 Area: Provide totally enclosed fan-cooled explosion-proof motor.

2. Class I, Division 2 Areas: Provide totally enclosed fan-cooled without brushes, switching mechanisms or other arc-producing devices.

A. Submersible Locations: For operation in an hazardous location, provide a completely sealed submersible motor.

2.07 Construction:

A. Motors, frames and end shields shall be heavy fabricated steel or cast iron 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. Openings for ventilation shall be uniformly spaced around the motor frame.

B. The shaft shall be made of high grade steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating.

C. Stator cores shall be made of low loss, non-aging electrical sheet steel with insulated laminations.

D. Stators shall be random wound and insulated with glass and mica applied directly to the coils. Motors shall have a Class "F" rise nonhygroscopic epoxy sealed or encapsulated insulation system limited to the temperature rise specified herein. All connections shall be silver soldered with no crimp connections used except for terminals. A coil bracing system for stator end turns shall be utilized to minimize coil movement during starting and running conditions.

E. Rotors shall be made from high grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel cage may be of cast aluminum or copper alloy bar type construction with brazed end rings.

F. All motors shall have an interior coating of chemical resistant corrosion and fungus protective coating on all interior surfaces. Exterior prime coating shall be compatible with the field applied finish coating.

G. Nameplates shall be stainless steel. Lifting lugs or type bolts shall be supplied on all motors capable of supporting the weight of the motors. Air intake and outlet openings in the motor enclosure shall be stainless steel screen and shall be protected against corrosion and insects.

H. All fittings, bolts, nuts and screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads.

I. The main terminal box shall be a NEMA rated enclosure compatible with the motor enclosure. Provide ample room for connections.

2.08 Performance Data:

A. Motor make, type and rating, speed-torque curves, along with the outline dimensions and the guaranteed full load and locked rotor amperes at full voltage, shall be presented with the equipment details for review and approval.

B. Motors shall have the following minimum full load efficiency and uncorrected power factor ratings (efficiencies and power factor of motors at other speeds shall be as specified with driver equipment):

Motor Efficiency and Power Factor - Minimum Percent

| | At 1800 RPM | | At 1200 RPM | |
|---|---|---|---|---|
| Horsepower | Efficiency | Power Factor | Efficiency | Power Factor |
| 1 | 81.5 | 74.3 | 78.5 | 69.7 |
| 1-1/2 | 82.5 | 76.5 | 84.0 | 62.0 |
| 2 | 82.5 | 70.3 | 85.5 | 70.1 |
| 3 | 86.5 | 79.9 | 86.5 | 73.7 |
| 5 | 87.0 | 83.8 | 86.5 | 75.8 |
| 7-1/2 | 88.5 | 82.4 | 88.5 | 78.2 |
| 10 | 88.5 | 85.0 | 88.5 | 76.4 |
| 15 | 90.2 | 85.0 | 89.5 | 81.1 |
| 20 | 90.2 | 84.6 | 89.5 | 81.9 |
| 25 | 91.7 | 84.5 | 91.0 | 82.0 |
| 30 | 91.7 | 84.2 | 91.0 | 82.5 |
| 40 | 92.4 | 84.2 | 92.4 | 83.3 |
| 50 | 92.4 | 85.0 | 92.4 | 84.9 |
| 60 | 93.0 | 86.8 | 93.0 | 85.7 |
| 75 | 93.6 | 86.6 | 93.0 | 86.0 |
| 100 | 94.1 | 88.3 | 93.6 | 86.4 |
| 125 | 94.1 | 89.3 | 93.6 | 85.8 |
| 150 | 94.5 | 88.5 | 94.5 | 87.5 |

C. The machine noise of the motors shall not exceed the following sound power levels when measured in accordance with IEEE Standard 85:

Overall Sound Power Level, Decibels, A-Weighted

| Horsepower | At 1800 RPM | At 1200 RPM |
|---|---|---|
| 1 - 2 | 70 | 67 |
| 3 - 5 | 74 | 71 |
| 7-1/2 - 10 | 77 | 74 |
| 15 - 20 | 81 | 78 |
| 25 - 30 | 85 | 80 |
| 40 - 50 | 89 | 84 |
| 60 - 75 | 90 | 88 |
| 100 - 150 | 90 | 93 |

2.09 Tests:

A. All motors shall be completely assembled at the factory and shall be given routine tests conducted in accordance with NEMA Standards MG1-20.46 and MG1-20.47 which include the following non-witness tests:

1. No load current.
2. Winding resistance.

3. High potential dielectric test.
4. Bearing inspection.

B. Copies of the test results for each motor above 20 HP shall be certified by a responsible test engineer. The test results shall be furnished to the Engineer for review before shipment of the motors.

## 3.0 EXECUTION

3.01 Installation: Installation of the motors shall be in accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installations 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. Anchor bolts shall be set by the CONTRACTOR in accordance with the manufacturer's recommendations.

3.02 Test Reports: Unless the equipment specifications stipulate shop tests reports on the actual motors used the test data shall be on a representative motor of the same horsepower and speed. Test reports shall be provided on motors rated 5 horsepower and above. They shall show the motor full load and locked rotor amperes and full load efficiency and power factor rating, and be recorded on standard test forms as outlined in the NEMA Standards

3.03 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 exposed portions of the pumps and motors shall be shop-primed, with primer compatible with field painting as specified.

C. All nameplates shall be properly protected during painting.

D. Bearing surfaces and other surfaces obviously not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory to the Engineer through the time of final acceptance.

3.04 Field Painting:

A. Field painting as specified in the Contract Documents. The shop primer and paint used in the field shall be products of the same manufacturer as the shop primer to assure compatibility.

B. All nameplates shall be properly protected during painting.

3.05 Inspection and Testing:

A. 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.

B. 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.

(End of Section 11 05 13)

# SECTION 23 00 00

# MECHANICAL GENERAL REQUIREMENTS

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Division 23. When in conflict the requirements of the Contract and Division 01 supersede those listed on Division 23.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work specified herein with that of other trades affecting, or affected by work of this Division 23. Cooperate with those trades to assure steady progress of work under contract. Promptly notify Project Superintendent of any issues that may affect the work under this Division 23.

### 1.02 SCOPE OF WORK

A. Provide the labor, materials and equipment for the installation and testing of the mechanical equipment and systems shown on the drawings and herein specified.

B. All systems shall be complete, tested and ready for operation at time of Substantial Completion. Refer to Specification Division 01 and Sections 23 01 00 and 23 02 00.

C. Refer to each Section of this Division 23 for the specific scope of work under that Section.

### 1.03 RELATED DOCUMENTS

A. The following sections of the specifications are included hereinafter:

23 05 00 Electrical Power and Auxiliaries
23 08 00 Painting and Identification
23 45 00 Corrosion Protection
23 70 00 Fans and Vents
23 95 00 Test and Balance

1.04 RELATED WORK NOT INCLUDED IN THIS DIVISION

A. Refer to related Sections of the Contract Documents for work to be provided by others such as but not limited to:

Electrical Work - Refer to Division 26
Wall Louvers - Refer to Section 08 91 00

1.05 DEFINITIONS

A. Specific items of terminology, as used herein, shall have the following meanings:

1. BY OTHER TRADES: Shall mean work that is to be provided by persons or parties responsible for work at the project other than the party or parties who have been awarded a contract for work under this Division 15. In the event that this document is used to acquire work as part of a general construction contract, the words “by other trades” shall mean by persons or parties who are not anticipated to be the installers for the work shown under this Division 23. In this context, the words “by other trades” shall not be interpreted to mean, “not included” in the overall contract.

2. DEMOLITION: Shall mean the removal of any existing equipment, piping, ducts, etc. and the temporary or permanent capping or plugging of indicated existing services.

3. DUCTWORK: Shall mean ducts, fittings, dampers, controls, hangers, insulation, and any other items customarily required in connection with the installation of systems for the movement and or distribution of air. Include all tests and the test and balance of such systems.

4. EXPOSED: Shall mean work that is not concealed.

5. FURNISH: Shall mean purchase and deliver to the project site indicated equipment and/or materials complete with necessary rigging, appurtenance and supports.

6. PROVIDE: Shall mean FURNISH and INSTALL.

7. WORK: Shall mean to include all materials, labor, equipment, tests and test and balance required for a complete and operable installation.

B. Except where modified by specific notation to the contrary, it shall be understood that the indication and/or description of any item, in drawings or specifications or both, carries with it the instruction to furnish and install item, regardless of whether or not this instruction is explicitly stated as part of indication or description.

1.06 QUALITY ASSURANCE

A. General

1. Refer to requirements of Division 01. It is the intent of the drawings and specifications to obtain a complete and operable installation.

2. All materials shall be new, properly labeled and/or identified, and in full compliance with the contract documents and applicable Codes and Standards.

3. All work shall comply with applicable Codes and Standards at the time the project is bid.

4. Manufacturer's model names and numbers used in this Division 23 are subject to change per manufacturer's action. Contractor shall therefore verify applicable information with manufacturer's representative before ordering any product or equipment. Notify Engineer of any changes and promptly furnish, for their review, information on new or replacement product. Changes shall be at no cost to the contract.

B. Installer's Qualifications

1. Installers performing work under this Division 23 shall be both a State and local licensed firms regularly engaged in providing the work specified under each Section of these Specifications. Provide copy of license upon request.

2. Each installer shall provide, upon request, a list of at least five similar jobs he has completed in the last two (2) years. Also refer to requirements of Division 01.

C. Drawings and Specifications

1. Drawings are diagrammatic but shall be followed as closely as actual construction of the building and the work of other trades will permit.

2. The specifications and drawings are complementary and are to be taken together for a complete interpretation of the work. Notes or details on drawings which refer to an individual element of work and that may conflict with the specifications shall be brought up to the attention of the Engineer for clarification before any equipment or materials are purchased or work is installed. Failure to follow these guidelines may cause the contractor to replace / correct the work at no cost to the contract.

3. The separate divisional drawings and specifications do not relieve the contractor from the responsibility to provide the work, which is indicated on any of the drawings or division of the specifications.

4. The drawings of necessity utilize notes, details, symbols and schematic diagrams to indicate various items of work. Therefore, no interpretation shall be made from the limitations of such notes, details, symbols and diagrams that any elements of work necessary for a complete installation are excluded. Any discrepancies shall be brought to the attention of the Engineer for clarification before bid time and the purchasing and installation of any equipment or materials. No work shall proceed until issues are resolved. Failure to follow these guidelines may cause the contractor to replace/correct the work at no cost to the contract.

5. Details, sections and enlarged plans that appear on the drawings are intended only for the purpose of establishing general feasibility. They do not supersede field coordination of the indicated work among the various trades working in that area.

6. Examine and coordinate site conditions, electrical, drawings and specifications prior to submitting bid. Any discrepancies shall be brought up to the attention of the Engineer.

7. The Engineers shall be notified of any discrepancies, omissions, conflicts or interferences, which occur between drawings and specifications. If such notification is received in adequate time prior to bid time additional data or clarifications will be issued by addendum to all bidders. Failure to follow these guidelines may cause the contractor to replace/correct the work at no cost to the contract. See note 4 above.

8. When extra work involving Division 23 trades is authorized, the work as shown on drawings, sketches, described by Addendum or Change Order is subject to this Specification in all respects.

D. Standards

1. Certain materials and installation procedures are described by reference to industry standards published by nationally recognized organizations such as, but not limited to, those listed below:

American Society for Testing Materials (ASTM)
National Fire Protection Association (NFPA)
National Electrical Manufacturers Association (NEMA)
Underwriter's Laboratories (UL)
American National Standards Institute (ANSI)
American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
Air Movement and Control Association (AMCA)

2. Additional standards may be listed in other Sections of the Specifications and in the 2010 Florida Building Code.

3. Whenever a reference is made to a standard, installation and materials shall comply with the **latest adopted and published edition of the Standard at the time project is bid**.

E. Requirements of Government Agencies

1. The work under this contract shall comply with the standards and requirements of the City of Tampa Wastewater Department.

2. The contractor, at no cost to the contract, shall correct any work found to be in noncompliance with those Standards.

1.07 PERMITS, FEES AND INSPECTIONS

A. Contractor shall give the necessary notices, obtain all permits and pay all government fees, sales taxes and other costs in connection with this work.

B. Obtain all required certificates of inspection for work and deliver them to the Engineer before requesting acceptance and final payment for the work.

1.08 CODES AND RULES

A. All work specified and installed under Division 23 shall comply with the Florida Building Code, 2010.

B. Applicable codes shall be those adopted by the authority having jurisdiction at the time project is bid.

C. Installer's of work specified under Division 23 shall include in the work, without extra cost to the contract the labor, materials, services, apparatus and drawings required to comply with applicable laws, ordinances, rules and regulations before submitting his bid.

D. Installer shall inform the Engineer of any work or materials which conflict with any of the applicable codes, standards, laws and regulations before submitting his bid.

1.09 FIELD CHANGES DURING CONSTRUCTION

A. Occasionally during construction changes that deviate from the approved permit documents may occur.

B. Local authorities may require that the changes be submitted for their review via signed and sealed documents indicating the design professional concurrence with said changes. Contractor shall therefore notify the design professional of any changes before proceeding with the work and provide justification for the change including supporting sketches detailing the extent and nature of the change.

C. Failure to follow this procedure may delay the design professional response until he / she is satisfied with the need for the change.

D. When changes are made for the contractor's sole convenience, contractor assumes full responsibility for reimbursing the design professional's for his / her time and other expenses. This includes changes caused by lack of coordination between installing contractors working in a common area.

2.0 PRODUCTS

2.01 SUBSTITUTIONS – GENERAL REQUIREMENTS

A. Materials or products specified herein and/or indicated on drawings by trade name, manufacturer's name and/or catalog number represent a standard of quality or performance on which the design of this project is based.

B. Since manufacturers reserve the right to change, at any time, the design and quality of their products, installers shall verify such information to assure that the equipment and materials being submitted are in compliance with the intent of the drawings and specifications. Shop drawings shall clearly note such changes. Any required changes shall be made at no cost to the contract.

C. For consideration of manufacturers' and/or products other than those used as the basis of design or listed on the contract documents, bidders shall submit, before bid time and within the specified time frame, a request in writing as indicated on the General and Supplementary Conditions of the Contract and Division 01 of the Specifications. Include all required information; incomplete or late information will not be considered. Acceptance, when granted, will be in the form of an addendum and subject to the review of complete shop drawings proving compliance with the contract documents.

D. Requests shall clearly define and describe the manufacturers and product for which acceptance is requested. Requests shall be accompanied by manufacturer's literature, specifications, drawings, performance data, list of references and other information necessary to completely describe the product and prove compliance with the contract documents.

E. Accepted substitution and listed manufacturers, other than those used as the basis of design, may have different requirements regarding the characteristics (dimensions, weight, etc.), quantity or arrangement of items such as foundations, supports, ductwork and piping connections, electrical characteristics and power demand and any other equipment or accessories that are standard or required for the proper installation and operation of the product. Manufacturer of accepted substitution and listed manufacturers, other than those used as the basis of design is responsible to disclose such changes to the Bidders/Contractors so that the latter can include additional costs to cover such changes in their bid. Subsequently, successful Bidder/Contractor shall furnish those changes at no additional costs to the contract. These additional costs include all changes and additions to his work and the work of others, including design professionals affected by the substitution or deviation.

F. A list of all materials and equipment, which the installer proposes to furnish, shall be submitted for approval within ten (10) days after the contract has been awarded.

G. Requests for substitution submitted after the project is awarded will only be considered when directed by the Owner. Provide complete data as hereinbefore specified for any substitution. Contractor submitting request shall be responsible for reimbursing the design professional for the expenses associated with the review of such late request.

2.02 SHOP AND ERECTION DRAWINGS AND SAMPLES

A. Submit required and/or requested performance data, fabrication and installation drawings, for review by Engineer. Refer to Specifications Division 01 and each Section of the Specifications for specific shop drawing requirements. Equipment or materials ordered or installed before Engineer's review the information may have to be removed from the project and replaced at contractor's expense if submitted information is found unacceptable.

B. Shop drawings shall consist of manufacturer's scale drawings, copies of catalogs, and other descriptive literature that clearly indicates performance, construction materials, physical dimensions, utility requirements, wiring diagrams, operating data clearly marked for each item. Data of general nature is not acceptable. Contractor shall verify equipment dimensions with available clearances in the area where the equipment is to be installed prior to ordering equipment.

C. Submittals for equipment shall include detailed and itemized schedules in the same format as shown on the drawings. Failure to provide required schedule will result in rejection of the complete submittal.

D. All manufacturers, whether named in the specifications or listed by addendum, are subject to full compliance with the specifications, schedules, and drawings. Therefore it is the contractor's responsibility to submit for review only products that meet the intent of the Contract Documents. When submitted and reviewed products and materials fail to perform within the specified parameters, contractor shall modify and/or replace such products and materials at no additional cost to the contract.

E. Shop drawings for equipment or materials that deviate from the contract documents shall list all differences in a cover letter attached to the submittal. Any unlisted deviations found during review or installation will result in the rejection of the entire submittal and installation.

F. Submit required number shop drawings assembled together in **a 3-ring hard cover binder.** Provide an index for ease of processing and record keeping. Index shall correspond to specification section numbers applicable to each item. **Shop drawings submitted via e-mail do not supersede or void the requirements of this paragraph. Contractor is responsible for submitting only those pages of the catalogs that are applicable to the product being considered. Applicable data shall be clearly identified on each page. Failure to follow these procedures will result in a delay of processing the electronic submittal or cause its rejection.**

G. All these drawings shall become part of the final as-built record documents. Refer to Specifications Division 01 and Section 23 02 00.

H Ductwork shop drawings shall be provided in accordance with requirements of Section 23 73 00.

I. The Engineer's review does not relieve the contractor of his responsibility to comply with all requirements of the contract documents and Division 01.

## 3.0 EXECUTION

### 3.01 ORGANIZATION OF THE WORK

A. At all times a competent superintendent shall be on site in charge of the work. Replace if performance is unsatisfactory to the Owner and/or Engineer.

B. Maintain a complete file of all contract and shop drawings at the site available for review by Owner's representatives and Engineer. A set of drawings shall be dedicated as the "As Built Record Set" where all changes and / or deviations from the contract documents are noted as they occur. Refer to Specifications Division 01.

C. Upon installation of equipment, shop drawings shall be initialed and dated. This procedure will ensure proper scheduling and allow Owner's representatives and Engineer to check the work in progress.

D. A set of the ductwork shop drawings shall be kept on site for use by the Test and Balance Agency and the contractor. They shall highlight the sections of duct being pressure tested and note date of the test. Names of individuals conducting the test shall be listed next to the date.

## 3.02 COORDINATION WITH OTHER TRADES

A. Coordinate work to be installed under Division 23 with other trades and existing field conditions to avoid interferences and delays. Assist in working out space requirements to make a satisfactory installation. Notify the Engineer of any major conflicts that cannot be resolved through normal field coordination with other trades.

B. When work by others is installed before it is coordinated with the work of Division 23 trades, and as a result interferes with the Division 23 trades work, the installer responsible for causing the conflict shall make the necessary changes in his work to correct the condition at no cost to the contract. Notify Engineer of such conflicts. Contractor is responsible for reimbursing the Engineer for his time and cost in assisting in the resolution of such issues.

C. Furnish to other trades all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

D. Local authorities may require that field changes that deviate from the contract documents be submitted for their review via signed and sealed documents that indicate design professional concurrence with said changes. **Contractor shall notify the design professional of such changes <u>before</u> proceeding with work and provide justification for the change.** Failure to follow this procedure will make the contractor responsible for all costs associated with the change including design professional's time and other expenses. This includes changes caused by lack of coordination between installing contractors working in a common area.

## 3.03 CUTTING AND PATCHING

A. The cutting and patching of walls necessary for reception of work indicated in this Section and Section 08 91 00 of the contract documents shall be this contractor responsibility.

B. When openings in walls/roofs are provided under the work of other sections, this installer shall furnish exact dimensions and locations of those openings.

C. No structural members shall be cut without the previous written approval of a Structural Engineer. This contractor is responsible for providing such engineering services. Provide copies of information to Design Professional.

## 3.04 EXAMINATION OF EXISTING CONDITIONS

A. This project includes work in an existing facility; therefore contractors shall visit the site and examine those areas of the existing buildings affected by this work. Contractor shall become familiar with existing conditions and difficulties that may affect the execution of the work before submitting proposals.

B. Submission of a proposal shall therefore be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered, which could have been foreseen had such examination been made, will not be recognized.

C. Upon completion of his site visit contractor may submit a list of questions requesting the clarification of items noted during his visit. Submit request within the time frame shown on the General Conditions of the contract and Division 01. Late requests will not be accepted.

## 3.05 DEMOLITION

A. Demolition shall be as shown on drawings and/or herein specified.

B. Schedule all demolition work to cause minimum downtime of any building service or function. No extra cost to the contract will be allowed for overtime work unless authorized in writing by the Owner / Engineer.

C. At each location where work is to be performed, the Contractor shall examine the existing conditions to determine the nature and extend to which the existing systems must be removed, modified or rearranged to accomplish the work of this contract. In addition, the Contractor shall determine the extent to which portions of the existing building must be cut, altered and restored to accommodate the project modifications. In every instance, the Contractor shall be responsible for the correctness, adequacy, fit and alignment of new work with existing conditions, and for the satisfactory restoration of affected building work as approved by the Owner.

D. The Contractor shall protect existing building contents, equipment, fixtures, the building structure and its finishes from damage due to dust, falling debris, or any other work operations. Repair or replace any damage to existing facilities at no extra cost to the contract.

E. Equipment or other items to be modified or relocated shall be carefully dismantled or disconnected in a manner to avoid damage. Items damaged by the contractor's operations shall be replaced or repaired in a manner satisfactory to the Owner. Items not to be re-used shall be removed from the site by the Contractor. Those items that are identified to be turned over to the Owner shall be stored on the site at a designated location.

F. In each area where work is performed, the work area shall be kept in a neat, clean condition. Rubbish and debris shall not be allowed to accumulate and shall be removed daily if necessary to maintain clean conditions satisfactory to the Owner.

3.06 SEQUENCING AND SCHEDULING OF WORK

A. All work to be performed under this contract shall be carried out in accordance with an approved construction sequence and schedule. Upon award of the contract, and prior to commencing work at the building, the Contractor shall prepare and submit a detailed schedule of his proposed sequence of work and the dates of completion of the various portions of the work.

B. Where existing active building systems and services must be disrupted to permit modification, relocation or connection of new work, the work shall be carefully planned to minimize downtime. In each instance, preparatory work shall be completed to the maximum extent possible, and required tests completed where feasible, before the particular system or service is shut down to permit final connection or switch over.

3.07 STORAGE OF EQUIPMENT AND MATERIALS

A. All equipment and materials shall be stored on site in a dry location where they are properly protected from the weather, injury or deterioration. Materials shall <u>not</u> be stored in contact with the ground or floor.

B. Do not remove manufacturer's packing materials until ready to install.

C. Materials showing signs of corrosion or damage due to improper handling or storage shall be replaced at no cost to the contract.

D. Provide continuous protection for all equipment and materials already installed.

3.08 WATERPROOFING

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done.

B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

3.09 EQUIPMENT SERVICE

A. Provide clearances around equipment as required by Code, owner standards and equipment manufacturer for the proper maintenance or removal of equipment. The most stringent requirements shall apply.

B. Coordinate with other trades so no conduit or other equipment interferes with the required clearances.

C. Notify project superintendent when work by other trades needs to be relocated in order to maintain required clearances. Notify Engineer if conditions persist and are not corrected by the responsible trade.

(END OF SECTION 23 00 00)

# SECTION 23 05 00

# ELECTRICAL POWER AND AUXILIARIES

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Specifications Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work specified herein with that of other trades affecting, or affected by work of this Section. Cooperate with those trades to assure steady progress of work under contract. Promptly notify Project Superintendent of any issues that may affect the work under this Section.

### 1.02 SCOPE OF WORK

A. Provide motor controllers including accessories such as H.O.A.'s, selector switches, pilot lights, etc., as required for the proper control and operation of the mechanical equipment and systems they are part of. Coordinate with Division 26 installer the power required for equipment provided under this Division 23.

B. Provide, under this Section, all low voltage (120V and under) control wiring for equipment and systems specified under this Division 23 such as:

1. Temperature control wiring
2. Equipment control wiring
3. Interlock wiring

C. All control wires shall be installed in conduit.

D. Conduit and control wiring shall meet the requirements of Division 26.

E. All electric motors provided under this Division 23 shall be high efficiency motors.

1.03 RELATED DOCUMENTS

A. The following sections of the Specifications are included hereinafter.

Division 26 - Electrical Systems

| | |
|---|---|
| 23 00 00 | Mechanical General Requirements |
| 23 70 00 | Fans And Vents |
| 23 95 00 | Test And Balance |

B. Refer to Division 26 drawings for specific information on project electrical characteristics (V-∅-CY). Contractor shall verify electrical characteristics of all equipment with electrical documents and electrical systems installer prior to submitting shop drawings and ordering equipment.

1.04 QUALITY ASSURANCE

A. All electrical work and equipment provided under this Division 23 shall meet the requirements of NFPA 70 / National Electric Code (NEC), UL, NEMA and other applicable codes and standards.

B. All electrical work associated with equipment installed under this Division 23 of the Specifications shall be tested to be free of shorts and grounds. Work to be inspected and approved by authorities having jurisdiction; maintain record of such inspections on site.

C. For additional Quality Assurance requirements refer to Specifications Division 01 and Section 23 00 00.

1.05 SHOP DRAWINGS

A. Submit complete shop drawings including but not limited to wiring diagrams, physical dimensions, access and service clearances and other required manufacturer’s literature for all products and materials specified or referred to in this section.

B. Provide proof of compliance with requirements of Division 26 whenever reference is made to that Division.

C. Equipment shop drawings shall clearly indicate the type of motor that is being provided with the equipment.

D. For additional Shop Drawing submission requirements refer to Specifications Division 01 and Section 23 00 00.

## 2.0 PRODUCTS

### 2.01 Refer to Division 26

## 3.0 EXECUTION

### 3.01 GENERAL

A. All electrical work and equipment provided under this Division 23 shall meet the requirements of NFPA70 / National Electric Code (NEC), UL, NEMA and other applicable Codes and Standards.

(END OF SECTION 23 05 00)

# SECTION 23 08 00

# PAINTING AND IDENTIFICATION

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work specified herein with that of other trades affecting, or affected by work of this Division 23. Cooperate with those trades to assure steady progress of work under contract. Promptly notify Project Superintendent of any issues that may affect the work under this Division 23.

### 1.02 SCOPE OF WORK

A. All ductwork provided under Division 23, which is exposed to view, to the weather and/or as indicated on the drawings and specifications shall be painted unless otherwise noted.

B. All galvanized metals that are to be field painted shall be properly prepared to accept specified paint. If paint peels, repeat treatment and repaint at no cost to the contract.

C. Fans shall have factory standard finish. Field painting of equipment over standard finish shall be as directed by Engineer.

D. Apply primer ready to field painting, where required.

E. All unfinished ironwork installed under Division 23, which is exposed to view within the building or exposed to the weather, shall be painted as herein specified.

F. Provide permanent identification on equipment and piping systems. Coordinate with City of Tampa Wastewater Department the numbering sequence of equipment. County Standards take precedence over these specifications.

1.03 RELATED DOCUMENTS

A. The following sections of the specifications are included hereinafter:

| | |
|---|---|
| 23 00 00 | Mechanical General Requirements |
| 23 70 00 | Fans And Vents |

1.04 SHOP DRAWINGS

A. Submit catalog data, color samples, and other requested data for following.

1. Paints
2. Treatment of galvanized metals
3. Markers
4. Labels

2.0 PRODUCTS

2.01 PAINT

A. Rust inhibitor paint shall be red chromate base made up in a synthetic resin vehicle.

B. Finish paint where specified shall meet the requirements of the City of Tampa Wastewater standards.

2.02 PAINT SCHEDULE

A. Painting schedule for equipment and piping:

Equipment and system components
Manufacturer’s standard color and finish

B. Colors shall meet ANSI A13.1 Standard recommendations:

As selected by City of Tampa Wastewater Department

C. Color of letters applied to above colors shall be black on a yellow background.

## 3.0 EXECUTION

### 3.01 PAINTING GENERAL

A. Ironwork installed under this Division 23 of the Specifications exposed to view within the building, and not otherwise specified to be galvanized, stainless steel, copper or chrome plated, such as duct hangers, structural supports, supports for equipment, etc., shall be painted with one (1) coat of rust inhibiting paint. Finish paint, color as selected by City of Tampa Waste Water Department.

B. Ironwork installed under this Division 23 of the Specifications which is exposed to the weather, and not otherwise specified to be galvanized, stainless steel, copper or chrome plated, such as duct supports, etc., shall be painted with two (2) coats of rust inhibiting paint and one (1) coat of an acrylic base UV and mold resistant white paint. The Owner may select a different color of the finish paint.

C. Painted galvanized metals from which paint peels shall be stripped, retreated and repainted at no cost to the contract.

### 3.02 EQUIPMENT IDENTIFICATION

A. Identify each piece of equipment by its system number and other appropriate designation by stenciling in letters of approved size and wording. Equipment requiring identification shall include but not limited to: exhaust fans, control cabinets, starters and power disconnects and others as directed by Engineer.

B. Identification numbers and names shown on the Contract Documents are for reference only. They shall be changed to meet Owner’s numbering sequence and standards. Contractor shall request a copy of such standards.

C. Contractor shall mark record construction documents to reflect the labeling and numbering sequences when different from contract documents.

END OF SECTION 23 08 00

# SECTION 23 41 00

# CORROSION PROTECTION

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Specifications Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work specified herein with that of other trades affecting, or affected by work of this Section. Cooperate with those trades to assure steady progress of work under contract. Promptly notify Project Superintendent of any issues that may affect the work under this Section.

### 1.02 SCOPE

A. The work under this section includes furnishing the labor, materials and equipment, and performing all operations necessary for the field application of coatings formulated for the protection against corrosion of the following equipment specified in this Section:

- Fans

B. Coatings shall completely cover and protect equipment components exposed to the weather.

C. For field applications, the applications contractor shall verify with the equipment manufacturer that the corrosion protection products he plans to use are compatible with the equipment. Include verification documentation with both equipment and corrosion protection materials shop drawing submittal.

### 1.03 RELATED DOCUMENTS

A. The following sections of the specifications are included hereinafter:

23 00 00 Mechanical General Requirements
23 70 00 Fans and Vents

1.04 SHOP DRAWINGS

A. Provide for each product the following information:

Corrosion protection materials data sheets
Application procedures
Warranties

B. For additional Shop Drawing submission requirements refer to Specifications Division 01 and Section 23 00 00.

1.05 QUALITY ASSURANCE / WARRANTIES

A. Applicator Company shall be regularly and specifically engaged in the corrosion protection coatings business on a full time basis. Company shall demonstrate technical capability and business longevity. Application staff shall be fulltime employees of the Company.

B. The applicator staff shall be certified and trained in the application of the products they use and have a minimum of two (2)-years' full time experiences doing this work.

C. Protective coatings shall carry five (5)-year unconditional warranties. Start of warranty is date of acceptance of project by the Owner. Include copy of Warranty in the Operations and Maintenance Manuals as per Specifications Division 01.

D. Product submittal shall include a list of local references of work completed within the last five (5) years. Provide contact names and phone numbers.

E. Application shall be done in strict accordance with the instructions provided with the product(s). Copy of the instructions shall be provided with the shop drawings and one kept at the site.

F. For additional Quality Assurance requirements refer to Specifications Division 01.

1.06 ACCEPTABLE FIELD APPLICATORS

A. Corrosion Solutions, Inc. and Blygold Florida Thermoguard.

B. Applicator's offices shall be located within a day's drive (maximum) from the job site.

C. Other applicators shall submit their qualifications, products and experience for review as per requirements of the General Conditions, Specifications Section 23 00 00 and this Section. Information shall be received at least ten (10) days prior to bid date.

1.07 ACCEPTABLE PRODUCTS

A. Products shall be formulated for the Florida weather. Provide test data upon request.

B. Polyurethane based, Heresite, Electrofin or Blygold.

C. Other products shall be submitted for review as per requirements of the General Conditions, Specifications Sections 01, 23 00 00 and this Section.

D. Manufacturer's products used in this Section of the Specifications and application procedures are subject to change per manufacturer's action. Contractor shall therefore verify applicable information with manufacturer's representative before ordering any product or equipment. Notify Engineer of any changes and submit for their review information on new or replacement product. Changes shall be at no cost to the contract.

2.0 MATERIALS

2.01 GENERAL

A. Coatings to be applied under this Section of the Specifications shall be specifically formulated for finished products constructed with galvanized steel and aluminum.

B. The selected coating shall provide excellent resistance and durability against the corrosive effects of alkaloids, acids, alcohols, petroleum hydrocarbons, seawater, salt air and similar corrosive environments. Testing shall meet: ASTM G85-3000 hour's industrial environment; ASTM B117-10,000 hour's marine environment and Kesternich test-80 cycles fuel combustion (sulfuric environment).

2.02 APPLICATIONS OF CORROSION PROTECTION FOR AIR HANDLING EQUIPMENT (FANS) – FIELD APPLIED

A. Coatings shall be applied at the job site after all rigging and equipment handling has ended.

B. Fan(s) surfaces and other components shall be degreased cleaned and prepared for coating application. All rust shall be removed. Fan cabinets shall be brushed, rolled or sprayed with a corrosion and moisture resistant film for all surfaces (interior and exterior) to accomplish 4 - 8 mils of thickness. All exposed surfaces shall be coated. Coating shall be clear or gray and may not impede the natural coloration of the equipment manufacturer's finished product. All written information applied to the fans by the manufacturer shall remain legible and original. Fans shall then be left untouched for approximately 12-24 hours to permit curing of the product.

C. Acceptable Products and Manufacturers:

1. Cabinet coating process shall be similar and equal to Blygold Refamac, "OxiBloc II" process as supplied by OxiGuard, Inc., or Corrosion Solutions PC-2000.
2. Thermoguard-Polyurethane-based.

2.03 COATINGS

A. The coating shall be applicator standard product and provide a complete envelope protection against chemical and ultraviolet corrosion. All products shall contain anti-microbial additives.

B. Coating shall be effective on ferrous and non-ferrous metals, galvanized, anodized and painted surfaces.

C. Coating shall consist of an aluminum-impregnated polyurethane topcoat or an air dried phenolic material with corrosion resistant properties including ASTM Certification, tensile strength and flexibility to prevent fissures, stress cracks, peeling or flaking. Coating must achieve thickness as required.

2.04 PRIMER

A. Provide a combination primer/finish coat material similar to Blygold Florida "Rfamac" or Corrosion Solutions, Perfect-Coat PC-2000 Series.

2.05 THINNER

A. For all spray applications use a thinner similar to Blygold Florida or Corrosion Solutions' PC-2000-S.

2.06 CURING SCHEDULE

A. Specify curing time that reflects product mixture, ambient air temperature, as well as overall environmental conditions.

## 3.0 EXECUTION

### 3.01 SURFACE PREPARATION

A. Remove all manufacturing machine oil, grease, corrosion and/or dirt from surfaces with an appropriate solvent and/or detergent cleaner.

### 3.02 APPLICATION

A. Do not apply product if temperature is less than 5ºF (-15ºC) above dew point, or if temperature is below 45ºF (7ºC).

B. All spray equipment must be thoroughly cleaned and hosed, in particular, shall be free of old products and contaminants.

C. Standard manufacturer spray equipment may be used with proprietary accessories to achieve the performance of the spray application process.

D. Compressed air supplies must be uncontaminated. Air pressures must be adjusted relative to the gun manufacturer, unique accessories and variable nozzles.

E. Apply a trial application of mist for bonding and pattern features.

F. Apply several cross passes. Finished product should be 3 to 4 mils as a wet film thickness.

### 3.03 DAMAGE TO EQUIPMENT

A. Applicator is responsible for any damage to the equipment.

(END OF SECTION 23 41 00)

# SECTION 23 70 00

# FANS AND VENTS

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate this work with that of other trades affecting, or affected by work of this Section and cooperate with such trades to assure the steady progress of work under the contract.

### 1.02 SCOPE

A. The work under this section includes furnishing the labor, materials, tools, appliances, equipment, and performing all operations necessary for the complete installation of fans shown and scheduled on the Contract Documents.

B. The following fan types are part of this project:

1. In-line cabinet fans

2. Utility fans

### 1.03 RELATED DOCUMENTS

A. The following sections of the specifications are included hereinafter:

| | |
|---|---|
| 23 00 00 | Mechanical General Requirements |
| 23 05 00 | Electrical Power And Auxiliaries |
| 23 41 00 | Corrosion Protection |
| 23 95 00 | Test and Balance |

1.04 QUALITY ASSURANCE

A. Each fan shall have manufacturer's name, address, serial and model numbers engraved on a metal plate securely attached to the equipment.

B. Capacities shall be not less than those indicated on the Contract Documents.

C. Provide certified sound and/or fan data as hereinafter specified and upon request from the Engineer.

1. Wall mounted equipment shall be provided with supports suitable for wall construction. When fan or its accessories installation requires penetration of outside wall, it shall include necessary caulking, etc. to prevent water intrusion. Coordination location of wall openings with project superintendent.

D. For additional Quality Assurance requirements refer to Specifications Division 01.

1.05 SHOP DRAWINGS

A. Prepare and submit shop drawings for the following items whenever they are shown on the Contract Documents or herein specified.

In-Line Fans
Utility Fans
Power Roof Exhaust Fans

B. For additional Shop Drawing submission requirements refer to Specifications Division 01 and Section 23 00 00.

2.0 PRODUCTS

2.01 IN-LINE FANS

A. Furnish and install duct mounted, belt driven centrifugal inline fans as herein specified and shown on contract documents..

B. Certifications: Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gaskets. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

D. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, *Balance Quality and Vibration Levels for Fans.*

E. Motor shall be NEMA design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.

F. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty greasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

G. Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

H. Basis of design fan is a model SQN-B as manufactured by Loren Cook Company of Springfield, Missouri. Acceptable similar fan as manufactured by Greenheck.

2.02 UTILITY FANS

A. Furnish and install belt driven utility fans as specified herein and scheduled on the Contract Documents. Utility fans shall be single width, single inlet.

B. The housing shall be constructed of heavy gauge galvanized steel with lock formed seams permitting no air leakage. The housing construction shall allow for the fan to be rotated in the field to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of welded heavy gauge galvanized steel members to prevent vibration and rigidly support the motor and wheel assemblies.

C. The fan wheel of direct drive fans shall be of the forward curved type and shall be constructed of heavy gauge aluminum with uniform stamped blades. The fan wheel of belt drive fans shall be of the non-overloading backward inclined, centrifugal fan type and constructed of heavy gauge steel. Wheels shall be statically and dynamically balanced at the factory. The wheel cone and fan inlet cone shall be matched for maximum performance and operating efficiency.

D. Motors shall be permanently lubricated, heavy-duty high efficiency ball bearing type matched to the fan load and furnished at the voltage, phase and enclosure shown on the fan schedule.

E. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

F. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 test code for air moving devices, and fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.

G. Fans shall be provided with provided with weather protection covers for exposed outdoor installation.

H. Belt Drive utility fans shall be Model SFB with forward curved wheels as manufactured by Greenheck and Cook.

2.03 POWER ROOF EXHAUST FAN

A. Furnish and install power roof exhaust fan of size and capacity as shown on plans and as herein specified.

B. Fan type shall be centrifugal wheel, belt or direct drive as scheduled, statically and dynamically balanced. Fan shall have AMCA certified rating seal.

C. Fan housings shall be weatherproof of heavy gauge aluminum construction.

D. Fan motor shall be supported on vibration isolating mounts. Belt driven fans shall be provided with adjustable sheave on the motor to allow changes in the fan speed and an increase of up to 30% in the RPM's.

E. Direct driven fan(s) shall be provided with unit mounted adjustable solid-state speed control. Fan(s) shall be selected to deliver specified CFM with the solid-state speed control set at 70% of its operating range.

F. Each fan shall be equipped with the following accessories:

1. A back draft damper installed in the curb of the fan.

2. A minimum 12 inches high pre-fabricated roof curb shall be furnished with the fan and match unit furnished. Installer shall verify requirements based on roof construction to assure top of curb is at least 10 inches above finished roof surface. Refer to Architectural and Structural Roof Plans.

3. Provide bird screen and disconnect switch.

4. For additional accessories and controls refer to schedule on the Contract Documents.

G. Acceptable manufacturers are: Greenheck and Cook.

## 3.0 EXECUTION

### 3.01 INSTALLATION

A. Each fan shall be installed in accordance with the approved recommendations of the manufacturer and conform to the requirements of the Contract Documents.

B. Fans shall be installed free of noise and vibration. Provide isolators as per manufacturer's recommendations.

C. Fans suspended from the building structure shall be provided with the required restraints to prevent swaying or lateral movement during start up and normal operation. Submit installation details with fans shop drawings.

D. Deliver equipment to the site in manufacturer's original packaging. Clearly mark each piece of equipment with the proper identification number. Storage shall be done in accordance with the requirements of Specifications Division 01 and Section 23 00 00.

E. Provide extended lubrication tubes and fittings for service of bearings located in difficult to reach sections of the equipment. Provide additional extensions as directed by Engineer or the Owner.

F. Duct elbows located near the fan discharge shall always be in the direction of fan rotation. Equipment installer shall coordinate arrangement of fan section to assure this condition is met. Inlet duct connections shall be free of turbulence.

G. Air moving equipment shall be joined to duct sections with a 30 oz. neoprene coated, glass fiber flexible connector.

3.03 EQUIPMENT PERFORMANCE

A. Performance indicated on schedule(s) is based on the listed equipment manufacturer used as the basis of design. For all other acceptable manufacturers, shop drawing data shall indicate equal or better performance characteristics than the basis of design equipment.

B. Once unit airside performance is achieved, replace adjustable sheave with a fixed sheave as selected by the Test and Balance Agency. Replacement shall be done at no cost to the contract. Include information in the Test and Balance Report and the Operations and Maintenance Manual.

3.04 TEST AND BALANCE

A. Test and Balance Agency shall adjust fan belts and test and record equipment performance. Refer to Specifications Section 23 95 00.

B. Test and Balance Agency shall select replacement fixed sheave for belt driven fans once unit airside performance is achieved.

3.05 EQUIPMENT SERVICE

A. Provide clearances around equipment as required by Code and equipment manufacturer for the proper maintenance or removal of equipment.

B. Coordinate with other trades so no conduit interfere with the required clearances.

C. Notify contractor for general construction when in order to install this equipment work by other trades needs to be relocated.

3.06 IDENTIFICATION

A. Each piece of equipment shall be identified as per Specifications Section 23 08 00 with a permanently engraved plastic plate securely attached to equipment. Identification numbers shall be as directed by the City of Tampa Wastewater Department Project Manager.

3.07 CORROSION PROTECTION

A. All fans specified under this section of the specifications shall have a corrosion protection coating applied as per Specifications Section 23 41 00.

(END OF SECTION 23 70 00)

# SECTION 23 95 00

# TEST AND BALANCE

## 1.0 GENERAL

### 1.01 GENERAL REQUIREMENTS

A. The requirements of the General and Supplementary Conditions of the Contract; Division 01 and of Section 23 00 00 shall apply to the Mechanical work shown on the drawings and specified under this Section.

B. Examine other Sections of the Specifications and the Contract Documents for requirements, which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate this work with that of other trades affecting, or affected by work of this Section and cooperate with such trades to assure the steady progress of work under the contract.

### 1.02 SCOPE

A. The contractor shall procure the services of a local, independent Test and Balance Agency, hereinafter referred to as the Agency, approved by the Engineer, which specializes in the testing and balancing of heating, ventilating, and air conditioning systems.

B. The Agency shall test, balance and adjust all air systems and temperature control equipment specified in this Division 23 of the Specifications.

C. The Contractor shall award the test and balance contract to the Agency as soon as possible to allow them to schedule their work in cooperation with other trades and meet the completion date.

D. The Agency shall test each Sequence of Operation for all systems to verify proper operation. Include description of operation in report, verify that all controls are installed and operating in accordance with the control Sequence of Operation on plans or on equipment submittals.

E. Submit a certified Test and Balance Report to the Engineer at least one week prior to the scheduled Substantial Completion. Refer to Specifications Division 01. If the report is not available, the Substantial Completion may be re-scheduled.

1.03 RELATED DOCUMENTS

A. Work covered under other sections of the specifications related to testing and balancing includes but is not limited to the following:

| | |
|---|---|
| 23 00 00 | Mechanical General Requirements |
| 23 05 00 | Electrical Power and Auxiliaries |
| 23 70 00 | Fans And Vents |

B. Work performed under the above sections is herein referred to as the Installer. Refer to specific items of work provided by each Installer. Installers shall cooperate with test and balance agency as required during execution of the work under this Section.

C. Prior to commencing the work under this Section, The Agency staff shall visit the construction site to review the work specified under the above listed Sections as it relates to work under this Section. Any deviations from plans and specifications that may affect the performance of the system(s) shall be reported to the Engineer and Contractor.

1.04 QUALITY ASSURANCE

A. Contractor shall list in his bid the name of the local Agency he proposes to use for the project. Agency is subject to acceptance by Engineer. Submit qualifications of Test and Balance Agency to Engineer for review and approval. Submission shall be forwarded as soon as contractor is selected. Once accepted, contractor, without good cause, cannot replace Test and Balance Agency.

B. All instruments used for test and balance shall be accurately calibrated within six months of commencing work on this project and maintained in good working order. Provide proof of calibration upon request.

C. Submit qualifications of Test and Balance Agency to Engineer for review and approval. Submit proposed test and balance procedures, list of equipment to be used and any other information that will allow the Engineer to properly evaluate Agency’s capabilities as related to the Project.

D. All readings shall be within +10% / -5% of the values shown on the plans and specifications, shop drawings and manufacturer’s literature. Readings for outside airflow shall be within –5% - 0% of the values shown on the plans. These allowances do not relieve the Agency from adjusting speed controllers, belts and other control devices to achieve design conditions.

E. Prior to commencing its work the Test and Balance Agency shall meet with the contractor and installers to review and obtain copies of the **latest** construction documents, addenda, shop drawings, change orders, field changes and any other information necessary for their thorough and complete understanding of the scope of the project. If required information is not readily available from the Contractor, Agency may request that information directly from the Engineer. Contractor shall be responsible for all reproduction costs.

F. The Agency shall be represented at the time of substantial completion for a random check of the values contained in the test and balance report. If report values cannot be verified, Agency shall re-test the entire system, prepare a new report and submit to the Engineer.

G. Project will not be considered substantially complete until Test and Balance Report can be reviewed and verified.

H. For additional Quality Assurance requirements refer to Specifications Division 01 and Section 23 00 00.

1.05 WARRANTY

A. During the first year after completion of test and balance work, the owner may request a recheck or resetting of any outlet, supply fan, or exhaust fan listed in the test and balance report.

1.06 REPORTS

A. At the end of each workday, the Agency technician shall furnish the Contractor with a list of items that must be repaired or adjusted. Provide a copy to the Engineer.

B. Test and Balance information shall be compiled in a neat, orderly, itemized format on standard AABC or NEBB Forms. Test data shall be submitted to the Engineer for review. Provide minimum of three (3) hard copies of the report for Engineer's review. When electronic copies are submitted, they shall be in PDF format. For large reports, a readable CD or DVD will be required.

C. After review comments are satisfied furnish the Engineer three (3) final sets of the complete final report. A report is deemed to be final when all outstanding items listed on previous reports have been corrected and are no longer listed on the report.

D. Included in the report shall be the following minimum information. Identify each piece of equipment with project tag number, model number and serial number. Serial number on exhaust fans may be omitted.

1. Air quantities at each exhaust air device tabulated against CFM shown on the Drawings.

2. Static pressure readings entering and leaving each exhaust fan. These readings shall be related to fan curves for CFM handled.

3. Motor current readings at each fan. The voltage at the time of readings shall be listed.

4. Test controls and Sequence of Operations of equipment.

5. Provide calculations and recommended fixed sheave selection for each fan where adjustable sheaves were used for test and balance. Contractor shall install fixed sheaves.

E. Submit three (3) bound copies of the final complete Test and Balance Report one week prior to substantial completion. Electronic copies are <u>not</u> acceptable other than for progress review of data. Failure to comply with this request may result in a postponement of the Substantial Completion Inspection.

1.07 COORDINATION WITH CONTRACTOR AND INSTALLERS

A. The Agency staff shall visit the construction site to review and become familiar with the installation of pipe systems, sheet metal work, temperature controls and other components and parts of the heating, air conditioning, and ventilating systems. Verify that adequate provisions have been made for the testing and balancing of the systems and equipment.

B. The Agency will not instruct or direct the Contractor in any work, but will provide him with daily reports of his findings with copy to the Engineer.

C. The Contract Documents indicate dampers and miscellaneous flow adjustment devices for the purpose of obtaining optimum operating conditions. When additional dampers are required by the Agency to achieve design airflows, the contractor, at no additional cost to the contract, shall provide them. It will be the responsibility of the Contractor to install these devices in a manner that leaves them accessible and adjustable. The Agency should be consulted if there are any questions concerning the arrangement and access to any control devices.

D. The controls installer shall initially set, adjust, relocate (if necessary), and calibrate all controls. The Agency shall verify proper operation of controls. Include in the report one week prior to the Substantial Completion a statement that all controls have been tested for proper operation in accordance with the Sequence of Operation and design intent.

E. Contractor to install fixed sheaves on air handling equipment as recommended by Test and Balance Agency.

## 2.0 PRODUCTS

NOT APPLICABLE

## 3.0 EXECUTION

### 3.01 GENERAL

A. Installer of mechanical systems shall make all preliminary tests and adjustments, place all systems and equipment in full operation and promptly notify the Test and Balance Agency to start their work. Installer shall maintain all systems in operation during each working day of testing and balancing.

B. Installer shall promptly correct all deficiencies noted by the Agency so as not to delay the completion of the test and balance work.

C. It shall be the responsibility of the Contractor to replace fan drives, sheaves, belts and/or motors as recommended by the Agency (without cost to the contract) to attain the specified air volumes.

(END OF SECTION 23 95 00)

# SECTION 25 14 23

# CONTROL PANELS

## 1.0 GENERAL

1.01 Scope: This Section includes requirements for providing a pump control panel and related equipment to control the pumps, levels, processes, etc., as indicated within the drawings.

The equipment shall be fully tested, complete and in good operating condition.

1.02 Related Work:

Section 26 00 00; General Provisions.

1.03 Quality Assurance:

A. Unit Responsibility: The control panel, frame and cover shall be supplied by the panel manufacturer to ensure unit responsibility.

B. Guaranteed Parts Stock Program: The panel supplier shall have a guaranteed parts stock program in the State of Florida.

1.04 Submittals:

A. Shop Drawings: The CONTRACTOR shall provide shop drawings prepared by the manufacturer and submitted to the Engineer for review prior to the manufacture of the equipment. The shop drawings shall include outline dimensions and external connection diagrams. A list of components, control panel one-line wiring diagram, specifications, and a copy of the manufacturer's warranty shall be included with the submitted data. In addition, the shop drawings shall include the following:

1. Control panel drawing, including material, showing components on the door front, showing components on the back panel and showing wiring diagram.
2. Warranties.

B. Operating Instructions: For all control panels furnished under this Section, the CONTRACTOR shall submit operation and maintenance manuals which include the following items:

1. General - equipment function, description and normal and limiting operating characteristics.

2. Installation instructions - assembly procedures and alignment and adjustment procedures.
3. Operation instructions - start-up procedures, normal operating conditions, emergency and normal shutdown procedure.
4. Maintenance instructions.
5. Trouble-shooting guide.
6. Parts list and predicted life of parts subject to wear.
7. Drawings - cross sectional view, assembly and wiring diagrams.

C. Factory Performance Test Data: A factory representative, who has complete knowledge of proper operation and maintenance of each control panel, shall be provided for one day per panel furnished to instruct representatives of the OWNER and the Engineer on proper operation and maintenance. With the permission of the OWNER, this work may be conducted in conjunction with the inspection of the installation and test run as provided in this Section. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional services shall be provided at no cost to the OWNER.

D. Certifications: The CONTRACTOR shall furnish the Engineer with a written certification signed by the manufacturer's representative that the equipment has been properly installed, tested, calibrated and operated under full load conditions, and satisfactory operation has been obtained.

1.05 Delivery, Storage and Handling:

A. Deliver a complete system ready to install as job progress requires.

B. Store in weather tight building or suitable covering to protect against damage of any nature.

C. Handle during delivery, storage and installation in a manner to prevent damage of any nature.

1.06 Warranty and Guarantees: All equipment shall be guaranteed against defects in material and workmanship for a minimum period of one year from the date of OWNER's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to OWNER.

## 2.0 PRODUCTS

2.01 General: A control panel shall be provided to control the pumps and to monitor alarm and display functions as noted in the drawings and specifications. The control panel shall incorporate a programmable logic controller (PLC) to perform the functions required of the control panel.

A. Control panels shall be designed, constructed and tested in accordance with applicable NEMA, UL and ISA standards. The latest edition of the NEC, as well as, all state and local codes and regulations, shall govern the materials, fabrication and installation of the control panels.

B. Electrical components used within the control panel shall be UL listed. The panel builder shall be UL-508A certified and a UL label shall be attached to the inside of the enclosure.

2.02 Operating Voltage: The control logic shall operate at the power characteristics specified on the drawings.

2.03 Enclosure: The control panel enclosure shall be NEMA 12 and constructed of 12 gauge minimum painted steel, size as indicated on the drawings.

A. A 3-point latching mechanism with latch rods and rollers shall be used to secure the door(s). The latching mechanism shall be operated by an oil-tight, zinc-plated, key lock handle.

B. The enclosure shall be provided with a hinged door(s) for front access to the interior of the enclosure.

C. The outer door(s) shall be hinged continuously along its length.

D. A painted stainless steel back plate extending the full height and width of the enclosure shall be provided for internally mounted components.

E. The following devices, as applicable, shall be mounted on the enclosure door(s):

1. Pump Temperature Alarm / Monitor.
2. Human Machine Interface (HMI) - Annunciator Panel.
3. Human Machine Interface (HMI) - Pump Control Panel.
4. Lower Explosive Limit (LEL) Monitor.
5. Pump Vibration Monitor.

2.04 Control Circuits: Circuit controls shall operate at the voltage indicated in the drawings.

2.05 Circuit Breakers/Supplementary Protectors:

A. Circuit Breakers: The control power circuit breaker(s) shall be a thermal-magnetic molded case circuit breaker of the ampere rating shown in the drawings with a minimum of 10,000 AIC unless otherwise specified. The control power circuit breakers shall be Siemens NGG series or equal.

B. Supplementary Protectors: Supplementary protectors shall be thermal-magnetic type and have a UL 1077 listing. The ampere rating of each supplementary protector shall be as designated in the drawings. Supplementary protectors shall be 10,000 AIC and DIN rail mountable. The line side of all supplementary protectors shall be interconnected using a 1-pole comb busbar with a minimum current rating of 100 amperes. All unused connection positions and ends shall be covered with insulating materials provided by the manufacturer. Supplementary protectors shall be Siemens 5SY4 series or equal.

2.06 Control Elements:

A. The control system components shall include components required to provide the operation as designated in the drawings and as described in the specifications, but not be limited to, plug-in relays with plug-in screw terminal sockets and a programmable logic controller.

B. Each wire shall be identified at each end with wire markers.

2.07 Terminals:

A. All wiring for alarms, controls and status indications which extend outside the control panel enclosure shall be terminated on terminal blocks mounted within the control panel. These terminal blocks shall be used for field connections and shall be in addition to terminals provided on the PLC I/O modules.

B. The terminals shall be sized to accommodate the field conductors. Terminals shall be molded plastic with barriers and box lug. White marking strips, fastened securely to the molded sections, shall be provided and wire numbers or circuit identifications shall be marked thereon with permanent marking fluid.

C. Terminal blocks shall be rated for 600 volts, 65 amperes, Weidmuller WDU10 series. Terminals shall be provided with the necessary end barriers, end clamps, marking strips and mounting tracks as required.

2.08 Nameplates:

A. Components and devices shall be labeled with nameplates as noted on the drawings. Internal panel control components shall be labeled, identifying the component tag or function as applicable.

B. All nameplates shall be three-ply phenolic, black-white-black, engraved through the first black layer. Lettering shall be 0.5 cm (3/16”) minimum. Edges of all nameplates shall be beveled at 45 degrees.

C. Nameplates shall be fastened to the equipment by means of two stainless steel screws or by means of epoxy cement.

D. A permanently affixed 11" x 17" (minimum) 20 gauge anodized aluminum plate, photographically etched shall be attached to the inside of the enclosure door. This etched plate shall detail the panel wiring schematic.

2.09 Float Switches:

A. Float Switches with electrical cables shall be provided to annunciate level alarms based upon the control level elevations shown on the drawings. Cable lengths shall be coordinated with the specific installation requirements. No cable splices will be permitted in the cable lengths.

B. The Float Switches shall be hollow and hermetically sealed, rigidly molded in abrasion and corrosion resistant polypropylene which contains a hermetically sealed SPDT mercury free switch, cushioned and mounted along the main axis at a 65 degree inclination. A two-conductor cable, heavily sheathed (10 mils) in PVC for resistance to immersion, abrasion, to conduct electrical signals and to provide support for the unit, shall be assembled into the small end of the sensor. Cable conductors shall be 75°C, 600 volt, polyethylene insulated, AWG 12 stranded copper. Anchor Scientific Eco-Float Model G.

C. The Float Switches shall contain an eccentric metal weight. When not immersed in liquid, the weight shall cause the sensor body to hang from the cable, providing one stable position for both body and circuit. As liquid immerses the body, the free end shall rise as the weighted end holds the cable taut, retaining a vertical position. This ensures the proper switch position for repeatable circuit closure at the given inclination.

2.10 Human Machine Interface (HMI) Panels:

A. General: A human machine interface (HMI) shall be provided on the outer door of the enclosure for the annunciator panel and for the pump control panel.

B. HMI Annunciator Panel:

1. All alarm statuses, motor run statuses, control statuses and automatic operation shall be through the HMI annunciator panel. Manual operations shall be independent of the PLC.
2. The HMI annunciator panel shall operate from 24 VDC, 1.6A max.
3. The HMI annunciator panel shall include a 15" color analog resistive touch screen with VGA 1024 x 768 resolution and 16 BIT color graphics.

4. The HMI annunciator panel shall be standard with 256 MB flash/RAM.
5. The HMI annunciator panel shall be compatible with serial protocol and Ethernet protocol.
6. The HMI annunciator panel shall include an RS-232 port, an Ethernet 10 Base-T port and two (2) USB ports.
7. The HMI annunciator panel shall be pre-programmed with graphical screen software, including alarms, trends, event logging, animation, security and symbol library.
8. The HMI annunciator panel shall be rated for NEMA 4/12 and IP65.
9. The HMI annunciator panel shall be a Maple Systems HMI 5150X touch screen or equal.

C. HMI Pump Control Panel:

1. All pump control statuses and setpoints shall be through the HMI pump control panel. Manual operations shall be independent of the PLC.
2. The HMI pump control panel shall operate from 24 VDC, 250 mA.
3. The HMI pump control panel shall include a 17" color analog resistive touch screen with VGA 800 x 480 resolution and 16 BIT color graphics.
4. The HMI pump control panel shall be standard with 128 MB flash/RAM.
5. The HMI pump control panel shall be compatible with serial protocol.
6. The HMI pump control panel shall include three (3) serial ports and one (1) USB port.
7. The HMI pump control panel shall be pre-programmed with graphical screen software, including alarms, trends, event logging, animation, security and symbol library.
8. The HMI pump control panel shall be rated for NEMA 4/12 and IP65.
9. The HMI pump control panel shall be a Maple Systems HMI 5070NH touch screen or equal.

D. HMI Screens:

1. The application programming for the integrated graphic display system for the pump control panel mounted HMI shall be provided by the Systems Integrator and coordinated with the OWNER. The HMI graphic screens shall be graphic representations of the equipment and processes controlled and monitored by the control panel. Each screen shall be developed, printed and submitted for approval by the OWNER.

The types of displays are:

a. Piping and valve layouts.
b. Process equipment graphics.
c. Statistical Process Control (SPC) point access pop-ups, adjustable.
d. Unit operation overview.
e. Continuous control/indication.
f. Discrete control/status displays.
g. Trend displays in the graphic format.
h. Scheduled and unscheduled maintenance functions.
i. Alarm and logs in the tabular format.
j. PLC status displays.

2. The layout or arrangement formats for each of the types of graphic and tabular displays shall be developed by the Systems Integrator. Graphic displays shall be interactive with the control panel/PLC system and shall provide both an overview and detailed presentations of each of the process areas. The graphical layout of the pumps shall be depicted on screens with the capability of location zoom-in detailing. The operator shall be able to select an area of interest on the screen and bring up localized information and graphics. Graphics shall include representations of facilities and equipment. Operating status and conditions shall be displayed visually using symbols and colors. Status and conditions shall include pumps, motors, valves and levels. The operator shall be capable of selecting pump and motor symbols on the screen to bring up a control panel for that pump or motor showing "Hand-Off-Auto" switches and "Cancel" buttons. Manual operations shall be independent of the PLC, unless designated otherwise in the drawings. This functionality shall be the rule for all objects normally under the control of the operators. Screen layouts shall, as closely as possible, represent the actual layout and orientation of the monitored equipment. General color choices shall be "easy on the eye". Instrumentation symbols used shall be easily discernible as the equipment they represent. Red shall denote "Closed" or "Off" and green shall denote "Open" or "On". Blinking shall denote an alarm condition with that device.

   All alarm annunciation and graphics on the HMI panel shall be local to the Krause Pumping Station only. Graphic displays shall include the following graphic screens and four (4) additional screens as prescribed by the OWNER:

   a. Site Plan
   b. Wet Well Levels
   c. Alarm History

d. Alarm Summary
e. Clock Control
f. Historical Trending
g. Pump Level Control Set Points
h. Pumping Station Flow Rate (GPM and CFS)
i. Pumping Station Totalized Flow
j. Float Switch Levels (contact status of each float)

3. Historical trend screens shall be provided with the ability to view trended variables of interest at the date and time of interest of the pumps. The process variables to be trended shall include flow(s) and levels. The graphic display screen shall display the stored 5-minute average values of the variable for a 4-hour period. Continued trend operation utilizes the "first-in/first-out" storage technique to display the latest values for the 4-hour period.

4. This program shall be configured by the Systems Integrator to allow display and/or printout of the shift log, daily report, weekly report or monthly report on a demand basis.

5. All run time accumulators and mathematical functions shall be programmed in the PLC with access at the HMI. The HMI software will not be used for mathematical conversions or accumulations.

6. Sample screen "A" and sample screen "B" are provided at the end of this specification section for reference. These sample screens portray the overall intent of what the Contractor is to provide in the development of the HMI graphic screens. These sample screens are not intended to provide a detailed representation of the graphics that are to be provided for the pumping station.

2.11 Pump Controller / SCADA / Radio (PCSR):

A. The Pump Controller / SCADA / Radio subassembly comprises a programmable logic controller (PLC) based system engineered to provide pump control, supervisory control and data acquisition (SCADA), and radio telemetry in one assembled package. The components shall be mounted on an aluminum sub-panel and be fully wired, tested, and ready for field connections through interface terminals. The subassembly shall operate on a 120 volt, 60 Hertz, single-phase power supply and shall have integral transient voltage protection.

B. The PCSR shall be a Motorola ACE 3600 package as distributed by DCR Engineering Services Inc., SCADA One, LLC. or Revere Control Systems, Inc. These vendors have experience with the City of Tampa Wastewater SCADA system and are familiar with the custom programming required. The CONTRACTOR shall coordinate his efforts with one of these vendors to ensure system compatibility, performance, and security. The CONTRACTOR shall provide and install a complete control system package, as assembled, programmed and configured by one of the vendors listed above.

C. The following is a partial list of PCSR features:

1. Motorola ACE 3600 remote terminal unit (RTU) with surge / lightning protection for power line and antenna shall be provided.

2. Digital input and output modules and analog input and output modules shall be provided as shown on the drawings.

3. Motorola CDM750 conventional radio: UHF band (450-512 MHz) shall be provided.

4. The pump controller shall operate independently of the SCADA / telemetry system in the event of communications loss.

5. DC power circuits derived from the RTU and feeding external loads shall be individually fused as required. Fuses shall have indicator LED’s to indicate fuse has blown.

6. A back-up pump controller shall be provided to facilitate emergency overflow protection in the event of an RTU failure.

7. Interposing control relays shall be provided as required.

8. Terminal blocks shall be arranged, and separated as follows: main power distribution block; 120 VAC power; 24 VDC power; RTU DC power bus.

9. All wires shall be permanently identified using a computer generated labeling system. All terminal numbers and identifying nomenclature shall correspond to and be shown on the electrical diagrams and schematics.

10. All external wiring shall terminate on terminal blocks.

11. The RTU shall provide both digital and analog inputs for use in monitoring and control. Simultaneous monitoring of analog and digital level sensing devices shall be supported where the analog level sensing device shall be primary. The RTU shall contain routines for detecting sensor failures and utilize the alternate level sensing device(s).

12. Battery back-up power shall be provided for the RTU so that monitoring is maintained during utility power failures. The batteries shall have the capacity of operating the RTU for a minimum of four hours. The power supply shall keep the batteries at float charge. The RTU shall contain a low battery cutout circuit, and the batteries shall not be damaged by deep discharges.

13. Local manual pump control is provided by Hand-Off-Auto (HOA) switches located in the adjustable frequency drives (AFD's). In the absence of RTU power or in the case of RTU failure, the pump AFD's shall remain operational in the HAND position. In no case shall the RTU have the capability to operate or override the pumps in the HAND or OFF positions.

14. The capability to remotely override or disable individual pumps shall be provided (local switches must be in the AUTO position).

15. Capability shall be provided to configure from one to four pumps.

16. Individual pump run status shall be reported to the Central HMI.

17. The following pump failures shall be reported to the Central HMI: fail to start; fail to stop; premature stop; motor controller fault; overtemperature; and vibration.

18. RTU configuration parameters shall be adjustable locally and remotely from the Central HMI.

19. A fail-safe input shall be provided indicating cabinet intrusion.

20. The RTU shall have the latest RTU SCADA application license compatible with the existing Central HMI configuration.

21. An expansion 8-port Ethernet switch module shall be provided.

2.12 Antennas and Support Mast:

A. The equipment for the new radio systems for the Control Panel shall include suitable cabling. The existing support mast and antenna shall be used.

B. Antenna cabling shall be a minimum of 5/8" OD, copper, heliax cable, suitable for direct burial and outdoor installation.

C. Grounding of the antenna support mast and surge protection of the antenna cables shall be provided.

2.13 Wiring: All control wiring existing and new shall be identified with numbers on all terminals. Markers shall be Thomas & Betts "E-Z-Code" clip-on markers or approved equal. All wiring shall meet or exceed the requirements found in Specification Section 26 05 19.

2.14 Power Supplies:

A. DIN rail mount power supplies shall provide power for 24 VDC loads. Power supplies with an input rating of 120 VAC and an output rating not less than 2.5 amperes at 24 VDC shall provide power to the PLC analog input/output modules. Power supplies shall be Sola model no. SDN2.5-24-100 or equal.

B. A circuit breaker (or supplementary circuit protector) shall be installed on the 120 VAC input for each DC power supply.

C. There shall be a minimum of 2" free space above, below and in front of all power supplies to maintain proper cooling.

D. No power supply shall provide power for more than one (1) PLC input or output module.

2.15 Lightning/Surge Protection:

A. Lightning/surge protection shall be provided to protect the system from induced surges at the power supply connections. The lightning/surge protection shall be such that the protective level shall not interfere with normal operation, but shall be lower than the protected device surge withstand level and shall be maintenance free and self-restoring. Surge protective devices shall be DIN rail mountable and properly grounded.

B. Grounding conductors for all surge protectors shall be connected to a grounding connection having a resistance to ground of 10 ohms or less. Each grounding conductor from each surge protective device shall be routed individually and insulated from one another up to the grounding connection point.

C. The surge protection devices shall be mounted within the equipment enclosure or a separate NEMA 4 junction box coupled to the enclosure.

D. Surge protection for 120 VAC, single phase circuits shall be DIN rail mount Phoenix Contact model no. 2817741 (base) and 2807586 (plug) or equal.

E. Analog surge protection shall be provided on each analog circuit connected to the control panel. Surge protection shall be provided in the control panel and shall be in addition to any surge protection provided at the end device as noted in the drawings. Analog cable surge suppression shall be DIN rail mount Phoenix Contact model no. 2838186 or equal.

2.16 Construction Requirements:

A. The CONTRACTOR shall furnish all necessary conduits, wireways, switches, indicators, controllers, electrical fittings, wire and optical fibers for all circuits and connections to instruments and other electrical devices to ensure a complete and functional installation. All wiring and connections within the control panel shall conform to the following electrical requirements:

1. Unless otherwise specified, all instruments, alarm systems, and motor controls shall operate at 120 VAC or 24 VDC.

2. Terminal connections shall be located in an accessible location near the top or bottom of the panel.

3. Analog signal and communications wiring shall be routed separately from power and 120 volt control wiring. All wiring and terminations shall be in accordance with NEC requirements. All Class 1 wiring shall be physically separated from any Class 2 and Class 3 wiring.

4. All wiring shall be routed in plastic wireways.

5. Conductors shall be flexible stranded copper conductors with THHN insulation and shall be rated at 600 volts. Conductors for discrete instrument signal circuits and alarm circuits shall be AWG 14. UL listed type MTW (machine tool wiring) is acceptable wiring for inside the control panel and not extending outside of the enclosure. All shielded cables shall be AWG 16.

6. Conductors supplying 120 volts AC power on the line side of a disconnecting switch shall be black insulation for the ungrounded conductor. Grounded (neutral) circuit conductors shall have white insulation. The grounding conductor shall have green insulation.

7. Conductors for ungrounded 120 AC control circuits shall have red insulation. All conductors energized by an AC voltage source external to the control panels shall have orange insulation. All conductors for DC voltage shall have blue insulation.

8. Terminals shall be installed in the control panel to terminate all field conductors connected to the control panel. Devices included in the control panel and connected to the PLC shall be connected to the terminals also. All spare conductors routed to the panel shall be neatly coiled and identified. PLC input/output modules (discrete and analog) installed shall have each point connected to the terminals for terminating field conductors. These connections shall include all input/output points for the PLC modules installed, including spare input/output points. Conductors routed from the PLC modules shall be terminated on the top side of the terminal blocks and field wiring shall be terminated on the bottom side of the terminal blocks. For terminals mounted in a vertical orientation, conductors from the PLC modules shall be terminated on the left side of the terminal blocks and field wiring shall be terminated on the right side of the terminal blocks.

9. Each signal, control, alarm, and indicating circuit conductor shall be identified by a single unique number. The number shall follow the following convention of designating the ISA tag number of the signal's source. Wire numbers shall be marked on all conductors at each terminal using white numbered wire markers which are plastic-coated (heat-shrink) cloth. Brady B-500, Thomas & Betts "E-Z Code" or equal.

10. Power circuits shall be identified with the associated panel and circuit numbers.

B. Each discrete input/output circuit extending out of the control panel shall be individually fused.

C. A circuit protector shall be installed on the 120 VAC supply for each PLC discrete input/output module.

## 3.0 PANEL CONTROL OPERATIONAL REQUIREMENTS

### 3.01 Pump Control Panel:

A. General: The pump control panel at the Krause Pumping Station shall control the automatic operation of four (4) wastewater pumps. The level of the wet well shall determine the running statuses of the pumps. The control and monitoring of the pumping station by the pump control panel shall be accomplished with the programmable logic controller (PLC) mounted in the control panel.

B. The pump control panel shall be operated as follows:

1. The four (4) pumps shall operate in a lead/lag/standby configuration. At any one time, a maximum of three (3) pumps will be in operation - one (1) lead pump, two (2) lag pumps and one (1) standby pump.

2. Lag pump no. 1 shall supplement the pumping capacity of the lead pump in the event the level in the wet well continues to rise while the lead pump is operating.

3. Lag pump no. 2 shall supplement the pumping capacity of the lead pump and lag pump no. 1 in the event the level in the wet well continues to rise while the lead pump and lag pump no. 1 are operating.

4. The lead pump, lag pump no. 1, lag pump no. 2 and the standby pump shall be alternated automatically every 24 hours to equalize the run time of each pump. When alternated, the lead pump shall assume lag pump no. 1 status, lag pump no. 1 shall assume lag pump no. 2 status, lag pump no. 2 shall assume the standby pump status, and the standby pump shall then become the lead pump. An alternator bypass function shall be provided in the HMI.

5. When a pump goes into a “failed” condition, this pump shall be “locked out” and a manual reset shall be required to restore the pump to the alternation sequence. The standby pump will then assume the status of the “failed” pump.

6. A delay of 25 seconds shall be provided between the starting of any two pumps.

7. Wet Well Level Controls:

   a. Wet well level set points at the Krause Pumping Station shall be inferred by the programmable logic controller (PLC) with input from the bubbler system transmitters. The wet well level set points shall be as indicated in the drawings.

   b. The signal from the upstream channel and the two (2) downstream channel bubbler wet well level transmitters shall be used for the pump control and alarm settings. The HMI screen shall allow the operator to select which wet well bubbler level signal is active. The downstream channel bubbler shall be the default bubbler for pump control.

   c. The float switch shall provide alarm and control actions independent of the bubbler system transmitters.

   d. The "lead pump on" set point shall turn the first pump on at minimum speed (75%). As the level in the wet well increases, an output signal from the PLC to the respective AFD increases the speed of the lead pump until the wet well level equilibrium is reached.

   e. When the speed of the lead pump is at 100% and the wet well level reaches the "lag pump no. 1" set point, the second pump shall turn on at minimum speed (75%) to ensure equal flow contribution from each pump, also reduce the speed of the lead pump to 75%. As the level in the wet well increases, an output signal from the PLC to the respective AFD increases the speed of the lead pump and lag pump no. 1 equally, until the wet well level equilibrium is reached. All pumps shall operate at the same speed to ensure balanced/predictable flow.

   f. When the speeds of the lead pump and lag pump no. 1 are at 100% and the wet well level reaches the "lag pump no. 2" set point, the third pump shall turn on at minimum speed (75%). To ensure equal flow contribution from each pump, also reduce the speed of the lead pump and lag pump no. 1 to 75%. As the level in the wet well increases, an output signal from the PLC to the respective AFD increases the speed of the lead pump, lag pump no. 1 and lag pump no. 2 equally, until the wet well level equilibrium is reached. All pumps shall operate at the same speed to ensure balanced/predictable flow.

g. To avoid "water hammer", the speed of each pump shall be reduced individually as the level in the wet well falls. When the off level set point of a pump is reached, the pump shall be decelerated by reducing the pump speed over a period of time. The pump speed shall be reduced from its operating speed value to zero speed and stopped over a period of 45 seconds. The pumps shall be turned off from the highest order lag pump to the lowest order lag pump. The lead pump shall be turned off last. The off level set points shall be set as indicated in the drawings.

h. A contact closed signal from Float Switch LSH-1 shall initiate a "Hi Level Alarm" (see Section 10 below). This alarm shall be a "latching" type alarm, requiring an "Alarm Reset" to clear the alarm.

Upon activation of the Float Switch LSH-1:

1) Operate the first available pump at 100% speed.
2) If the contact closed signal from Float Switch LSH-1 has not cleared within 1-minute of the first pump running, then operate the second available pump at 100% speed.
3) If the contact closed signal from Float Switch LSH-1 has not cleared within 1-minute of both the first pump and second pump running, then operate the third available pump at 100% speed.
4) Upon a contact open signal from Float Switch LSH-1, continue running the pump(s) for an additional 3-minutes. Return to normal automatic control.
5) If after the 3-minutes normal automatic control is not available (bubbler faulty signal, etc.), continue to run the pump(s) at absolute minimum speed to maintain positive sewage flow.

8. Pump Control/Communication: Modbus communication from the PLC shall be provided for status communication of each of the four (4) pump AFD's.

Discrete contacts shall be used for pump "on/off" commands and "status/fault" signals from the AFD.

PLC analog outputs shall be used for AFD speed reference.

9. Pump Monitoring: A pump monitoring system for temperature and vibration, with a control panel door mounted operator display, shall be provided to protect each pump in the event of a failure and to prevent faults from occurring.

    a. Pump volute high temperature, pump stator winding high temperature, pump main bearing high temperature or pump support bearing high temperature shall turn off the affected pump.

    b. Excessive motor vibration shall turn off the affected pump.

    c. An alarm indication screen shall be annunciated on the HMI and a Panel Alarm (see Section 10 below) shall be initiated when a pump high temperature condition, a motor high temperature condition, a bearing high temperature condition or a motor excessive vibration condition are present for any pump. This alarm shall be a "latching" type alarm, requiring an "Alarm Reset" to clear the alarm.

10. Alarm Control and Annunciation:

    a. A Panel Alarm shall be initiated from the following alarm points:

        1) Wet Well High Level
        2) AFD Failed/Pump Failed
        3) Wet Well Gas Detection
        4) AC Power Off
        5) Motor High Temperature
        6) Pump High Temperature
        7) Bearing High Temperature
        8) Pump/Motor Excessive Vibration

    b. A Panel Alarm shall annunciate an alarm indication screen on the HMI.

    c. The Panel Alarm shall be a "latching" type alarm. The Panel Alarm can be cleared only after the alarm point is cleared and subsequently depressing the HMI Alarm Reset.

    d. The HMI Alarm Reset shall clear the Panel Alarm and the aforementioned alarm indication screen on the HMI.

## 4.0 EXECUTION

### 4.01 Installation:

A. All materials and equipment shall be installed as shown on the Drawings and as recommended by the manufacturer.

B. Additional items of construction necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these Specifications.

### 4.02 Inspection and Testing:

A. Personnel: The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble-free operation, and instruct the operating personnel in the proper care and operation of the equipment prior to the final acceptance of the control panel and its associated installation.

B. Field Test: When the pumping station is complete and ready for operation, then the control panel shall be inspected and tested for compliance with the Contract Documents. Test of the equipment shall be made by the CONTRACTOR in the presence of the OWNER's Engineer, the Electrical Subcontractor, the equipment manufacturer's representative, and the OWNER's representative. The equipment tests shall include, but not be limited to, the following:

1. Controls: Controls shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels, pump sequence and alarm actuation.

2. Electrical: CONTRACTOR shall record readings of voltage and amperage on all electrical components at start and steady state operating conditions. Such readings shall be recorded on a form provided by the manufacturer and the results shall meet the manufacturer's prescribed limits. If a tested item fails to meet its requirements, then it shall be replaced. Results of the tests, including the serial number of the accessories tested, shall be given to the Engineer.

3. Inspection: A thorough inspection of all mechanical and electrical equipment and controls, fittings, brackets, mountings, seals, conduit, painting, components and features shall be made while the station is being tested to determine performance and compliance with design requirements and specifications.

4. Repairs, Adjustments and Replacements: The CONTRACTOR shall make any and all necessary repairs, adjustments and replacements until performance has been demonstrated to the satisfaction of the Engineer. The CONTRACTOR shall bear the cost of any repair, adjustment and replacement.

(End of Section 25 14 23)

# Sample Screen "A"

TPB012-099

| PUMP #1 | PUMP #2 | PUMP #3 | PUMP #4 | SWITCHGEAR |
|---|---|---|---|---|
| STOPPED | RUNNING | STOPPED | STOPPED | MAIN "A" CLOSED |
| 0.0 % SPEED | 67.8 % SPEED | 0.0 % SPEED | 0.0 % SPEED | MAIN "B" CLOSED |
| 0.0 KW | 97.3 KW | 0.0 KW | 0.0 KW | TIE OPENED |
| 0.0 AMPS | 146 AMPS | 0.0 AMPS | 0.0 AMPS | MAIN "A" AMPS |
| FAIL TO START | FAIL TO START | FAIL TO START | FAIL TO START | MAIN "B" AMPS |
| AFD READY | AFD READY | AFD NOT READY | AFD READY | MAIN "A" KW |

| | | |
|---|---|---|
| W. W. UPSTREAM HIGH WARNING | P#2 FAILED TO START | P#3 STATOR SEAL LEAK |
| W. W. UPSTREAM HIGH ALARM | P#2 DISH. VALVE FAIL TO OPEN | P#3 CABLE SEAL LEAK |
| W. W. DWNSTREAM LOW WARNING | P#2 DISH. VALVE FAIL TO CLOSE | P#3 BEARING OVERTEMP. |
| BUBBLER CNTRL PWR FAIL | P#2 AFD FAIL | P#4 FAILED TO START |
| LEL GAS 25% | P#2 MTR STATOR OVERTEMP. | P#4 DISH. VALVE FAIL TO OPEN |
| LEL GAS 50% | P#2 STATOR SEAL LEAK | P#4 DISH. VALVE FAIL TO CLOSE |
| GAS DETECTOR OK | P#2 CABLE SEAL LEAK | P#4 AFD FAIL |
| P#1 FAILED TO START | P#2 BEARING OVERTEMP. | P#4 MTR STATOR OVERTEMP. |
| P#1 DISH. VALVE FAIL TO OPEN | P#3 FAILED TO START | P#4 STATOR SEAL LEAK |
| P#1 DISH. VALVE FAIL TO CLOSE | P#3 DISH. VALVE FAIL TO OPEN | |
| P#1 AFD FAIL | P#3 DISH. VALVE FAIL TO CLOSE | WASTEWATER FLOW MGD |
| P#1 MTR STATOR OVERTEMP. | P#3 AFD FAIL | W. W. DWNSTREAM HIGH FLOAT |
| P#1 STATOR SEAL LEAK | P#3 MTR STATOR OVERTEMP. | |
| ALARMS | | |

PROPOSED ANNUNCIATOR SAMPLE SCREEN 1

| PUMP #1 | PUMP #2 | PUMP #3 | PUMP #4 | SWITCHGEAR |
|---|---|---|---|---|
| STOPPED | RUNNING | STOPPED | STOPPED | MAIN "B" KW |
| 0.0 % SPEED | 67.8 % SPEED | 0.0 % SPEED | 0.0 % SPEED | MAIN "A" PF |
| 0.0 KW | 97.3 KW | 0.0 KW | 0.0 KW | MAIN "B" PF |
| 0.0 AMPS | 146 AMPS | 0.0 AMPS | 0.0 AMPS | MAIN "A" KVA |
| FAIL TO START | FAIL TO START | FAIL TO START | FAIL TO START | MAIN "B" KVA |
| AFD READY | AFD READY | AFD NOT READY | AFD READY | MCC-65A AMPS |

| | | |
|---|---|---|
| SUMP PUMP LEVEL | SCREEN CONTROL POWER | COMPACTOR RUNNING |
| PLANT WATER PRESSURE | SCREEN RUNNING | COMPACTOR FAULT |
| HVAC TROUBLE | SCREEN FAULT | COMPACTOR LOW LOAD |
| | SCREEN SPRAY WASH FAILURE | COMPACTOR HIGH LOAD |
| LIGHTING ATS TROUBLE | SCREEN SPRAY WATER FLOW GPM | |
| LIGHTING ATS ON BUS "A" | | |
| LIGHTING ATS ON BUS "B" | SCREEN ATS TROUBLE | |
| | SCREEN ATS ON BUS "A" | |
| | SCREEN ATS ON BUS "B" | |
| | | |
| | | |
| | | |
| ALARMS | | |

PROPOSED ANNUNCIATOR SAMPLE SCREEN 2

| SWITCHGEAR |
|---|
| COGEN OFF. AMPS |
| MCC-64A AMPS |
| MCC-64B AMPS |
| CARPR SHOP AMPS |
| MCC-65B AMPS |
| |

ADDITIONAL S/G INFO

NOTE:
1. THE ANNUNCIATOR HMI IS A MAPLE SYSTEMS # HMI5150X.
2. SCREEN 1 AND SCREEN 2 SHOWS THE INFORMATION DISPLAYED ON THE SAME HMI AT DIFFERENT TIMES AS CONTROLLED BY OPERATOR TOUCH-SCREEN INPUT.
3. DISPLAY GRAPHICS AND CHARACTERISTICS SHALL FOLLOW THE STANDARDS SET FORTH AT SULPHUR SPRINGS AND YBOR PUMPING STATIONS.

ROMAN D. KORCHAK, P.E. #42626
ELECTRICAL SECTION HEAD
WASTEWATER DEPARTMENT

| No. | DATE | REVISIONS |
|---|---|---|
| 3 | | |
| 2 | | |
| 1 | | |

DES: RDK
DRN: RDK
CKD:
DATE: 9/18/13

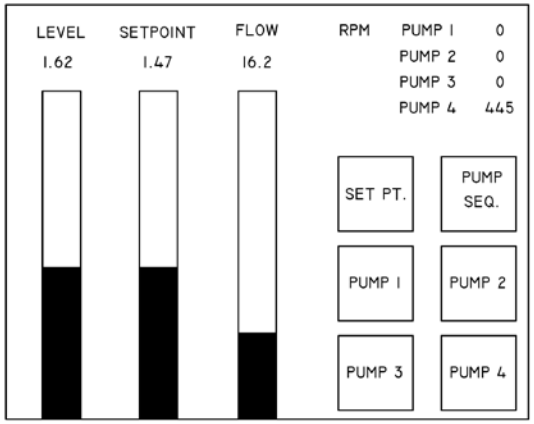
CITY of TAMPA
WASTEWATER DEPARTMENT

HOWARD F. CURREN ADVANCED WASTEWATER TREATMENT PLANT
RAW SEWAGE PUMPING STATON IMPROVEMENTS- ELECTRICAL
PROPOSED ANNUNCIATOR SCREENS

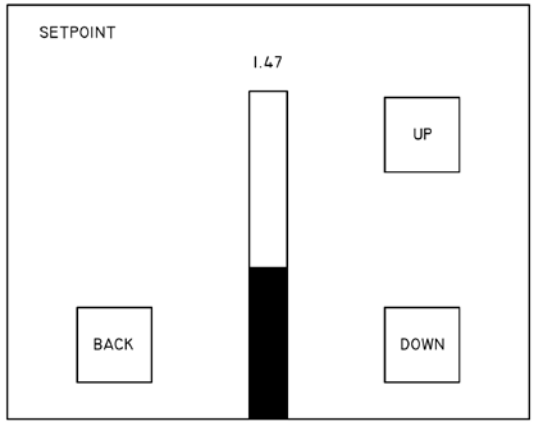
W.O. 4506
SHEET
E16A
OF

# Sample Screen "B"

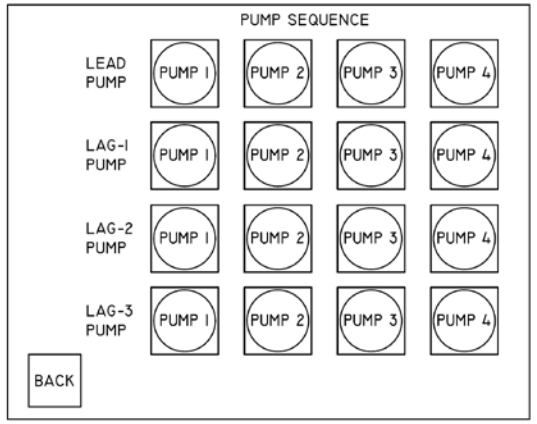
TPB012-100




PROP. PUMP CONTROL- HOME SCREEN

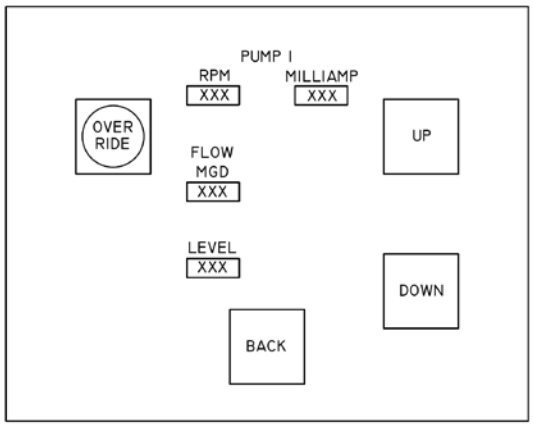



PROP. PUMP CONTROL- SETPOINT SCREEN




PROP. PUMP CONTROL- PUMP SEQUENCE SCREEN

NOTE:
1. THE PUMP CONTROL HMI IS A MAPLE SYSTEMS # HMI5070NH
2. THE THREE SAMPLE SCREENS SHOW THE INFORMATION DISPLAYED ON THE SAME HMI AT DIFFERENT TIMES AS CONTROLLED BY OPERATOR TOUCH-SCREEN INPUT.
3. DISPLAY GRAPHICS AND CHARACTERISTICS SHALL FOLLOW THE STANDARDS SET FORTH AT SULPHUR SPRINGS AND YBOR PUMPING STATIONS.




PROP. PUMP CONTROL- OVERRIDE SCREEN

| | | | | | | |
|---|---|---|---|---|---|---|
| ROMAN D. KORCHAK, P.E. #42626<br>ELECTRICAL SECTION HEAD<br>WASTEWATER DEPARTMENT | No. | DATE | REVISIONS | DES: RDK<br>DRN: RDK<br>CKD:<br>DATE: 9/18/13 | CITY of TAMPA<br>WASTEWATER DEPARTMENT | HOWARD F. CURREN ADVANCED WASTEWATER TREATMENT PLANT<br>RAW SEWAGE PUMPING STATON IMPROVEMENTS- ELECTRICAL<br>PROPOSED PUMP CONTROL SCREENS | W.O. 4506<br>SHEET<br>E16B<br>OF |
| | 3 | | | | | | |
| | 2 | | | | | | |
| | 1 | | | | | | |

# SECTION 26 00 00

# GENERAL PROVISIONS

## 1.0 GENERAL

### 1.01 Scope of Division:

A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning electrical installation in accordance with local and state codes, and contract drawings and specifications. Work shall be understood to include all work specified in Division 26, electrical section numbers 26 00 00 through 26 99 99, inclusive, of the specifications.

B. It is the intent of the specifications that all materials and equipment shall be installed by the CONTRACTOR in accordance with the good practice of the several trades involved, ready to operate in the manner indicated or manifestly implied, irrespective of whether or not such completeness, workmanship or practices are detailed herein. Any item not specifically required by the specifications, drawings and plans but which is necessary for a complete, working installation shall be provided by the CONTRACTOR at no additional cost to OWNER.

C. Motors specified in Division 26 shall be furnished and installed as specified in other divisions, unless otherwise noted.

D. The term “CONTRACTOR” as used in these Division 26 sections refers to the Contractor that is responsible for the work in accordance with the agreement with the OWNER. Any reference to the “electrical subcontractor” or to other subcontractors is intended only to provide technical requirements for the electrical work to be performed within the CONTRACTOR’s scope of work.

### 1.02 Examination of Site:

A. Bidders shall visit the site and familiarize themselves with existing conditions and satisfy themselves as to the nature and scope of the work and the difficulties that attend its execution. The submission of a bid will be construed as evidence that such an examination has been made, and that existing conditions have been allowed for in his bid.

B. CONTRACTOR shall be responsible for field verification of scale dimensions, exact equipment locations, cable lengths, bills of materials and other construction data.

C. All fees and permits in connection with electrical services shall be included in this contract.

1.03 Codes and Standards:

A. Materials and installation, as a minimum, shall conform with local and state codes and ordinances. Equipment, where applicable, shall be Underwriters Laboratories, Inc. listed and shall conform to National Electrical Manufacturers Association (NEMA) Standards. Do not reduce standards of quality and workmanship established by Drawings and Specifications by any of these codes and ordinances.

B. The following codes set minimum requirements for work specified in Division 26:

1. National Fire Protection (NFPA) 70-2014.
2. Occupational and Safety Hazard Act (OSHA).
3. State and local ordinances.
4. Others as specified.

1.04 Drawings and Specifications:

A. Drawings and specifications are intended to agree and be mutually explanatory. Specific notes on drawings take precedence over general terminology of the specifications.

B. Electrical drawings are diagrammatic but shall be followed as closely as actual construction of the building and the work of other trades will permit.

C. Because of the small scale of the drawings, it is not possible to indicate all of the offsets, fittings and accessories required. CONTRACTOR shall investigate the structural and finish conditions affecting his work and shall arrange such work accordingly, furnishing fittings, bends, junction boxes, pull boxes, access panels and accessories required to meet such conditions.

D. Field coordinate with other trades in ample time to build all chases and openings, set all sleeves, inserts and concealed materials, and provide clearances that may be required to accommodate materials and equipment. Electrical work shall be laid out so that in case of interference with other items, the layout may be altered to suit conditions encountered.

E. The Engineer reserves the right to make any reasonable changes (approximately 6 feet) in the location of outlets, fixtures, switches, receptacles or equipment, prior to the rough-in of such, without additional cost to the OWNER.

F. No deviations from the plans and specifications shall be made without the full knowledge and consent of the Engineer. Should the CONTRACTOR find, at any time during the progress of the work, that, in his judgment, a modification of the requirements of any particular item is necessary, he shall report such item promptly to the Engineer for his decision and instruction.

G. CONTRACTOR shall notify all other Contractors of any deviations or special conditions necessary for the installation of his work. Interferences between the work of various Contractors shall be resolved prior to installation. Work installed not in compliance with the drawings and specifications and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled by the CONTRACTOR without additional cost to the OWNER. The Engineer or his Representative shall be the mediating authority in all deviations and conflicting disputes arising on the project.

H. Insofar as it is possible to determine in advance, the CONTRACTOR shall consult with the masonry contractor and others so as to leave the proper chases and openings for his work; and he shall place all of his outlets, anchors, sleeves and supports prior to pouring concrete or installing masonry work. Should the CONTRACTOR neglect doing this, any cutting and/or patching shall be done at the CONTRACTOR's expense.

1.05 Cutting and Patching:

A. Any routine damage caused by cutting or in any other way caused by the electrical contractor in the performance of his contract shall be repaired or replaced under the separate heading for the type material included and in a manner satisfactory to the Engineer.

B. Any unnecessary damage caused by the CONTRACTOR, due to installation of the electrical work, brought about through carelessness or lack of coordination, shall be corrected under the separate heading for the type of materials involved and paid for by the CONTRACTOR.

1.06 Access Panels: The CONTRACTOR's attention is called to access panels. It is a requirement of these specifications that all access panels required in architectural finishes or surfaces to provide access to junction boxes, smoke detectors, strip heaters, ballasts or other devices be provided and located by the trade requiring access. The access panel shall be installed by the trade constructing the base to which the access panel will be anchored.

1.07 Structural Support:

A. Provide shop drawings for fabrication and erection of structure framing required for attachment of hangers or other devices to support electrical equipment.

B. Framing members shall be standard rolled steel shapes, ASTM 36 steel, except those members welded to main structural member. Framing shall be "simple beam" type with end connections welded or bolted for shear loads. Cantilevers may be used only when detailed or specifically approved. Location of supplementary framing shall be subject to approval. Welding shall be done by certified welders.

C. Framing members shall be designed for their actual loads, with allowable stresses set forth in the AISC code, without excessive deflection and with consideration for rigidity under vibration, in accordance with standard structural practices.

D. Supplementary framing, including design loads, member size and location, shall be clearly shown on shop drawings.

E. When supplementary framing is indicated, the CONTRACTOR shall verify that dimensions are suitable and that framing is structurally adequate for the equipment furnished.

F. No cutting or drilling of holes in structural members will be permitted, except where written permission has been obtained from the Engineer.

1.08 Operations and Maintenance:

A. Furnish required copies of manufacturer's operating and maintenance manuals. Include for each piece of equipment; product data sheets, wiring diagrams, maintenance recommendations, parts lists, and instruction sheets. Prepare manuals to include all systems and equipment shown and/or specified.

B. Instruct representatives of OWNER in operation and maintenance of installed systems. Furnish letter naming OWNER's personnel receiving instruction. Have maintenance manual available, and acquaint OWNER's representatives with its contents during instruction.

C. Operating and maintenance manuals shall be prepared and submitted in accordance with the requirements of the section entitled "Submittal Data".

1.09 Record Drawings:

A. Maintain one extra set of black-line or black-line print drawings for use as Record Drawings. Records shall be kept daily, using colored pencil. As the work is completed, relevant information shall be transferred to a reproducible set, and copies made to be given to the Engineer.

B. Comply with the following for all work specified in Division 26. As-built information shall be shown to scale, using standard symbols listed in the legend. As a minimum, show the following:

1. Location of stub-outs, dimensioned from permanent building lines.
2. Location and depth of under-slab and in-slab raceways.
3. All routing of raceways.
4. Corrected panelboard and equipment schedules.
5. Corrected circuit numbers as they appear on panelboard directories.
6. Corrected motor horsepower and full load amperages.
7. Number, size, type of insulation and number of wires in each conduit or multi-conductor cable whether in conduit or exposed.
8. Location of junction boxes, pullboxes and splices.
9. Location of access panels.

C. Each “as-built” drawing provided by the CONTRACTOR shall be signed and dated with changes clearly noted in red. Additionally, the printed name of the individual signing the “as-built” drawings along with that person’s company affiliation shall be included. If no change was made during construction, a note designating “no changes” shall be included on the drawing, as well as, the previously stated information and signature.

1.10 Electrical Service:

A. Electrical service characteristics shall be as indicated on drawings. Furnish metering and service entrance arrangement in accordance with requirements of the utility. Consult with representatives of the utility immediately after award of construction contract, and reach agreement with its representatives as to details of service for this project. See drawings for additional requirements.

B. CONTRACTOR shall leave the required length of free cable in the transformer’s secondary compartment of the utility transformer(s) or in the utility company connection pedestal at the base of the utility power pole, as applicable. Furnish suitable connectors for attaching cables to the secondary bushings in the utility transformer(s) or secondary conductors from pole-mounted transformers in accordance with utility company requirements. See drawings for additional requirements.

1.11 Telephone Service:

A. Provide conduit for all telephone cables. Install a No. 14 galvanized steel pullwire in each conduit. Number at each outlet with corresponding number on each end of pull wire.

B. Furnish cover plates as specified in the section entitled "Basic Materials and Methods" for installation by the telephone utility. Provide blank cover plates installed on all outlets not wired for use.

1.12 Interface With Work Specified In Other Divisions:

A. Note that work specified under other divisions requires coordination and cooperation of the subcontractor performing work under Division 26. Attend necessary coordination and scheduling meetings and be informed so interfacing is accomplished to result in complete and operating systems.

B. The HVAC system includes designated HVAC equipment completely installed. Feeder circuit, branch circuit, motor control and switch leg connections, to operate units, shall be provided under Division 26.

1.13 Temporary Lights and Power:

A. CONTRACTOR shall provide a temporary electrical distribution system of 120/240 volt, 3-phase, 200 amp minimum. All temporary work shall be installed in a neat and safe manner.

B. The CONTRACTOR shall furnish and install power outlets and lighting necessary for construction. Power outlets shall be 30-amp, 1-phase; fused disconnect switches shall be for 120/240 volts as necessary for construction activities.

C. The service and panelboards required for the above light and power outlets shall be furnished and installed by CONTRACTOR, and power consumption shall be paid for by the CONTRACTOR.

D. Temporary electrical power distribution and wiring shall be removed when no longer required.

1.14 Applicable Documents: The listed publications form a part of this specification and, where referred to by basic designation only, are applicable to the extent indicated.

A. American Society for Testing and Materials (ASTM).

1. (A 36-75) Specification for Structural Steel.

2. (A 153-73) Specification for Zinc Coating (Hot dip) on iron and steel hardware.

B. American Institute of Steel Construction (AISC).

1. "Specification for the design, fabrication and erection of structural steel for the buildings", with commentary, herein, designated as the AISC Specification.

## 2.0 PRODUCTS

### 2.01 Uniform Products:

A. Equipment and materials of the same type or classification and used for the same purpose, shall be products of the same manufacturer.

B. Materials and equipment shall conform in all respects to the requirements set forth in these specifications and the accompanying drawings. However, wherever a product is identified by name, equal products which meet the Engineer's written approval may be used.

C. Except as otherwise specified, materials and equipment shall be new and bear the approval label of Underwriters Laboratories, Incorporated.

2.02 Shipping Dates for Major Items of Equipment: Not later than six weeks after the Notice to Proceed is issued to the CONTRACTOR, the CONTRACTOR shall furnish to the Engineer a complete list of all major items of electrical equipment including pad mounted transformers, primary switchgear, unit substation, low voltage switchboards, panelboards, bus duct, dry type transformers, lighting fixtures, etc., along with vendors, dates orders were placed and scheduled delivery dates.

2.03 Shop Drawings:

A. As soon as practical, after the notice to proceed is issued, in order that work under this contract will not be delayed, submit to the Engineer, for review, complete descriptive and dimensional data on:

1. Wire (600 volts and below).
2. Conduit.
3. Outlet cover plates.
4. Wiring devices.
5. Wiring.
6. Time switches.
7. Low voltage switchboards.
8. Panelboards.

9. Magnetic contactors.
10. Safety switches.
11. Lighting fixtures.
12. Adjustable frequency drives (AFD's).
13. Motor control centers (MCC's).
14. Enclosures.
15. Transformers.

B. Corrections or comments made on shop drawings during the review do not relieve CONTRACTOR from compliance with requirements of contract documents, plans and specifications. Shop drawings will be checked for general conformance with the design concept of the project and general compliance with information given in the contract documents. Review of the shop drawings shall not relieve the CONTRACTOR from responsibility for confirming and correlating all quantities and dimensions, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner. Review of shop drawings shall not permit any deviation from plans and specifications.

C. See Specific Provisions for number of copies of shop drawings to be submitted.

2.04 Equipment Manuals:

A. Before the project is finally accepted, the CONTRACTOR shall furnish to the Engineer four (4) bound sets of descriptive, dimensional parts data on:

1. Wire (600 volts and below).
2. Conduit.
3. Outlet cover plates.
4. Wiring devices.
5. Wiring.
6. Time switches.
7. Low voltage switchboards.
8. Panelboards.
9. Magnetic contactors.
10. Safety switches.
11. Lighting fixtures.
12. Adjustable frequency drives (AFD's).
13. Motor control centers (MCC's).
14. Enclosures.
15. Transformers.

B. Each set of this literature shall be bound in a permanent type hard cover ring binder and shall be suitably indexed.

C. Equipment manuals shall include complete details of equipment such as primary switchgear, switchboards and unit substations, complete with wiring diagrams and bus ratings, and trip curves for power air circuit breakers, fuses and molded case circuit breakers (600 amp and larger).

D. Equipment manuals shall also include warranties, guarantees, and manufacturer's instructions shipped with equipment.

## 3.0 EXECUTION

### 3.01 General:

A. The CONTRACTOR shall, at his own cost, obtain all necessary permits (except as noted in SP-2 of the Specific Provisions), pay all legal fees and charges, and comply with all state and local building and safety laws, ordinances, and regulations relating to building and public health and safety. A final inspection certification from the local inspection authorities shall be furnished to the Engineer.

B. The CONTRACTOR shall keep the work installed by him in perfect working order for one year from date of final written acceptance of the project, said guarantee to be based upon defective materials and/or workmanship. CONTRACTOR shall furnish to the OWNER materials and labor necessary to comply with this guarantee.

C. All defects with the equipment which develop during the testing or during the initial installation shall be repaired and corrected by the CONTRACTOR at no cost to the OWNER. After each/any repair or correction, the CONTRACTOR must retest the equipment. The CONTRACTOR shall bear the expense of any repair or retest necessitated by his faulty workmanship or material. The OWNER shall not bear the expense of repairs, readjustment and retest resulting from the use of faulty materials supplied by the CONTRACTOR.

D. All work shall be neat and installed in a craftsmanlike manner. Return calls (second or later trips) or installation revisions which are necessary to repair equipment/correct installation obviously made necessary as a result of incorrect work by the CONTRACTOR will be the responsibility of and at the expense of the CONTRACTOR.

E. The CONTRACTOR shall inspect all electrical equipment upon receipt. Any damaged or missing items shall be reported by the CONTRACTOR to the Engineer.

F. Erection of all equipment and materials shall be done in a neat and workmanlike manner, aligned, leveled and adjusted for satisfactory operation. Equipment shall be installed so that all functional parts are easily accessible with adequate clearance for inspection, operation, maintenance, repair and replacement. Coordinate layout with all trades.

G. Work required to pierce any waterproofing shall be done with care and after the part piercing the waterproofing has been set in place, the opening made for this purpose shall be sealed and made absolutely watertight in accordance with recommendations of waterproofing manufacturer.

3.02 Fire Rating:

A. Installation under this division shall be so made that the fire-protective rating of fire walls and fire-resistant or fire-stopped walls, partitions, ceilings and floors will be substantially equivalent to its original rating.

B. CONTRACTOR shall review architectural plans and specifications for approved fire rating materials and installation methods.

3.03 Protection and Finish:

A. Where marring or disfigurement has occurred, replace or refinish the damaged surfaces as directed.

B. Equipment or components exposed to the weather shall be sealed weather-tight. All equipment outlets and conduit openings shall be protected with temporary plugs or caps at all times that work is not in progress.

C. Prepare all exposed raceways, fittings, boxes, supports and panelboards for painting by removing all oil, grease and dirt. Employ the necessary precautionary methods to prevent painting over or obscuring any nameplates or designations on all electrical apparatus and devices.

D. All surfaces of ferrous metal on equipment exposed to the weather and all ferrous metal not otherwise specified shall be given a rust inhibiting treatment, consisting of hot-dipped galvanizing after fabrication followed by the application of rust inhibiting primer and finish paint. Weight of the coating shall be in accordance with ASTM A153.

3.04 Storage of Materials: Prior to and during installation, store materials to protect them from damage, ingress of dust, moisture or deterioration. Material shall not be stored in contact with ground or floor. In determining required protection for stored materials, consider use for which the equipment was designed. If suitable storage areas are not available at the job site, provide temporary construction or store materials off-site in suitable warehouses. Do not remove manufacturer's packing materials until ready to install. Materials showing signs of corrosion, improper handling or storage shall be replaced.

3.05 Tests and Inspections: Prior to acceptance inspection, clean and where required, paint all equipment installed under Division 26. Factory applied finishes that have been scratched or otherwise damaged shall be touched up with color matched paint furnished by the manufacturer.

(End of Section 26 00 00)

# SECTION 26 05 00

# BASIC MATERIALS AND METHODS

## 1.0 GENERAL

1.01 Applicable Sections:

A. Drawings and general provisions of the contract, including general and supplementary conditions and all division specification sections, apply to work of these Division 26 sections.

B. Excavation and backfill for work under this Section shall conform to the requirements specified in the division entitled “Sitework”.

1.02 Wiring Methods: All wiring for power, control and signal systems shall be installed in raceway systems specified herein, unless specifically exempted.

1.03 Equipment Connections:

A. In general, provide electrical power and control system connections to all equipment shown on the drawings. Included are wiring, raceways, disconnects and other devices shown. Excluded are devices furnished integrally with the manufacturer’s package and work specified in other sections of these specifications.

B. Control wiring and temperature control wiring shall be installed under the supervision of the mechanical subcontractor.

C. All electrical work required for the installation of the temperature control system shall be provided as shown on the electrical drawings or called for in the electrical specifications.

1.04 Applicable Publications: NFPA No. 70 - National Electrical Code.

(End of Section 26 05 00)

# SECTION 26 05 01

# SUBMITTAL DATA

## 1.0 GENERAL

1.01 Drawings and general provisions of the contract, including general and supplementary conditions and all division specification sections, apply to work of this Section.

1.02 Standard for Materials: It is the intention of these specifications to indicate a standard of performance and quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only those named manufacturers' products will be considered and the CONTRACTOR's bid shall be on their products. The first named of several manufacturers is the manufacturer whose product was used in engineering the project. Manufacturers of products other than those specified, although acceptable as manufacturers, shall guarantee that their product will perform as specified and will meet space requirements. Where performance characteristics of such equipment differs from the equipment scheduled on the drawings, the Engineer shall reserve the right to reject it. Where use of such equipment requires different quantity or arrangement of foundations, supports, ductwork, piping, wiring, conduit and any other equipment, the CONTRACTOR shall furnish said changes and additions and pay all costs for all changes to the work and the work of others affected by using such equipment.

1.03 Submittal Data:

A. Materials List:

1. Disconnect switches.
2. Rigid metal conduit and fittings.
3. Rigid nonmetallic conduit and fittings.
4. Specialty conduit fittings.
5. Outlet boxes.
6. Conductors.
7. Wiring devices.
8. Lamps.
9. Materials specified on drawings.
10. Enclosures.

B. Product Data:

1. Fuses and time-current curves.
2. Circuit breakers and time-current curves.

3. Motor control centers (MCC's).
4. Low voltage switchboards.
5. Panelboards.
6. Magnetic contactors.
7. Safety switches.
8. Adjustable frequency drives (AFD's).
9. Transformers.
10. Lighting fixtures.
11. Time switches.
12. Photo controls.
13. Material specified on drawings.
14. Receptacles, switches, etc.

(End of Section 26 05 01)

# SECTION 26 05 19

# LOW VOLTAGE ELECTRICAL WIRE AND CABLE

## 1.0 GENERAL

1.01 Scope: The work of this Section includes wiring for systems operating at 600 volts or less.

1.02 Cooperation with Other Trades: It shall be the responsibility of the CONTRACTOR to coordinate all electrical power, control and interlock wiring and installation between the various trades involved so that all equipment and devices furnished under other Sections are properly wired and installed to perform their intended functions. All necessary materials, equipment and labor to perform this work shall be provided without change in the contract amount.

1.03 Submittals: Submit list of material proposed for use.

1.04 Applicable Standards: Provide only UL listed or labeled products.

## 2.0 PRODUCTS

2.01 600 Volt Power and Control Wiring:

A. General: New, copper, soft drawn, annealed, wiring free of kinks, cuts and abrasions, single conductor type. All conductors shall be stranded unless otherwise designated or approved in writing. All wiring insulation shall be color coded.

B. Insulation:

1. Building Wires: The following types are acceptable: Type THHN/THWN polyvinyl chloride insulation, nylon jacket, 600 volt listed by UL for 75°C operation in wet locations. Type THHW, cross link polyethylene insulation, 600 volt, listed by UL for 75°C operation in wet locations. Minimum size building wires, No. 12 AWG conductor.

2. Direct Current Carrying Wires: For circuits operating at 50 volts or more in direct current (DC) applications, Type RHH/RHW hypalon insulation, 600 volt listed by UL for 75°C operation in wet locations. Minimum size conductor, No. 12 AWG.

3. Fixture Wires: In accordance with Article 402 of the NEC. Minimum size, #16 AWG.

4. Ground Wires: Bare or Type TW, green, thermoplastic, 600 volt, listed by UL for 60°C operation, wet or dry locations.

5. Control Wires: Except for specialized multi-conductor control systems, type TW thermoplastic, 600 volt, listed by UL for 60°C operation, wet or dry locations. Minimum size, #14 AWG except where permitted otherwise.

2.02 600-Volt Instrumentation Cables: Wiring for instrumentation signals (e.g. 1-5 VDC, 4-20 mA DC) shall be shielded two-conductor no. 16 AWG cables. Instrumentation cables shall have stranded copper conductors with 600-volt insulation. Cable pairs shall be twisted and shielded. Conductor insulation shall be polyethylene. Shields shall be overlapped metalized tape providing 100 percent coverage with tinned copper drain wire. Cable outer jacketing shall be of polyvinyl chloride. Cables shall be as manufactured by Belden, Dekoron, or equal.

2.03 Wire Connectors:

A. Compression Type: Solderless, UL approved compression type.

B. Twist Type: Insulated shell, helical spring steel twist-on type connector for connection only in dry locations. No. 10 AWG maximum conductor size.

## 3.0 EXECUTION

3.01 GENERAL: Install all wire and cable in conduit. Size as indicated on drawings. Identify feeders and branch circuit building wires as follows:

| Wire | 120/208 Volt | 120/240 Volt | 277/480 Volt |
|---|---|---|---|
| Phase A | Black | Black | Black |
| Phase B | Red | Orange | Orange |
| Phase C | Blue | Blue | Yellow |
| Neutral | White | White | Gray |
| Switch Leg | Purple | Purple | Purple |
| Ground | Green | Green | Green |

Motor control circuits shall be identified as follows:

| Wire | Color |
|---|---|
| Stop | Red |
| Start | Blue |
| Common | Yellow |
| Pilot Light | Orange * |

* Use white when connected to control circuit neutral.

3.02 Identification of Conductors: Identification shall be by colored insulation on conductors or by use of colored, non-aging plastic tape. Tape shall be permitted only for #8 AWG and larger conductor sizes. Where tape is used to identify conductors, apply at all terminations, junction boxes, pull boxes and wireways. Apply tape, butt lapped, for a minimum distance of 2 inches and, where applied to ends of conductors, start at cut end of the conductor insulation. Signal and control conductors shall be color coded or labeled as necessary for clear identification. Use terminal strips for terminating control wiring in all control equipment and terminal cabinets. The conductivity and insulation of all joints in wire and cables shall not be less than that of the original conductors. Use solderless lugs and compression type connectors only.

When pulling wires, use appropriate wire pulling lubricants recommended by conductor manufacturer. Do not pull wire or cable through any box, fitting or enclosure where change of raceway alignment or direction occurs; do not cut strands from conductors to fit lugs or terminals; and do not bend conductors to less than recommended radius.

3.03 Wiring in Enclosures: Train in a neat and orderly manner all conductors in panelboards, cabinets, control panels, motor controllers, motor control centers, wireways and wiring troughs. Where conductors cannot be properly trained otherwise, secure with “Ty-Raps” or other suitable lacing. Identify all control, instrumentation and alarm wiring at cabinets and boxes using suitable conductors tags.

3.04 Terminations: Lugs shall be required for stranded wire #10 AWG and larger and where so designated in the drawings.

(End of Section 26 05 19)

# SECTION 26 05 26

# ELECTRICAL SYSTEM GROUNDING

## 1.0 GENERAL

1.01 Scope: All grounding shall be in accordance with Article 250 of the NEC, except where specifically indicated otherwise. In no case shall a grounding conductor be smaller than #12 AWG.

1.02 Submittals: Submit to Engineer a list of all materials plus manufacturer's catalog data for all connection devices.

## 2.0 PRODUCTS

2.01 General: Use copper and copper alloy materials specifically intended for electrical grounding.

2.02 Conductors: Grounding conductors shall be copper only, stranded, and sized as indicated or as necessary. Solid conductors are not acceptable. Conductors may be bare or have type TW insulation unless otherwise indicated. Insulated conductors shall have green color insulation.

2.03 Connections: Copper and copper alloy only.

A. Mechanical Type:

1. Connection to water pipe shall be copper alloy body, single conductor, "U" bolt clamp.

2. Connection to bus or other flat surfaces shall be copper body, compression type, two bolt lug.

3. Acceptable: O.Z. C.G. series, Thomas and Betts and Burndy.

B. Welded Type: All grounding connections made below grade (or which are made in inaccessible locations) shall be made by exothermic welds (such as Cadweld).

## 3.0 EXECUTION

3.01 General: All grounding shall be electrically continuous to grounding electrodes. Provide grounding type bushings and copper jumpers at switchboard and elsewhere to provide suitable raceway grounding where conduits cannot be properly terminated with lock nuts at sheet metal enclosures.

3.02 Ground the Following: All non-current carrying metal parts of all electrical apparatus, conduits and cabinets for power, lighting and communications shall be grounded. Provide additional grounding where indicated or specified and as required by code.

3.03 Equipment Grounds: All circuits, including feeders and 3-phase motors, shall have a separate green colored insulated grounding wire pulled in same conduit with power wires. Ground wires shall be solidly grounded at all termination points, panelboards, and other equipment as necessary and shall be solidly grounded to system ground.

3.04 Conduit Bonding:

A. The conduit shall not serve as the sole ground connection. However, the conduit shall be provided with proper fittings to bond the conduit to the associated power equipment.

B. Conduits that enter switchgear, motor control center and similar open-bottom or top entry enclosures shall be terminated in the insulated ground-type bushings that are bonded together by a minimum AWG size of number 6 bare copper conductor and connected to the equipment ground bar or to the enclosure.

3.05 Receptacles: Receptacles shall be grounded with a self-grounding clip on the receptacle except where separate green ground is indicated on drawings.

3.06 Separately Derived Systems: The neutral of all separately derived systems shall be solidly grounded at the points designated only. These shall be the only points in the entire electrical distribution system where the neutral is grounded. The neutral at all other points shall be fully insulated from ground.

(End of Section 26 05 26)

# SECTION 26 05 29

# SUPPORTING DEVICES

## 1.0 GENERAL

1.01 Scope: This Section includes the requirements for channel strut used for miscellaneous framing and supports.

1.02 Submittals: Submit manufacturer's catalog data for proposed channel strut, including fittings and clearly showing finish and load ratings.

## 2.0 PRODUCTS

2.01 General: Channel strut shall be aluminum or stainless steel, as designated on the drawings, with continuous opening along one side designed to receive nuts and other devices for hangers. Provide nominal 9/16 inch holes or slots at top surface for securing to structure as necessary.

2.02 Load Rating: Minimum channel size and gauge shall be such that a uniformly distributed load of 150 pounds will not cause a deflection greater than 1/360 of span length over a beam span of 72 inches. The same beam shall support a concentrated load of 130 pounds minimum at center of span without exceeding the above deflection. Load rating of channel for all applications shall be increased as necessary so that imposed load, whether concentrated or distributed, does not cause a greater deflection than given above.

2.03 Finish:

A. After fabrication, channel strut shall be chemically cleaned and degreased.

B. Accessories: All fasteners, brackets, clips, bolts, rods, nuts and other related items for use with channel strut (including aluminum unistrut) shall be 316 stainless steel. Conduit clamps for use with aluminum channel shall be aluminum.

2.04 Acceptable: B-Line, Unistrut and Kindorf.

## 3.0 EXECUTION

3.01 General: Secure to structural elements by welding, bolting or by other means acceptable to the Engineer. Provide all necessary accessories to safely support imposed loads.

3.02 Touch-Up: After installation, touch-up all tool marks, cut ends, and other areas where finish has been damaged.

3.03 Finish Cuts: File all ends smooth on channel strut which has been cut, removing burrs and sharp edges.

3.04 Insulation: Provide 1/8" neoprene insulation between aluminum channel unistrut and steel shapes or concrete to protect against galvanic actions and corrosion.

(End of Section 26 05 29)

SECTION 26 05 33

ELECTRICAL CONDUIT

1.0 GENERAL

1.01 Scope: This section includes requirements for conduit and fittings.

1.02 Submittals: Submit manufacturer's catalog data for all conduit and fittings proposed for use.

2.0 PRODUCTS

2.01 Conduit:

A. Rigid steel conduit, elbows, couplings and nipples shall be hot dipped galvanized after fabrication. Galvanizing shall include uniform zinc coating both inside and outside, including all threads on conduit and fittings. Compliance: ANSI C80.1, UL 6.

Acceptable: Triangle-PWC, Robroy, Republic Steel, Wheatland and Allied.

**Rigid steel conduit is not acceptable for use at Krause Pumping Station.**

B. Electrical Metallic Tubing (EMT) and Elbows: Steel tubing, zinc coated. Compliance: ANSI-C80.3, UL 797.

**Electrical metallic tubing (EMT) is not acceptable for use at Krause Pumping Station.**

C. Flexible Steel Conduit: Continuous length, spiral wound steel strip, zinc coated inside and outside, each convolution interlocked with the following convolution. Compliance: UL 1.

**Flexible steel conduit is not acceptable for use at Krause Pumping Station.**

D. Liquid Tight Flexible Steel Conduit: As specified for flexible steel conduit with continuous length copper bonding strip and extruded polyvinyl chloride (PVC) jacket. Compliance: UL 360. Flexible non-metallic conduit is not acceptable.

Acceptable: American Hose Type UA Sealtite hose.

**Liquid tight flexible steel conduit is not acceptable for use at Krause Pumping Station.**

E. Liquid Tight Flexible Nonmetallic Conduit:

1. Size 2 Inch or Less: All flexible conduits size 2 inch or less in non-classified areas shall be nonmetallic, liquid tight, and have a circular cross section. The conduit shall be resistant to oil, water, heat, sunlight, corrosion, most acids, ozone, alkali, strains, abrasions, and crushing. The conduit shall be rated for continuous use at 140°F and be U.L. Inc. listed. Compatible liquid tight nonmetallic fittings shall be used for conduit installation.

   Acceptable: Carlon, Kellems, K-Flex, or equal.

2. Greater Than 2 Inch: All flexible conduits greater than 2 inch in non-classified areas shall be metallic, liquid tight, and have a circular cross section. The conduit shall be of a light-weight aluminum core, coupled with a PVC jacket. The conduit shall be resistant to sunlight, acid, and oil. The conduit shall be rated for a working temperature between -20°C to 80°C and U.L. Inc. listed. Compatible liquid tight metallic fittings shall be used for conduit installation.

   Acceptable: Thomas & Betts or equal.

F. Electrical Plastic Conduit: Polyvinyl chloride, Schedule 80, heavy wall, UL listed for application. NEMA designation EPC-80-PVC. Compliance: NEMA TC-2, UL 651. Use only below grade unless specifically indicated otherwise.

G. Rigid Aluminum Conduit: Rigid aluminum conduit shall be 6063 aluminum alloy, T-1 temper. Compliance: ANSI C80.5, UL 6.

Acceptable: Wheatland, Robroy, and Allied.

H. PVC Coated Conduit: Polyvinyl chloride (PVC) coated conduit shall be rigid aluminum coated with a 40 mil (0.040”) PVC coating on the exterior and a 2 mil (0.002”) urethane coating on the interior. The conduit shall meet the requirements of ANSI C80.5 and UL Standard #6. The PVC coating shall be UL listed for UV resistance.

Acceptable: Robroy Industries Plasti-Bond Red, Thomas & Betts Ocal-Blue.

2.02 Conduit Fittings:

A. Rigid Steel Conduit Fittings: Zinc coated steel or cadmium coated, malleable iron for steel conduit. Compliance: ANSI-C80.4, UL 514.

1. Ells, Tees and Entrance Fittings: Malleable iron with tapered threads with neoprene gasket and screw on metal cover.

Acceptable: Appleton series L, T, and X.

2. Offsets and Reducers: Tapered threads.

Acceptable: Appleton series OFN, RB, and ME.

3. Expansion Couplings: Tapered thread, weatherproof with neoprene gland and copper bonding jumper, 4 inch movement.

Acceptable: Appleton series XJ; Crouse-Hinds, OZ.

4. Union Couplings: Tapered thread.

Acceptable: Appleton series UN.

5. Lock Nuts: Steel, 2 inches smaller. Malleable iron, larger than 2 inches.

Acceptable: Appleton series BL.

6. Bushings: Malleable iron, insulated throat. Provide grounding type where necessary. Plastic bushings are not acceptable.

Acceptable: Appleton series BU and G1B.

7. Clamps: Malleable iron.

Acceptable: Appleton series CL and CLB.

**Rigid steel conduit fittings are not acceptable for use at Krause Pumping Station.**

B. EMT Fittings: Zinc coated steel, inside/outside including threads. Rain-tight, compression gland type or concrete tight, set screw type fittings. Compliance: ANSI-C80.4.

1. Ells: Compression coupling with neoprene gasket and screw fastened steel cover.

Acceptable: T&B series.

2. Connectors and Couplings: Compression or set screw type. Connectors shall have insulated throat.

   Acceptable: T&B series.

3. Rigid Conduit Adapters: Tapered threads and compression coupling.

   Acceptable: Appleton series TWR.

4. Clamps: Steel alloy, 1 inch and smaller. Malleable iron, larger than 1 inch.

   Acceptable: Appleton series TWCL.

**EMT conduit fittings are not acceptable for use at Krause Pumping Station.**

C. Flexible Steel Conduit Fittings: Steel alloy, zinc coated, with insulated throat. Slip-proof, positive grip type with screw tightened, double gripping steel wedge set at an angle to grip tighter under strain. Set screw type, squeeze type and clamp type fittings shall not be used. Rigid conduit adapters shall have beveled threads at one end.

   Acceptable: T&B "Tite-Bite" series.

   **Flexible steel conduit fittings are not acceptable for use at Krause Pumping Station.**

D. Liquid Tight Flexible Conduit Fittings: Steel alloy, zinc coated with molded nylon compression ring and insulated throat. Liquid tight beveled thread, gland nut design with ground cone and sealing ring.

   Acceptable: T&B series 5300.

   **Steel Liquid tight flexible conduit fittings are not acceptable for use at Krause Pumping Station.**

E. Plastic Conduit Fittings: Polyvinyl chloride, UL approved for application. Manufacturer's standard solvent cement. Compliance: NEMA TC-3, UL 514B.

F. Expansion Fittings: Designed for use across structural expansion joints and meeting NEC code requirements for electrical continuity.

Acceptable: O-Z/Gedney.

G. Aluminum Conduit Fittings: Couplings and fittings for use with the rigid aluminum conduit shall be 6063 alloy, T-1 temper.

Acceptable: Appleton Electric, Thomas & Betts, Crouse-Hinds and O-Z/Gedney.

H. PVC Coated Conduit Fittings: Couplings and fittings for use with PVC coated conduit shall be of the same manufacturer as the conduit. The couplings and fittings shall be aluminum with a 40 mil (0.040") PVC coating bonded to the exterior and a 2 mil (0.002") urethane coating bonded to the interior. Flexible, overlapping, pressure-sealing sleeves shall be on each coupling and fitting to protect the connections. Fastening hardware for fittings shall be stainless steel and shall be encapsulated for maximum corrosion protection.

Acceptable: Robroy Industries Plasti-Bond Red, Thomas & Betts Ocal-Blue.

2.03 Acceptable: Manufacturer's names and series numbers listed for conduit fittings are for reference to type, materials, and finish intended for use. Equivalent fittings manufactured by Appleton, Crouse-Hinds, T&B, Raco, Efcor, O.Z. and Steel City will be acceptable provided such fittings meet the express requirements of this specification.

2.04 Concrete for encasing conduits shall be steel reinforced cement, lime, aggregate and all other concrete components with aggregate size not exceeding 3/8-inch. Concrete shall have a minimum compressive strength at 28 days of 4,000 psi.

There shall be not less than 3-inches of concrete between the outside of a duct and the earth. There shall be not less than 2-inches of concrete between adjacent ducts. All duct line concrete pours shall be continuous between manholes or hand holes and between manholes or hand holes and structures. Where duct lines pass through concrete walls, the concrete envelopes shall be extended through and finished flush with inside surfaces. Water-tight construction joints of an approved type shall be provided.

Duct banks shall be reinforced with steel as shown in the drawings. Install No. 4 steel reinforcing bars on 6" centers each way, extending the length of the concrete encasement. Additionally, No. 4 steel hoops surrounding the ducts shall be placed on 24" centers along the length of the duct bank.

Duct bank lines shall be laid in trenches on mats of gravel not less than 6 inches thick and well graded. The minimum cover for duct lines shall be 24-inches unless otherwise permitted by the Engineer.

Concrete for duct bank encasement shall be dyed red for easy identification.

## 3.0 EXECUTION

3.01 General: Conduits concealed below finish level of floors which have water barriers shall be located within slab, where practicable, to avoid penetrating water barriers. Where electrical conduits are completely concealed in concrete slab, conduits shall be secured to the upper side of the bottom reinforcing steel or to the lower side of the top reinforcing steel. Conduit shall not interfere with the functioning of the concrete or the reinforcing steel.

Install exposed conduits plumb where vertical and parallel to floors and walls where horizontal. Group parallel conduits where possible with spaces between adjacent conduits kept to a minimum. Support individual conduits with stainless steel conduit straps.

Where conduits are not adjacent to structure, support by adjustable stainless steel pipe hangers or trapeze hangers. Perforated strap hangers or tie wire will not be permitted. Install conduit to clear all piping, ductwork, structural members and equipment. Independently support conduit from the structure and not from ductwork, piping, ceiling framing members or equipment without written permission from Engineer. All conduit fittings shall be properly installed and made up mechanically and electrically tight. Provide grounding type bushings where necessary. Branch circuit conduits for recessed lighting in suspended ceilings may be supported from the ceiling suspension system if the suspension system is not compromised, and provided suitable fasteners, intended for the purpose, are used.

Conduits shall be supported at maximum intervals of 10 feet. Additional supports shall be provided at bends, fittings, and fixtures as necessary to keep the conduit system rigid and vibration free. Supports shall be adequate for the loads imposed.

Pull-points shall be installed so that no conduit run has more than four 90-degree bends.

If conduit runs exceed the equivalent of a 150-foot straight run or contain more than the equivalent of three 90-degree bends, pull fittings shall be provided. One 90-degree bend shall be considered equivalent to 50 feet of straight run.

Underground conduit bends shall be “long radius” bends. Radius of bends for special cases shall be calculated.

Where bends or offsets are required, they shall be made with suitable conduit bending equipment. Uniform circular cross section of the conduit shall be maintained at such bends. No single bend shall be greater than 90 degrees.

Couplings or other fitting shall not be installed in the curved portion of bends. Where unions are required because of a bend, they shall be installed at least one joint from bends.

All conduits (including those installed underground) shall be installed at right angles to or parallel to equipment and building base lines unless otherwise noted on the drawings.

Underground conduits shall be installed a minimum of twenty-four (24) inches below grade. The backfill shall be free from refuse, scrap and boulders. The backfill shall be tamped about the conduit and in successive six-inch (6") layers. Whenever conduit is stubbed vertically out of the ground, provision shall be made to ensure that the conduit is rigidly fixed.

All underground conduits for feeders, instrumentation wiring, control wiring, and communication wiring shall be PVC conduits and shall be encased in reinforced concrete as shown, unless otherwise noted. Conduits shall be installed as shown and shall be sloped approximately 3-inches per 100 feet uniformly between the elevations shown. Manufactured fitted plastic duct spacers shall be used for installation spacing of conduits.

Concrete for the encasement shall be Class B using aggregate not exceeding 3/8-inch and shall be reinforced as shown. Ducts shall drain to the manholes or end structures. End bell fittings shall be provided on the ducts in manholes.

Appropriate expansion fittings or other approved methods shall be used in the installation of plastic ducts so as to avoid expansion and distortion prior to encasement in concrete. Spacers shall be located a maximum of 8 feet on centers and the duct spacings center-to-center shall not vary in excess of 1/16 inch from the specified spacings shown, prior to and after encasement.

Each duct shall be carefully cleaned before and after installation. All inside surfaces shall be free from imperfections likely to injure the cable. After installation of complete duct runs in sizes 2 inches and larger, ducts shall be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the duct. Ducts through which the mandrel will not pass shall not be incorporated in the work. After snaking, the ends of dead-ended ducts shall be protected with standard conduit caps to prevent the entrance of water or other foreign matter.

Where ducts enter buildings or at stub-ups to equipment, transitions to metallic conduits (rigid aluminum) shall be made. Where it is not otherwise shown, all ducts entering buildings and structures, exclusive of manholes, shall have transitions to metallic conduit at least 5 feet from the outermost edge of the pile cap or footing supporting the outermost vertical wall of the building or structure.

Transition from above-grade metallic conduit to nonmetallic conduit shall be accomplished with a threaded adapter. Metallic conduit installed above grade and extending below grade shall include the first 90° elbow. All metallic conduit extending below grade shall be coated with two coats of an asphaltum-type paint along its entire length below grade and extending 6" above grade or above the top of the finished slab. The asphaltum-type paint shall conform to Fed. Spec. TT-V-51 and equivalent to Koppers Bitumastic Super Service Black.

Install a warning ribbon approximately 12-inches below finished grade and a minimum of 12-inches above all underground duct banks. The identifying ribbon shall be a PVC tape, 3-inches wide, yellow color, permanently imprinted with, "CAUTION BURIED ELECTRIC LINE BELOW" in black letters. Cut tape every 15 feet.

All metallic conduit shall be terminated with insulated bushings to prevent damage to wire during pulling operations, except in enclosures where hub design is adequate to prevent insulation damage.

PVC coated conduit and fittings shall be installed with tools specifically designated for the installation of coated conduit systems. All damages to the PVC coating, including nicks and abrasions, shall be repaired with touch-up coating compounds recommended by the manufacturer of the PVC coated conduit.

(End of Section 26 05 33)

SECTION 26 05 53

ELECTRICAL EQUIPMENT IDENTIFICATIONS

## 1.0 GENERAL

### 1.01 Nameplates:

A. Engraved phenolic nameplates shall be installed on each panel, disconnect (safety) switch, motor starter, dry transformer, equipment cabinet, terminal cabinet, and circuit breaker in main switchboard hereinafter specified.

B. Nameplates for 120/208 volt (or 120/240 volt) shall be white letters on a black background.

C. Nameplates for 277/480 volt shall be black letters on a white background.

D. Nameplates for equipment on emergency equipment shall be similar to those specified in 1.01 B and 1.01 C, except that background shall be red.

E. Nameplates shall include equipment designation as indicated on drawings, branch of service, and voltage.

1. Typical panelboard nameplate (example):

Panel A
120/208 volt - 3Ø, 4W.
LIFE SAFETY

2. Nameplates for disconnect (safety) switches and motor starters shall be similar to those indicated in E. 1 above.

F. Nameplates shall be three-ply phenolic - black-white-black, white-black-white or red-white-red, as required - engraved through the first layer. Lettering shall be 0.5 cm (3/16") minimum. Edges of all nameplates shall be beveled at 45 degrees.

## 2.0 EXECUTION

### 2.01 Nameplates shall be secured by screws to the equipment. Use of glue is not permitted.

(End of Section 26 05 53)

SECTION 26 20 00

ELECTRIC DISTRIBUTION AND SERVICE

## 1.0 GENERAL

1.01 Scope: This Section includes requirements for providing electric distribution and service to all elements of the project as indicated on the drawings and as specified within the various sections of Division 26 specifications.

1.02 Shop Drawings and Data: As required under the various sections of Division 26 specifications.

1.03 Coordination: The CONTRACTOR shall coordinate the electrical distribution system with the local utility company to ensure suitable locations and type of instrument transformers, meters, cable terminations, conduit and other necessary materials and equipment.

1.04 Tests: Upon completion of installation of the complete electric distribution and service, CONTRACTOR shall demonstrate to the Engineer that the complete system is properly installed and properly functioning. All factory certifications and field test reports as required under various sections of Division 26 specifications shall be submitted to the Engineer prior to demonstration of system.

1.05 Description of Systems:

A. General: Electrical power for the project will be provided by the local utility company to the on-site utility transformer. The CONTRACTOR shall provide all elements of the system on the load side of the utility transformer and shall assist the utility as necessary to ensure a properly working system. CONTRACTOR shall provide underground ductbank and manholes as indicated on the drawings.

B. Voltages: Voltage at the secondary terminals of the utility power transformer(s), as provided by the local utility company, will be as shown on the drawings. This system voltage shall be connected to the main disconnects and distributed to various loads as shown on the drawings.

C. Distribution: Electric power for the project shall be distributed generally as indicated on the drawings. Distribution shall include bus and cables, as specified in various sections of Division 26 specifications.

## 2.0 PRODUCTS

2.01 As specified in various sections of Division 26 specifications.

## 3.0 EXECUTION

3.01 As specified in various sections of Division 26 specifications and in conformance with all regulatory codes, the National Electrical Code.

(End of Section 26 20 00)

# SECTION 26 22 13

# GENERAL PURPOSE DRY TYPE TRANSFORMERS

## 1.0 GENERAL

### 1.01 Summary:

A. Section Includes: Requirements for furnishing and installing ventilated, dry-type transformers.

B. Related Work Specified in Other Sections Includes:

1. Section 26 05 00 - Basic Materials and Methods.
2. Section 26 05 26 - Electrical System Grounding.

### 1.02 References:

A. Codes and standards referred to in this Section are:

1. ASTM D 635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

2. NFPA 70 - National Electrical Code.

3. NEMA ST 20 - Dry Type Transformers for General Applications.

4. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers.

### 1.03 Submittals:

A. General: Furnish all submittals, including the following, as specified in the Specific/General Provisions.

B. Product Data and Information: Furnish manufacturer's data including:

1. KVA ratings.
2. Service voltages.
3. Impedance and X/R ratio.
4. Number of phases.
5. Taps.
6. Insulation class.
7. Temperature rise.
8. Primary and secondary winding material.

9. Sound level.
10. Dimensions.
11. Weights.
12. Mounting details.

C. Quality Control: Furnish the following:

1. Test Reports: Certified production reports for sound-level and temperature in accordance with NEMA ST 20.

2. Manufacturer's Installation Instructions.

B. Operations and Maintenance Manuals: Furnish six (6) copies of manufacturer's operations and maintenance manuals.

1.04 Quality Assurance:

A. UL Label: Provide UL listing label or mark.

B. Energy Star Compliance: Provide "Energy Star" label for all transformers rated 15 kVA and above in accordance with NEMA TP 1.

1.05 Delivery, Storage And Handling: Deliver, store and handle all products and materials as specified in the Specific/General Provisions.

## 2.0 PRODUCTS

2.01 Manufacturers:

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

1. Siemens.
2. Eaton.
3. General Electric Company.
4. Square D Company.

2.02 Materials:

A. General: Provide dry-type transformers suitable for indoor use.

B. Insulation: Provide transformers above 15 kVA with 220°C temperature insulation materials. Provide transformers 15 kVA and below with a minimum of 185°C insulation materials.

C. Flame Retardant Materials: Provide transformers with flame retardant materials that will not support combustion as defined in ASTM D 635.

2.03 Fabrication:

A. Transformer Taps: Provide transformers rated over 15 kVA with at least two (2) 2-1/2% full capacity taps above and below nominal in the primary winding. Provide transformers rated 15 kVA and below with two (2) 5% taps or with four (4) 2-1/2 percent taps below rated voltage on the primary winding.

B. Windings: Provide primary and secondary windings fabricated from copper conductors.

C. Voltage and KVA Ratings: Provide 3-phase or single-phase transformers with primary and secondary voltages and kVA ratings as specified.

D. Connections:

1. 3-Phase: Primary - 3-wire Delta; Secondary - 4-wire, solidly-grounded wye.

2. Single Phase: Primary - 2-wire; Secondary - 3-wire with mid-point solidly-grounded.

E. Continuous Operations: Provide transformers suitable for continuous operation at the rated kVA with a normal life expectancy as defined in NEMA ST 20 and the performance obtained without exceeding 80°C average temperature rise by resistance or 110°C hot spot temperature rise in 40°C ambient temperature. Do not provide transformers that exceed 150°C maximum coil hot spot temperature.

F. K-Factor: Provide three-phase transformers with a K-Factor not less than 13.

G. Electrostatic Shields: Provide electrostatic shields between windings.

H. Construction: Provide transformers with core mounting frames and enclosures of welded and bolted construction with sufficient mechanical rigidity and strength to withstand shipping, erection and short circuit stresses.

I. Sound Levels: Do not provide transformers that exceed the following sound levels:

| Transformer kVA | Average Sound Level in dB NEMA ST 20 |
|---|---|
| 0 - 09 | 40 |
| 10 - 50 | 45 |
| 51 - 150 | 50 |

J. Lifting Lugs and Jacking Plates: Provide lifting lugs and jacking plates as required on the transformer.

## 3.0 EXECUTION

### 3.01 Installation:

A. General: Install all transformers and provide guards as specified by the latest NEC and ANSI standards, and in accordance with manufacturer's instructions.

B. Clearances: Provide clearance around the transformer meeting the manufacturer's recommendation.

C. Supports: Provide suitable supports for all transformers. Mount transformers on one inch of Korfund, or equal sound-absorbent material.

D. Primary Disconnect: Provide primary disconnect circuit breaker or disconnect switch as shown or required.

### 3.02 Cleaning And Painting:

A. Field Painting: Clean and touch up scratched and marred surfaces to match the original finish.

(End of Section 26 22 13)

# SECTION 26 24 13

# SWITCHBOARDS

## 1.0 GENERAL

1.01 Scope: Furnish and install the switchboard(s) as herein specified and shown on the drawings. The switchboard(s) shall meet Underwriters Laboratories requirements and be furnished with an Underwriters Laboratories service entrance label.

1.02 Submittals: Prior to ordering equipment or commencing fabrication, submit to Engineer complete manufacturer's shop drawings for switchboard assembly indicating all materials, ratings, construction and finishes. Include complete descriptive data for all circuit protective devices.

1.03 Shop drawings shall indicate front and side enclosure elevations with overall dimensions shown, conduit entrance locations and requirements, nameplate legends, one-line diagrams, equipment schedule, and switchboard instrument details.

1.04 References: The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:

A. NEMA PB-2, Deadfront Distribution Switchboards.
B. UL Standard 891, Deadfront Switchboards.

## 2.0 PRODUCTS

2.01 General: Equipment shall be designed, constructed and tested in accordance with NEMA and UL standards. The main circuit breaker section(s) shall each contain a U.L. label indicating for use as service entrance equipment. Provided equipment shall be suitable for use at 60 Hertz and for the voltage indicated on the drawings and complete with all necessary framing, barriers, steel enclosures, phase buses, neutral bus, ground bus, and protective devices. Provide suitable entry and connectors for the phase, neutral and ground conductors indicated on the drawings.

2.02 Structures: The switchboard shall be totally enclosed, dead front, free standing, front and rear aligned with front accessibility only required. The switchboard shall use compartmentalized circuit protective devices as specified herein and as shown on the drawings. The switchboard shall be NEMA Type 1 General Purpose. The framework shall be of UL gauge steel and secured together to support all cover plates, bussing and component devices during shipment and installation. There shall be a barrier between the device compartment and the bus compartment. Formed removable closure plates shall be used on the front, rear and sides. All closure plates shall be single tool, screw removable. Adequate ventilation shall be provided. Each section shall include a single-piece removable top plate. All empty spaces shall be fully bused.

When draw-out circuit breakers are provided, a remote circuit breaker racking device, a circuit breaker transfer truck and a circuit breaker lifting device shall be provided.

2.03 Remote Circuit Breaker Racking Device: A remote circuit breaker racking device shall be provided by the switchboard manufacturer to remotely operate the racking mechanism of circuit breakers from a distance of 30 feet.

The remote circuit breaker racking device shall be furnished complete with a drive unit, a control unit, a 30 foot control cable, a power cable (120V) and a carrying case.

2.04 Circuit Breaker Lifting Device: The circuit breaker lifting device shall be suitable for lifting all insulated case circuit breakers included in the switchboard. The circuit breaker lifting device shall be a top rail mounted crane integral to the top frame structure of the switchboard.

The crane assembly shall be furnished complete with circuit breaker racking handles, hoist operating handle and lifting spreader bar to fit the circuit breakers.

The assembly shall be provided with adequate lifting means for loading/offloading the switchboard section(s).

2.05 Finish: All painted parts shall be pretreated and provided with a corrosion-resistant, UL Listed acrylic baked paint finish.

A. The paint color shall be medium gray, ANSI #49.

B. Cadmium plated steel hardware shall be used throughout.

2.06 Fault Withstandability: The entire switchboard shall be suitable for operation at the specified available fault current. The switchboard shall be labeled to indicate the maximum available fault current rating, taking into account the structure, bussing and switchboard branch circuit devices. The short circuit current rating of the switchboard(s) shall not be less than 65,000 RMS symmetrical amperes at 480 VAC. The switchboard branch circuit devices short circuit current rating shall be fully rated.

2.07 Bussing: The switchboard through-bus shall be tin-plated copper. The switchboard bussing shall be of sufficient cross sectional area to meet UL Standard 891 for temperature rise. The through-bus shall have a minimum ampacity of 2500 amperes and extend the full length of the switchboard. The through-bus shall be 100% rated. Provisions shall be provided for future splicing of additional sections from either end, including all necessary splicing hardware.

A. Where a neutral bus is required, as indicated on the drawings, the neutral bus shall be 100% rated and of the same material as the through-bus. The neutral bus shall extend the full length of the switchboard.

B. The switchboard feeder section buses shall be of the same material as the through-bus and shall be rated 1200 amperes.

C. The ground bus shall be sized per UL Standard 891 and of the same material as the through-bus. The ground bus shall extend the full length of the switchboard and shall be firmly secured and electrically bonded to each vertical section.

D. All hardware used on the conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.08 Voltage Indicator: A flashing LED-type voltage indicator shall be connected to the load side of each circuit breaker. This indicator shall be mounted through the door of each compartment containing a circuit breaker to readily indicate to the operator the presence of voltage on the load side of the circuit breaker.

The voltage indicator shall be phase insensitive, UL Listed and suitable for voltages between 40-750 VAC / 30-1000 VDC. The voltage indicator shall be complete with flashing LED’s, flush-mount bezel assembly and voltage warning label.

The voltage indicator shall be a Safeside R-3W-KB, manufactured by Grace Engineering or equal.

2.09 Utility Metering: Where indicated on the drawings, furnish a separate barriered-off metering compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per NEC and local requirements.

2.10 Wiring/Terminations:

A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on the manufacturer's wiring diagrams.

B. Mechanical-type terminals shall be provided for all line and load terminations and shall be suitable for copper conductors rated for 75°C and of the size as indicated on the drawings.

C. Lugs shall be provided in the incoming line section for connection of the grounding electrode conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle-type terminals provided are integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.11 Main, Tie and Feeder Protective Devices: The main, tie and feeder circuit protective devices, rated 600 amperes or more, shall be electrically operated, draw-out, insulated case circuit breakers of the sizes designated on the drawings. Insulated case circuit breakers shall be in accordance with Section 26 28 16.2 - Low Voltage Encased Power Circuit Breakers.

A. All circuit breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

B. Circuit breakers shall be electrically operated (EO) unless manually operated circuit breakers are indicated on the drawings.

C. Each circuit protective device shall be mounted in a separate barriered compartment within the switchboard structure, as designated on the drawings.

2.12 Metering/Power Quality Relay:

A. Electronic metering/power quality relay equivalent to a Square D Type PM 620 or Siemens 9600 power quality meter shall be provided where shown on the drawings. Electronic metering shall be mounted in the door and supplied with the designated protective relaying functions, appropriate transformer(s) displays and selector switch(es) as required.

B. The digital power meter shall have an accuracy of 0.25% and shall have the following features: A, V, kW, kVAR, kVA, PF, F, kWh, kVARh, kVAh, KYZ, RS-485 communications, THD, demand, kWd, kVARd, kVAd, date/time stamping.

C. Where indicated on the drawings, provide a separate customer metering compartment with front hinged door and include the following:

1. Current transformers shall be provided for each meter. Current transformers shall be wired to shorting-type terminal blocks.
2. Potential transformers, including primary and secondary fuses with disconnecting means, shall be provided, as necessary, for the metering as shown on the drawings.

2.13 Nameplates:

A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be block style letters, 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating.

B. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer’s name, general order number, and item number.

C. Control components mounted within the assembly such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2.14 An arc flash hazard warning label should be affixed to the front and back of each switchboard section, each hinged door or compartment in the switchboard and each removable panel on the switchboard. Reference NFPA 70E and ANSI Z535 for appropriate warning label guidelines.

2.15 Spares: Provide three (3) spare fuses of each type and ampere rating used in the switchboard line-up.

2.16 Shipping Splits: Switchboards shall be separated into shipping blocks. Each switchboard section shall be capable of being handled individually with the use of removable lifting bars or rollers and be clearly labeled with proper handling procedures.

A. Switchboard sections shall be capable of being joined at the job site with the use of internal splice bars. These splice bars shall be preassembled onto the through bus and not shipped loose in a splice bar kit.

B. The through bus splice bars shall utilize two bolts, one on each side of the shipping split, for each phase. Conical washers shall be used to provide a constant pressure once the proper torque is achieved. The through bus splice connection shall be capable of being maintained by the use of a single tool and shall be front accessible.

2.17 Acceptable Manufacturers: Square D, Eaton, General Electric and Siemens.

## 3.0 EXECUTION

3.01 Factory Testing:

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

C. A certified test report of all production tests shall be available to the Engineer upon request.

3.02 Training:

A. The Contractor shall provide a training session for up to five (5) representatives, designated by the OWNER, for three (3) workdays at the project site.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.03 General: Locate as indicated on drawings. Make up all bus joints to recommended torque and install and connect all protective devices and circuit wiring. Ground conduits as specified in Section entitled "Electrical System Grounding".

3.04 Protection: Carefully protect switchboard from the elements after delivery to the site. Where switchboard is stored in areas subject to moisture (either precipitation or condensation) provide suitable electric heaters inside cubicles to reduce detrimental effects from such moisture. Any switchboard left uncovered in a manner which results in direct exposure to rain may be rejected by the Engineer as unacceptable for installation on the project.

3.05 Installation:

A. General:

1. The CONTRACTOR shall install all equipment per the manufacturer's instructions, contract drawings and the National Electrical Code.

2. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the 4" high concrete housekeeping pads without the use of floor sills. The concrete housekeeping pad shall be level to 1/8 inch per 3-foot distance in any direction. All necessary hardware to secure the assembly in place shall be provided by the CONTRACTOR.

3. Locate as indicated on drawings. Provide the concrete housekeeping pad for the switchboard as indicated on the drawings. Make up all bus joints to recommended torque and install and connect all protective devices and circuit wiring. Ground conduits as specified in Section entitled "Electrical System Grounding".

B. Delivery, Storage, Protection and Handling:

1. Deliver, store, protect and handle products in conformance with the manufacturer's recommended practices as outlined in the applicable Installation and Maintenance Manuals.

2. Shipping splits shall be individually wrapped for protection and mounted on shipping skids.

3. Carefully protect the switchboard from the elements after delivery to the site. Where the switchboard is stored in areas subject to moisture (either precipitation or condensation) provide suitable electric heaters inside cubicles to reduce detrimental effects from such moisture. Any switchboard left uncovered in a manner which results in direct exposure to rain may be rejected by the Engineer as unacceptable for installation on the project.

4. Handle in accordance with NEMA PB 2.1 and the manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to the switchboard internal components, enclosure and finish.

C. Field Adjustments: The CONTRACTOR shall perform field adjustments of the protective devices as required to place the equipment in final operating condition.

(End of Section 26 24 13)

# SECTION 26 24 16

# PANELBOARDS

## 1.0 GENERAL

1.01 Scope: This Section includes requirements for panelboards constructed for use with circuit breakers or fusible switches as indicated on the drawings.

1.02 Submittals: Submittals shall be in accordance with section entitled “Submittal Data”.

1.03 Shop Drawings: Submit shop drawings for each panelboard provided. Include circuit breaker and/or fusible switch data.

## 2.0 PRODUCTS

2.01 General: Panelboards shall be designed, constructed and tested in accordance with NEMA and UL standards for panelboards, cabinets and boxes. Circuit breaker type or fusible switch type panelboards shall be provided as indicated with number of circuit protective devices and spaces indicated. Provide main protective device where indicated. Panelboards shall be completely dead front design.

2.02 Service Entrance: Where panelboards are used as service entrance equipment, they shall be labeled as suitable for that purpose.

2.03 Buses:

A. General: All buses for panelboards shall have copper buses. All buses shall be braced for the indicated short circuit duty or a minimum of 22,000 AIC where no interrupting rating is specified.

B. Phase Buses: Power buses shall be full size from top to bottom and rated to carry the full current indicated on the drawings. Phase sequence shall be A-B-C from left to right as viewed from the front. Buses shall be fully drilled and tapped for all cross and center connectors and complete with all connections necessary for main and branch protective devices.

C. Neutral Bus: The neutral bus shall be full rated, electrically isolated and complete with solderless connectors for all feeder and branch neutral conductors. Material shall be the same as phase buses.

D. Ground Bus: The ground bus shall be solid copper, electrically bonded to panelboard box and complete with solderless connectors for all feeder and branch grounding conductors. Provide for all panelboards. Where ground buses are not necessary, provide ground lugs suitable for feeder grounds and other grounding conductors, all electrically bonded to the panelboard enclosure. Set screw type bonding connection (at neutral bus or ground connection) will not be permitted.

2.04 Boxes: Boxes shall be constructed of code gauge galvanized steel. Wiring gutters shall conform to the requirements of Article 312.6 of the NEC but in no case, less than 4-inches on all sides. Boxes for panelboards having parallel conductors for feeders or branches or having sub-feed lugs or through feed conductors shall have increased size gutters in accordance with Article 312.6 of the NEC. Boxes for mains or branches rated 101 to 225 amperes shall have a minimum of 6-inches of wiring space, and for mains or branches rated greater than 225 amperes shall have a minimum of 8-inches of wiring space.

2.05 Interiors: Interiors shall be completely factory assembled with all main and branch circuit protective devices. Branch circuits shall be arranged in a double row configuration where practical, and it shall be possible to remove or add branch devices without disturbing adjacent units. Unless otherwise indicated, all main and branch circuit protective devices shall be bolt-on type. The “dead front” cover on all 480 volt panels shall be clearly labeled with 1/2” letters designating 480 VAC.

2.06 Fronts: All panelboards shall be provided with fronts having hinged doors. Construction shall be code gauge steel. All doors shall be complete with cadmium plated tumbler locks and all shall be keyed alike. Units shall be so designed that with doors open, no live parts are exposed. Doors more than 40-inches high shall be equipped with 3-point latching. Provide directory frame with directory card and transparent cover on the inside of each door.

2.07 Flush Panels: Fronts for flush panels shall have minimum 3/4 inch overlap trim on all sides, and shall have concealed hardware and trim clamps.

2.08 Short Circuit Ratings: Each panelboard shall be braced and rated to withstand the full RMS symmetrical short circuit current of the lowest rated protective device contained therein, but in no case less than ratings where indicated on the drawings or 22,000 amperes, whichever is higher.

2.09 Panelboards shall be fully rated for operation at the voltages indicated on the drawings.

2.10 Protective Devices: Main and branch circuit protective devices shall be either molded case circuit breakers or fusible switches as indicated on the drawings. Refer to sections entitled “Molded Case Circuit Breakers” and “Fusible Switches” as appropriate.

2.11 Finish: Panelboards shall be finished with manufacturer's standard enamel.

2.12 Acceptable: Siemens, Eaton, GE or equal.

## 3.0 EXECUTION

3.01 Secure panelboards rigidly to structure using framing channel as necessary. All surface mounted panelboards shall be mounted using channel behind panelboard to secure it to the structure. The top of the panelboard shall be mounted 6 feet above the floor. The height to the highest mounted device operating handle shall not exceed 6'-6" above floor. Make up all wiring and conduit terminations and ensure ground continuity between raceway and box. Align box and trim to ensure a flush, plumb installation. Provide typewritten directory and other labeling as necessary and/or specified.

(End of Section 26 24 16)

# SECTION 26 24 19

# LOW VOLTAGE MOTOR CONTROL

## 1.0 GENERAL

1.01 Description: This section includes requirements for a 600 volt motor control center (MCC) and all required control devices as shown on the drawing and specified to be part of the MCC equipment. The MCC shall be connected to 480/277 volt, 3-phase, 4-wire, 60 Hertz service.

1.02 Related Work:

A. Section 26 00 00; General Provisions.
B. Section 26 28 16.1; Molded Case Circuit Breakers.
C. Section 26 29 23; Adjustable Frequency Drives.

1.03 Submittals:

A. Submit shop drawings in accordance with the General Provisions and the following.

B. Shop drawings shall include ratings, one-line diagrams, circuit diagrams (including remote devices and connection points), dimensional data, weights, conduit entry restrictions, anchor bolt locations, protective relaying and Bill of Material. Product data sheets, installation and maintenance manuals and catalog cut sheets shall be included with the shop drawings submitted.

C. Drawings are subject to approval. Construction shall not commence until all shop drawings are approved.

D. After completion of installation, CONTRACTOR shall furnish one (1) set of reproducible tracings of final certified drawings, one (1) electronic high-resolution color .pdf copy of the drawings and four (4) sets of all drawings and data sheets or manuals that include the following:

1. Plan, elevation and location of equipment.
2. Dimension outlines including weights.
3. Terminal arrangements, type and location of accessories.
4. Assembly details.
5. Complete bill of material.
6. Any and all other drawings required for erection and installation of the equipment.
7. Complete power and control wiring diagrams including all accessories.

8. Operations, maintenance and installation instruction books.
9. Spare parts list.

1.04 Standards:

A. The design, fabrication and performance of the equipment shall conform to the applicable requirements of the following standards and codes:

1. American National Standards Institute (ANSI).
2. National Electrical Manufacturer's Association (NEMA).
3. National Electrical Code (NEC).
4. Underwriters Laboratories (UL) 845, current edition.

B. Any conflict between the above mentioned documents and this specification shall be referred to the Engineer for clarification before proceeding with the fabrication of the affected parts.

1.05 Tests: Standard design and production tests shall be performed in accordance with the requirements of NEMA, ANSI and IEEE Standards.

1.06 Packing/Shipping: The MCC shall be separated into shipping blocks of no more than three vertical sections each. Each shipping block shall include a removable "lifting angle" which will allow an easy means of attaching an overhead crane or other suitable lifting equipment.

1.07 Storage: If the motor control center cannot be placed into service reasonably soon after its receipt, it shall be stored in a clean, dry and ventilated building free from temperature extremes. Acceptable storage temperatures are from 0°C (32°F) to 40°C (104°F).

1.08 Warranty: The MCC shall be free from defects in materials and workmanship for a period of one (1) year from the date of start-up or 18-months from the date of shipment by the manufacturer.

2.0 PRODUCT

2.01 Manufacturers: Shall be a Square D Model 6 MCC or equal manufactured by Siemens, Eaton or Allen-Bradley.

2.02 Materials:

A. Steel material shall comply with UL845.

B. Each motor control center shall consist of vertical sections of heavy gauge steel bolted together to form a rigid, free-standing assembly. A removable 7 gauge structural steel lifting angle shall be mounted the full width of each of the motor control center shipping blocks at the top. Removable 7 gauge bottom channel sills shall be mounted on the front and rear of the vertical sections, extending the full width of each of the shipping blocks. Vertical sections shall have structural support members formed from a minimum of 12 gauge hot rolled steel. Internal reinforcement structural parts shall be of 12 gauge steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged to withstand all stresses included in transit and during installation.

2.03 MCC Finish:

A. All steel parts shall be provided with UL listed acrylic baked enamel paint finish, except plated parts used for ground connections. All painted parts shall undergo a multi-stage treatment process, followed by the finishing paint coat.

B. Pre-treatment shall include:

1. Hot alkaline cleaner to remove grease and oil.
2. Iron phosphate treatment to improve adhesion and corrosion resistance.
3. Non-chrome sealer to enhance corrosion resistance.

C. The paint shall be applied using an electro-deposition process to ensure a uniform paint coat with high adhesion.

D. The standard paint finish shall be able to pass at least 300 hours of salt spray per ASTM B117 with less than 1/8” loss of paint from a scribed line.

E. Paint color shall be #49 medium light gray per ANSI standard Z55.1-1967.

F. All unit interior surfaces shall be painted white for improved visibility inside the unit enclosure.

2.04 Structures:

A. Structures shall be 20 inches deep, totally enclosed, dead-front, free standing assemblies. Structures shall be bolted together to form a single assembly.

B. The overall height of the MCC shall not exceed 90”.

C. Structures shall be NEMA 1A gasketed.

D. Each 20 inch wide standard section shall have all the necessary hardware and bussing for modular plug-in units to be added and moved around. All unused spaces shall be covered by hinged blank doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus shutters. Larger section widths may be provided for larger equipment.

E. Each section shall include a top plate (single piece or two-piece). Plates shall be removable to ease the cutting of conduit entry openings.

2.05 Wireways:

A. Structures shall contain a minimum 12" high horizontal wireway at the top of each section and a minimum 6" high horizontal wireway at the bottom of each section. These wireways shall extend the full length of motor control center to allow room for power and control cables to connect between units in different sections.

B. A vertical wireway shall be provided in each motor control center section that accepts modular plug-in units. The vertical wireway shall connect with both the top and bottom horizontal wireway. The vertical wireway shall be 4" wide minimum with a separate hinged door. Access to the wireways shall not require opening control unit doors. Structures that house a single, full section control unit are not required to have vertical wireways. Those control units must open directly into the motor control center horizontal wireways.

2.06 Barriers:

A. All power bussing and splice connections shall be isolated from the unit compartments and the wireways. The horizontal bus shall be mounted onto a molded-glass filled polyester support assembly that braces the bus against the forces generated during a short circuit. The horizontal bus shall be isolated from the top horizontal wireway by a grounded steel barrier. This barrier shall be removable to allow access to the bus and connections for maintenance.

B. The vertical bus shall be housed in a molded glass-filled polyester support that provides bus insulation and braces the bus against the forces generated during a short circuit. These supports shall have openings every 3" for unit stab-on connections. Each opening shall be provided with a manual shutter to close off the stab opening. These shutters shall be attached to the structure so that when they are removed (to allow a stab connection) they are retained in the structure and are readily accessible for use should a plug-in unit be removed from the motor control center.

C. Barriers shall be provided in the vertical structure and unit design to prevent the contact of any energized bus or terminal from the conduit or wireway areas.

2.07 Bussing:

A. All bussing and connectors shall be tin-plated copper.

B. The main horizontal bus shall be rated at 600 amperes continuous and shall extend the full length of the motor control center. Bus ratings shall be based on 65°C maximum temperature rise in a 40°C ambient. Provisions shall be provided for splicing additional sections onto either end of the motor control center.

C. The horizontal bus splice bars shall be pre-assembled into a captive bus stack which can be easily installed into the end of the motor control center power bus to allow the installation of additional sections. The main bus splice shall utilize four bolts, two on each side of the bus split, for each phase. Additional bolts shall not be required when splicing higher amperage bus. The splice bolts shall secure to self clenching nuts installed in the bus assembly. It shall be possible to maintain any bus connection with a single tool. "Nut and bolt" bus connections to the power bus will not be permitted.

D. Each section that accepts plug-in units shall be provided with a vertical bus for distributing power from the main bus to the individual plug-in starter units. This bus shall be of the same material and plating as the main bus and shall be rated at 600 amperes continuous. The vertical bus shall be connected directly to the horizontal bus stack without the use of risers or other intervening connectors. It shall be possible to maintain the vertical to horizontal bus connection with a single tool. "Nut and bolt" bus connections to the power bus shall not be permitted.

E. A tin-plated copper ground bus shall be provided that extends the entire length of the motor control center. The ground bus shall be 0.25" x 1.0" and be rated for 300 amperes. A compression lug shall be provided in the motor control center for an AWG 4/0-250 KCMIL grounding conductor. The ground bus shall be provided with (6) 0.38" holes for each vertical section to accept ground lugs for any loads requiring a ground conductor.

F. Each vertical section shall have a vertical ground bus that is connected to the horizontal ground bus. This vertical ground bus shall be installed so the plug-in units engage the ground bus prior to engagement of the power stabs and shall disengage only after the power stabs are disconnected upon removal of the plug-in unit.

G. The power bus system shall be braced for a short circuit capacity of 42,000 RMS amperes minimum.

H. A neutral bus is not required through the length of the motor control center.

2.08 Unit Connections:

A. Units with circuit breaker disconnects through 400 amperes frame and fusible switch disconnects through 400 amperes shall connect to the vertical bus through a spring reinforced, tin-plated, stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.

Stabs on all plug-in units shall be solidly bussed to the unit disconnect. Cabled stab assemblies are not permitted.

B. All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

C. All plug-on units shall utilize a two stage ADVANCE/RETRACT type operating mechanism which will allow the unit to disengage from the power bus without withdrawing the unit from the motor control center.

In the ADVANCED position, the unit stabs shall engage the vertical phase bus. When the unit door is closed, the mechanism will allow complete "on/off" control of the unit disconnect with clear indication of the disconnect's status.

In the RETRACT position, the unit stabs shall be disengaged from the vertical phase bus. A non-defeatable mechanical interlock shall prevent the disconnect from being placed in the "on" position. A single standard padlock shall be able to lock the unit in the RETRACT position, and simultaneously lock the disconnect in the "off" position. When in this RETRACT position, it shall be possible to close the unit door in order to maintain the enclosure's integrity.

A non-defeatable mechanical interlock shall prevent installing or removing a plug-in unit from the structure unless the mechanism is first placed in the RETRACT position.

The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

D. All non-plug-on units shall utilize a fixed position type operating mechanism which allows complete "on/off" control of the unit disconnect with the clear indication of the disconnect's status. All circuit breaker operators shall include a separate "tripped" position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door. A mechanical interlock shall prevent an operator from opening the unit door when the disconnect is in the "on" position. Another mechanical interlock shall prevent an operator from placing the disconnect in the "on" position while the unit door is open.

E. Provisions shall be provided for locking all disconnects in the "off" position with up to three padlocks.

2.09 Combination Starters:

A. Combination starters shall utilize a circuit breaker-type disconnect. Magnetic starters shall be furnished in all combination starter units. All starters shall utilize NEMA rated contactors with encapsulated magnet coils. Starters shall be provided with a 3-pole, external manual reset, solid state overload relay. The overload relay shall have Class 10 or 20 fixed tripping characteristics and shall be ambient temperature compensated.

B. The circuit breaker-type disconnect for the starter shall be a magnetic trip only motor circuit protector.

C. The control circuit transformers shall be as specified herein, and shall be sized to accommodate the contactor(s) and all connected control circuit loads.

D. Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall be field convertible to normally open or normally closed operation.

E. NEMA size 1-4 starters shall be mounted directly adjacent to the wireway so that power wiring (motor leads) shall connect directly to the starter terminals without the use of interposing terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of the starter cubical without entering the vertical wireway.

F. Starter units shall be as indicated on the drawings, two-speed, reversing, full voltage, reduced voltage, etc.

2.10 Feeder Disconnects:

A. Feeder disconnects shall be molded case, thermal magnetic circuit breakers. Feeder disconnects shall be dual mounted, where possible.

B. Circuit breakers shall be in accordance with Specification Section 26 28 16.1 - Molded Case Circuit Breakers.

C. Feeder disconnect units shall be as indicated on the drawings.

2.11 Main Circuit Breaker(s):

A. The Bus A main circuit breaker and Bus B circuit breaker shall be a 600 ampere frame, 3-phase, 600 volt, 60 Hertz, UL listed, molded case, solid state trip, circuit breaker with a 42,000 amperes symmetrical interrupting capacity.

1. The long time trip point of said breaker shall be set as indicated on the drawings.

2. The circuit breaker shall be U.L. listed for 80% continuous current operation.

3. Ground fault sensing shall be included with the circuit breaker. This device shall be factory set to trip the circuit breaker at 100 amperes of ground fault with a time delay of 0.3 seconds.

4. Circuit breaker adjustable trip functions shall include:

a. long time current and delay
b. short time pickup and delay
c. instantaneous pickup
d. ground fault pickup and delay

B. The circuit breaker shall be fixed mounted in the motor control center and shall be provided in accordance with the drawings. The main circuit breaker shall be in accordance with Specification Section 26 28 16.1 - Molded Case Circuit Breakers.

C. One (1) set of normally open (“A”) and one (1) set of normally closed (“B”) contacts shall be furnished to indicate the open/closed status of the circuit breaker. Wiring for these contacts shall be brought to terminals in the main circuit breaker section.

2.12 Main Tie Circuit Breaker:

A. The main tie circuit breaker shall be a 600 ampere frame, 3-phase, 600 volt, 60 Hertz, UL listed, molded case, solid state trip, circuit breaker with a 42,000 amperes symmetrical interrupting capacity.

1. The long time trip point of said breaker shall be set as indicated on the drawings.

2. The circuit breaker shall be U.L. listed for 80% continuous current operation.

3. Circuit breaker adjustable trip functions shall include:

a. long time current and delay
b. short time pickup and delay
c. instantaneous pickup

B. The circuit breaker shall be fixed mounted in the motor control center and shall be provided in accordance with the drawings. The main tie circuit breaker shall be in accordance with Specification Section 26 28 16.1 - Molded Case Circuit Breakers.

2.13 Components:

A. The motor control center shall consist of 20" deep, rigid, free standing sections which are joined together to form a complete assembly as shown on the Drawings. Provisions shall be made for top or bottom cable entry as designated in the drawings and shall consist of the number of sections designated in the drawings. All controls, feeder circuit breaker units, starter units and controllers shown in the drawings shall be included in the motor control center.

B. Control Power Transformer:

1. Each starter unit shall be provided with an encapsulated control transformer of sufficient size to accommodate the control circuit loads, including contactor coil burden, cooling fans, specified auxiliary devices, etc. One leg of the 120 volt secondary circuits shall be fused using a standard 250 volt fuse. The other secondary leg shall be solidly grounded. The primary side of the transformer shall be fused with two (2) 600 volt, current limiting fuses with an interrupting capacity not less than the interrupting capacity of the circuit breaker.

2. The control power transformer shall be rated for 100 VA minimum capacity.

3. Where designed on the drawings and the control power is provided from a source remote from the motor control center, a control transformer will not be required in that starter unit. The disconnect for that starter shall include an interlock for disconnecting the externally powered control circuit(s).

C. Terminal Blocks:

1. All starter units shall be provided with unit control terminal blocks.

2. Terminal blocks shall be the pull-apart type rated at 600 volts, 25 amperes. All current carrying parts shall be tin-plated. Terminals shall be accessible from inside the enclosure with the enclosure door is opened. Terminal blocks shall be DIN rail mounted with the stationary portion of the block secured to the unit divider located below each unit. The stationary portion shall be used for field connections and shall remain attached to the unit when the unit is removed. The terminals used for field connections shall face forward so they can be wired without removing the unit or any of its components. The unit shall be constructed so the unit can be removed without disturbing any of the field control wiring. The portion of the terminal blocks used for the unit wiring (factory connections) shall be removable with the unit.

D. Wiring:

1. The motor control center shall be wired using standard copper conductors with 90°C rated thermoplastic insulation. Control wiring shall be #14 AWG. Power wiring shall be minimum #12 AWG. Wires and terminal block shall be marked as indicated on as-built drawing schematics.

2. Wiring shall be NEMA Class I, Type B. Additional wiring details are shown on the drawings.

E. Line and Bus Connection:

1. The line and load terminals on the main circuit breaker shall be sized to accommodate the conductors designated in the drawings. Terminals shall be suitable for termination of copper conductors. Line and load conductors connected to the main circuit breaker will enter the motor control center as designated in the drawings.

2. Main lug connections to the horizontal bus of the motor control center, where applicable, shall be sized to accommodate the conductors designated in the drawings. Lugs shall be suitable for termination of copper conductors. Conductors shall connect to the horizontal bus from above or below as designated in the drawings.

F. Nameplates: Shall be engraved phenolic nameplates for each motor control center and each unit compartment. Nameplates shall be black background with white letters, measuring a minimum of 1.5" H x 6" W total outside dimensions. Nameplates shall be secured in place with stainless steel screws.

G. Pilot Devices: Each starter shall be provided with the pilot devices indicated on the drawings. Pushbuttons, selector switches and indicating lights shall be the 30 mm, heavy-duty, oil-tight type and shall mount on a removable panel located on the starter unit, not on the compartment door. Pilot lights shall be LED type.

H. Voltage Indicator: A flashing LED-type voltage indicator shall be connected to the load side of each circuit breaker. This indicator shall be mounted through the door of each compartment containing a circuit breaker to readily indicate to the operator the presence of voltage on the load side of the circuit breaker.

The voltage indicator shall be phase insensitive, UL Listed and suitable for voltages between 40-750 VAC / 30-1000 VDC. The voltage indicator shall be complete with flashing LED's, flush-mount bezel assembly and voltage warning label.

The voltage indicator shall be a Safeside R-3W-KB, manufactured by Grace Engineering or equal.

I. Control Components: Where shown in the drawings, auxiliary contacts, control relays and timers shall be provided, as required. Relays shall be heavy-duty, general purpose type, having 120 volt, 60 Hertz operating coils and 120 volt, 10 ampere rated contacts.

J. Wiring and Device Identification: Provide control wiring and device identification for each motor control center:

1. Identify all control conductors with permanent type wire markers. Each wire shall be identified by a unique number and shall be attached to the wire at each termination point.

2. Identify all control devices with permanent type markers. Each device shall be identified by unique number and shall be attached to each device.

3. The numbering system for each wire and control device shall be identified on the wiring diagrams and shall reflect the actual designations used in the work.

K. Arc Flash Warning: An arc flash hazard warning label shall be affixed to the front and back of each motor control center section, each hinged door or compartment in the motor control center and each removable panel on the motor control center. Reference NFPA 70E and ANSI Z535 for appropriate warning label guidelines.

2.14 Quality Control: The entire motor control center shall go through a quality inspection before shipment. This inspection shall include:

A. Physical Inspection of:

1. The structure,
2. The electrical conductors, including:

a. Bussing,
b. General wiring,
c. Units.

B. Electrical Tests:

1. General Electrical Tests including:

a. Power circuit phasing,
b. Control circuit wiring,
c. Instrument transformers,
d. Meters,
e. Ground fault system, and
f. Device electrical operation.

2. AC dielectric tests of the power circuits.

C. Markings/Labels, including:

1. Instructional type,
2. Underwriters Laboratories (U.L.),
3. Inspector’s stamps.

The manufacturer will use integral quality control checks throughout the manufacturing process to maintain the correctness of the MCC.

## 3.0 EXECUTION

3.01 Location: The motor control center shall be located with a minimum of 6” of space between the back of the motor control center and the wall.

The motor control center shall be assembled on a smooth level surface so that all sections are properly aligned.

(End of Section 26 24 19)

SECTION 26 27 26

OUTLET BOXES, CABINETS AND ENCLOSURES

1.0 GENERAL

1.01 Scope: Provide appropriate electrical junction boxes and metal enclosures where indicated on the drawings and elsewhere as necessary. When installing electrical conduit, provide junction boxes as necessary to route electrical conduit and wire as required by the National Electrical Code.

1.02 Submittals: Submit list of material proposed for use.

2.0 PRODUCTS

2.01 Junction Boxes For Receptacle Outlets: Only cast aluminum or PVC-coated cast aluminum outlet boxes are acceptable. Minimum size 4 inches square by 1-1/2 inch deep, except where specifically indicated otherwise. Suitable for location where installed. Provide boxes in all cases of adequate size to accommodate the number and type of devices installed.

A. Concealed Work for Surface Outlets: 4 inch octagonal.

B. Exposed Work and Concealed Work for Recessed Outlets: 4 inches square.

C. Wet or Damp Areas: Cast box with cast cover and vapor tight gasket, with threaded hubs and appropriate cover for device required.

D. Concealed Work for Switch or Receptacle Outlet: 4 inches square with appropriate plaster ring for one or two devices. Standard gang boxes and plaster rings for more than two devices. Flush boxes in exposed block walls shall be squared type designed for application.

E. Exposed Work for Switch or Receptacle Outlet: 4 inches square, with metal cover for device required. For more than one device, standard gang boxes with appropriate metal cover for number of devices required.

F. Embedded in Concrete: 4 inch octagonal, designed for embedding in concrete.

G. Signal and Special Outlets: As necessary for devices.

H. Telephone Outlet: 4-11/16 inches square.

I. Acceptable: Steel City, National, Crouse-Hinds, Raco or Appleton.

2.02 Metal Enclosures: Type 304 stainless steel. In areas exposed to weather or in damp areas, enclosures shall be NEMA 4X, watertight construction; and in other areas, NEMA 1 (gasketed) construction unless otherwise indicated.

A. Wireways, Junction and Pull Boxes: Sized as necessary.

B. Terminal Cabinets: Surface or flush as indicated with hinged door, flush cadmium plated lock and catch, 316 stainless steel backplate. Provide necessary numbered terminal strips.

2.03 Hardware for Outlet Boxes and Metal Enclosures: All hardware and screws shall be 316 stainless steel.

## 3.0 EXECUTION

3.01 General: Use boxes suitable for the location where installed. Locate where indicated or necessary. Install straight and plumb. Secure rigidly to structure. Firmly anchor boxes in place and, where necessary, provide with fixture supports. Use suitable expansion screws with lead inserts for securing boxes to solid masonry and concrete; approved type toggles for securing to hollow masonry units, machine screws or threaded studs for securing to steel members. Install flush mounted boxes so that face of box, or plaster ring where used, finishes flush with, or not more than, 1/16-inch back of finished building surface.

3.02 Location of Outlets and Enclosures: The locations of outlets and enclosures shown on diagrammatic wiring plans are approximate. Before installing outlet boxes and enclosures, study all pertinent drawings and obtain precise information from architectural and mechanical schedules, scale drawings, large scale and full size details of finished rooms and structures, and approved shop drawings of other trades or obtain direction from the Engineer as necessary to determine desired location of outlet boxes and enclosures. The CONTRACTOR shall make all necessary adjustments to fit conditions for recessed boxes installed in block, tile, concrete or other special finish material, in order that all boxes may register flush with finish. In centering outlets and enclosures, make necessary allowance for overhead piping, ducts, window and door trim, variations in thicknesses of furring, plastering, etc., as erected regardless of conditions which may be otherwise shown on small scale drawings. Outlets and enclosures incorrectly located shall be properly relocated without change in the contract amount.

Toggle switches which are shown near doors shall be located at strike side of door as finally hung, regardless of swing shown on drawings. Do not locate pull boxes or junction boxes within finished spaces unless specifically permitted by the Engineer.

A. Ceiling Outlet: Secure rigidly to ceiling structural members. Where conduits are route concealed, mount boxes flush with finished ceiling.

B. Wall Outlet: Secure rigidly to wall and/or structural members. Where outlet boxes are installed flush in wall, install boxes so that standard wall plate, or device to be installed, will completely cover opening and finish with wall material.

C. Enclosures: Secure bases, cabinets or enclosures to wall and/or structural members. Erect concrete or structural steel/aluminum stanchion as required for support.

(End of Section 26 27 26)

SECTION 26 28 16.1

MOLDED CASE CIRCUIT BREAKERS

1.0 GENERAL

1.01 Scope: This Section includes provisions for molded case circuit breakers rated up to 1200 amperes.

1.02 Submittals: Submit manufacturer's catalog data for each frame size circuit breaker proposed for installation.

1.03 Tests: Each circuit breaker used as main service entrance equipment, and each circuit breaker 225 ampere frame size and larger shall be tested for proper operation.

2.0 PRODUCTS

2.01 General: Molded case circuit breakers shall have a molded insulated case and shall be bolt-on or plug-in style of the frame size and trip rating indicated on the drawings. Circuit breakers shall be listed by UL and shall conform to the applicable standards of NEMA publication AB 1-1993 and Federal Specification W-C-375b. Circuit breakers used as main service entrance equipment shall be so listed by UL. Operating handles shall be toggle style, operable at the front of the circuit breaker.

2.02 Contacts: Circuit breaker contacts shall be silver plated and rated for the continuous current indicated by the circuit breaker frame size.

2.03 Operator: Mechanism for operation shall be quick-make, quick-break and of trip free design so that contacts cannot be held closed against a short circuit or overload. Units shall be designed for common tripping of all poles.

2.04 Trip Mechanism: The trip mechanism shall be a combination thermal-magnetic type. Thermal elements shall have inverse time characteristics for overload conditions and magnetic element shall protect against short circuits by providing instantaneous trip. Magnetic trip shall be adjustable for all circuit breakers of 225 amperes or larger frame size.

2.05 Voltage Ratings: Circuit breaker shall be rated for use at the voltages indicated on the drawings.

2.06 Interrupting Ratings: Circuit breakers shall be rated for short circuit duty at not less than the RMS symmetrical current values indicated on the drawings, but in no case less than the following ratings:

Interrupting Rating in RMS Symmetrical Amperes

| Frame Size | Poles | 120 Volts | 240 Volts | 277 Volts | 480 Volts |
|---|---|---|---|---|---|
| 100 amp. | 1-P | 10,000 | ---- | 14,000 | ---- |
| 100 amp. | 2,3-P | ---- | 10,000 | ---- | 14,000 |
| 225 amp. | 2,3-P | ---- | 25,000 | ---- | 22,000 |
| 400 amp. | 2,3-P | ---- | 42,000 | ---- | 30,000 |
| 600 amp. | 2,3-P | ---- | 42,000 | ---- | 30,000 |
| 800 amp. | 2,3-P | ---- | 42,000 | ---- | 30,000 |
| 1200 amp. | 2,3-P | ---- | 42,000 | ---- | 30,000 |

2.07 Enclosures: Circuit breakers shall be suitable for and rated for use in panelboards, switchboards and other enclosures.

2.08 Individual Enclosures: Where indicated, circuit breakers shall be installed in separate steel enclosures. Enclosures shall be NEMA 1 for general indoor use, NEMA 3R for general outdoor use, and NEMA 4X stainless steel, where indicated on the drawings.

2.09 Acceptable: Siemens, Eaton, GE and Square D.

## 3.0 EXECUTION

3.01 Panelboards and Switchboards: Circuit breakers shall be factory installed in panelboard or switchboard assemblies as indicated on the drawings. Devices shall be bolted in place. Make up all conductor terminations.

3.02 Individual Enclosures: Circuit breaker enclosures shall be suitably supported on structures using framing channel as necessary. Where practical, locate the top of the enclosure 6 feet above the floor. The circuit breaker operating handle shall not be less than 4 feet above the floor. Make up all conductor terminations and conduit.

3.03 Trip Adjustment: Magnetic trip adjustments on all adjustable trip breakers shall be set in accordance with the manufacturer’s directives and in accordance with the drawings.

(End of Section 26 28 16.1)

SECTION 26 28 16.2

LOW VOLTAGE ENCASED POWER CIRCUIT BREAKERS

1.0 GENERAL

1.01 Scope: This Section includes requirements for low voltage power circuit breakers encased in insulated housings and suitable for switchboard application.

A. Insulated case circuit breakers shall be provided for main circuit breakers, main bus tie circuit breakers, generator circuit breakers and feeder circuit breakers in the switchboard, as designated on the drawings. These circuit breakers shall be the drawout type with electrical operators.

1.02 Quality Assurance:

A. Reference standards. Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:

1. NEC Article 408, Switchboards and Panelboards.
2. NEMA 250, Enclosures for Electrical Equipment (1,000 volts maximum).
3. UL Standard 489, Molded Case Circuit Breakers.
4. UL Standard 1066.

1.03 Submittals:

A. Submit complete manufacturer’s data for each frame size circuit breaker including time current characteristic curves.

B. Shop Drawings: Submit for approval the following:

1. Manufacturer’s technical information for circuit breaker proposed for use.
2. Listing of the accessories.
3. Construction details of enclosure.

1.04 Tests:

A. Each circuit breaker shall be tested in the field before acceptance.

B. Retain the services of the circuit breaker manufacturer for field inspection and testing.

## 2.0 PRODUCTS

### 2.01 General:

A. Circuit breakers shall be UL listed for 100% current carrying duty, and where used for main service entrance equipment shall be so listed by UL. Breakers shall be electrically operated (E.O.) as indicated on the drawings. Breakers shall be totally enclosed within molded style, insulated case. Voltage rating shall be 600 volts, 60 Hertz. Breakers shall be provided with the number of poles indicated on the drawings at the applied system voltage and have an interrupting rating of not less than 65,000 RMS symmetrical amperes. Units shall be designed for reliable operation at full rated current over the minimum ambient temperature range of 0°F to 120°F. Circuit breakers shall be quick-make, quick-break, employing stored mechanical energy for both closing and opening. Units shall provide for common tripping of all poles and shall be of trip free design so that the breaker cannot be held closed against a condition causing a trip. Breakers shall have provisions for padlocking the breaker in the "open" position. Where required for drawout applications, the circuit breaker shall readily adapt to drawout carriage mounting in switchboards, or motor control centers, as applicable.

B. Circuit breaker element shall have connected, test and disconnected position indicators (for drawout type), spring charged/discharged indicators and circuit breaker open or closed and ready to close indicators all of which shall be visible to the operator with the compartment door closed. For drawout type circuit breakers, it shall be possible to rack the circuit breaker element from the connected to the disconnected position with the compartment door closed, otherwise known as "through the door drawout".

C. Drawout type circuit breakers shall be provided with interlocks to prevent racking the circuit breaker unless the breaker is open.

D. The circuit breaker shall be provided complete and ready for installation, including, but not limited to, all controls, indicators, fusing, transformers, wiring and terminals.

E. Insulated case circuit breakers, as described herein, are distinguished from molded case circuit breakers by the stored energy mechanism employed to open and close the circuit breaker, and the inclusion of an internal motor operator when electrical operation is required.

2.02 Manual Operator: The circuit breaker shall be equipped with a front mounted means for manually opening and closing the breaker. Manual charging of the stored energy mechanism and operation of devices shall be accomplished with the compartment door closed and latched.

2.03 Electrical Operator: The electrical operator shall be an integrally mounted two-step stored energy mechanism for opening and closing the circuit breaker. The electric operator shall be installed on the front of the circuit breaker. The operating voltage of the electric operation shall match the control power source. Provide push button or selector switch control on front of compartment with terminals to allow for connections for remote operation.

All breakers shall include a push button on the front of the breaker for tripping open and shall have a position indicator to indicate “open”, “closed”, “charged”, “discharged” state. The charging mechanism shall be so designed that any circuit breaker, when closed, has inherently the necessary stored energy for tripping.

The electric operator shall come complete with charging motor, motor controller, gear box, cam mechanism, closing solenoid, motor fuse and check switches to monitor the positions of the mechanical components. The controller of the electric operator shall be a microprocessor-based controller, providing voltage independent charging time, charging status indication and software-controlled closing logic for the electric close function.

2.04 Keyed Interlocking: Keyed interlocking capabilities shall be provided and keyed as designated on the drawings.

2.05 Trip Units: Trip units shall be self-contained, integral type, all solid state, static trip device including current sensors and self-contained power supply so that automatic tripping of breakers is independent of external source of power. The static trip device and controls shall be constructed of industrial grade components designed for long life within an ambient temperature range of -20°C to 55°C. Trip level shall be factory set at indicated ampere trip level and shall be adjustable in the field (without special tools or disassembly of breaker). Each circuit breaker shall have mechanical or electrical devices to indicate nature of trip from (1) Long Time, (2) Short Time/Instantaneous, or (3) Ground Fault.

2.06 Trip Unit Adjustment Ranges: Trip units shall have fully field adjustable settings over the minimum ranges listed below:

A. Long Time Pick-Up: 6 steps, nominally 50% to 100% of current sensor rating.

B. Long Time Delay: 3 bands, adjustable over the minimum nominal range of 20 to 80 seconds at 300% of long time pick-up.

C. Short Time Pick-Up: 5 steps, nominally 200% to 800% of long time trip setting, minimum range.

D. Short Time Delay: 3 bands, nominally 0.1 to 0.3 seconds.

E. Ground Fault Pick-Up: 5 steps.

F. Ground Fault Delay: 3 bands.

G. Instantaneous: 5 steps, nominally 300% to 1000% minimum range.

2.07 Circuit Breaker Adjustment Features: Unless otherwise indicated on the drawings, circuit breakers shall have adjustment features as indicated below:

A. Main and Tie Circuit Breakers: Long time pick-up and delay, short time pick-up and delay, instantaneous pick-up.

B. Feeder Circuit Breakers: Long time pick-up and delay, short time pick-up and delay, instantaneous pick-up.

C. All Circuit Breakers: Provide ground fault pick-up and delay as shown on the drawings.

2.08 Zone Selective Interlocking: Connections shall be made between main, tie and feeder circuit breakers to ensure the circuit breaker closest to the fault trips for short time and ground fault conditions.

2.09 Mechanism Operated Cell (MOC) Switch: Drawout circuit breakers shall include a MOC switch operated by the circuit breaker operating mechanism.

2.10 Arc Flash Protection: The main breakers shall have a dual protective setting capability with graphic display. The main breakers will allow the installer to set two different trip curves into one breaker. One curve will be set for standard operating mode and the second curve, with instantaneous protection, shall be set for arc flash mode.

2.11 Transformers: Provide all control voltage transformers and current transformers (CT's) as required for proper operation, including all necessary ground fault sensing CT's.

2.12 Auxiliary Contacts: Provide N.O. and N.C. contacts as indicated or necessary for control and signal function.

2.13 Acceptable Breakers: Circuit breakers shall be Siemens type WL, Eaton Magnum DS or Square D Masterpact.

## 3.0 EXECUTION

3.01 Circuit breakers shall be properly installed in appropriate compartments of factory assembled switchboards.

(End of Section 26 28 16.2)

SECTION 26 29 23

ADJUSTABLE FREQUENCY DRIVES

## 1.0 GENERAL

### 1.01 Scope of Work:

A. This Section describes the requirements for adjustable frequency drives and variable speed drives, herein identified as an AFD for use with AC motors.

B. The manufacturer shall furnish, field test, adjust and place in satisfactory operation all AFD equipment.

C. Any exceptions/deviations to this specification shall be indicated in writing and submitted with the quotation.

### 1.02 References:

A. ANSI/NFPA 70 - National Electrical Code
B. ANSI C84.1 - Voltages Tolerances for North America
C. CSA C22.2 No. 14-M91 - Industrial Control Equipment
D. IEC 68 Part 2-3 - Basic Environmental Testing Procedures Part 2: tests - Test Ca: Damp Heat
E. IEC 146.1 - Semiconductor Converters-General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements
F. IEC 664 - Insulation Coordination for Equipment Within Low-Voltage Systems
G. IEC 447 - Man-Machine Interface Actuating Principles
H. IEC 439 Part 1 - Low Voltage Switchgear and Controlgear Assemblies
I. IEC 947 - Low Voltage Switchgear and Controlgear Components
J. IEC 364 - Electrical Installation of Buildings
K. IEC 204/NFPA 79 - Electrical Equipment of Industrial Machines/Industrial Machinery
L. IEC 106 - Guide for Specifying Environmental Conditions for Equipment Performance Rating
M. IEC 529 - Degrees of Protection Provided by Enclosure
N. IEC 1000 - Electromagnetic Compatibility
O. IEC 721 - Classification of Environmental Conditions
P. IEC 255-8 Overload Relays
Q. IEC 801-2,-3,-4,-5 - Immunity Tests
R. NEMA ICS 6 - Industrial Control and Systems Enclosures
S. NEMA ICS, Part 4 Overload Relays
T. NEMA 250 Enclosures for Electrical Equipment
U. NEMA ICS 2-321 - Electrical Interlocks

V. NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives
W. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives
X. UL 50 - UL Standard for Safety Enclosures for Electrical Equipment
Y. UL 98 - UL Standard for Disconnect Switches
Z. UL 507 - UL Standard for Safety Electric Fans
AA. UL 508 - UL Standard for Safety Industrial Control Equipment
BB. UL 508C - UL Standard for Safety Power Conversion Equipment
CC. UL 991 - UL Standard for Safety Tests for Safety Related Controls employing Solid State Devices
DD. OSHA 1910.95 - AC Drive Controller Acoustical Noise
EE. Conforming to National Safe Transmit Association and International Safe Transmit Association Test for Packages Weighing 100 lbs or Over

1.03 Related Work:

A. Section 26 24 19; Low Voltage Motor Control.
B. Section 25 14 23; Control Panels.

1.04 Submittals:

A. Complete wiring diagrams and enclosure outline drawings shall be furnished for review and approval before assembly of the AFD commences. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legends.

B. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated AFD unit provided.

C. Standard operation and maintenance instruction manuals shall be furnished for each different horsepower rated AFD unit.

1.05 Warranty: A 1-year warranty shall be provided on materials and workmanship from the date of start-up or 18-months from the date of shipment.

1.06 Quality Assurance:

A. The manufacturer of the AFD shall be a certified ISO 9001 facility.

B. The AFD and all associated optional equipment shall be UL listed according to Power Conversation Equipment UL 508C. A UL label shall be attached inside each enclosure as verification of its listing.

C. The AFD shall be designed, constructed and tested in accordance with NEMA, NEC, and IEC standards.

D. The power converter for each AFD shall be tested with an actual AC Induction Motor 100% loaded and temperature cycled within an environment chamber at 104°F (40°C). Documentation shall be furnished to verify successful completion of the test.

E. All AFD door mounted pilot devices shall be tested to verify successful operation.

F. The AFD shall be Hi-Pot tested, with all enclosed devices mounted and wired, prior to shipment.

## 2.0 PRODUCT

### 2.01 Manufacturers:

A. The AFD shall be a Yaskawa, Model iQ1000, provided by Icon Technologies. A Letter of Standardization has been executed for this equipment. The letter states that no other adjustable frequency drive shall be considered an "or equal" in accordance with the City's Standardization Program. The Standardization Certificate of Conditions and Circumstances is on file with the City.

B. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

### 2.02 General Description:

A. The AFD shall convert the connected input AC power to an adjustable frequency and voltage as defined in the following sections.

B. The AFD shall be of the pulse width modulated type with a bridge converter to convert incoming fixed voltage/frequency to a fixed DC voltage. All components shall be integral to the AFD enclosure and require no additional installation costs. The pulse width modulation strategy shall be implemented in a microprocessor that generates a sine-coded output voltage.

C. The AFD shall be designed with a rectifier input designed for 12-pulse minimum operation. Phase shifting transformers shall be housed in the AFD enclosure. Active harmonic filters and inductor-capacitor filters are not acceptable.

2.03 Construction:

A. The AFD shall be mounted in a NEMA Type 12 filtered and gasketed enclosure with full rear cover plates and the ability to externally duct all heat generated to the outside of the enclosure. The AFD shall also include an externally operated disconnect device.

B. A mechanical interlock shall prevent an operator from opening the AFD unit door when the disconnect is in the "on" position. Another mechanical interlock shall prevent an operator from placing the disconnect in the "on" position while the AFD unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

C. Provisions shall be provided for locking all disconnects in the "off" position with up to three (3) padlocks.

D. Current limiting fuses shall be installed and wired to the AFD input.

E. Provisions shall be made for accepting a padlock to lock the enclosure door.

2.04 Motor Load:

A. The AFD shall be sized to operate the motor(s) and connected loads shown in the drawings.

B. The manufacturer of the AFD shall coordinate the installation of the filters or reactors on the output of the AFD to ensure overshoot voltage at the motor terminals does not exceed the maximum withstand voltage of the connected motor load. The overshoot voltage shall take into account pulse rise time, cable length, minimum time between pulses and phase-to-phase transition time.

2.05 Application Data:

A. The AFD shall be sized to operate the connected motor with all driven loads attached.

B. The speed range shall be 40:1.

2.06 Environmental Ratings:

A. The AFD shall be of construction that allows operation in a pollution Degree 3 environment. AFD units that are only rated for Pollution Degree 2 environment will not be allowed.

B. The AFD shall be designed to operate in an ambient temperature from -10 to +40°C (+14 to 104°F).

C. The storage temperature range shall be -20 to +60°C.

D. The maximum relative humidity shall be 95% at 40°C, non-condensing.

E. The AFD shall be rated to operate at altitudes less than or equal to 3,300 ft (1000m).

F. The AFD shall meet the IEC 68-2 operational vibration specification.

2.07 Ratings:

A. The AFD shall be designed to operate from an input voltage of 460± 15% VAC.

B. The AFD shall operate from an input voltage frequency range from 47.5 to 63 Hertz.

C. The displacement power factor shall not be less than 0.95 lagging at any speed or load condition.

D. The efficiency of the AFD at 100% speed and load shall not be less than 96%.

E. The variable torque rated AFD overcurrent capacity shall be 110% for 1 minute.

F. The output carrier frequency of the AFD shall be randomly modulated and selectable at 2, 4, or 10 kHz depending on the AFD rating for low noise operation. No AFD with an operable carrier frequency above 10 kHz will be allowed.

G. The output frequency shall be from 0.1 to 400 Hertz for AFD units up to 75 HP. At ratings above 75 HP, the maximum output frequency shall be 200 Hertz.

2.08 Protection:

A. Upon power-up the AFD shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.

B. The AFD shall be UL 508C listed for use on distribution systems with the available fault current shown on the drawings. The power converter section of the AFD shall meet short circuit withstand-ability of 65,000 RMS symmetrical amperes as defined by NEMA ICS 7.1.09 and have the value listed on the AFD nameplate.

C. The power converter section of the AFD shall be protected against short circuits, between output phases and ground; and the logic and analog outputs.

D. The AFD shall have a minimum AC undervoltage power loss ride-through of 2 seconds. The AFD shall have the user defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the power loss ride-through.

E. The AFD shall have a selectable ride-through function which will allow the logic to maintain control for a minimum of one second without faulting in the event of a loss of power.

F. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to five (5) programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 600 seconds.

G. The deceleration mode of the AFD shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.

H. Upon loss of the analog process follower reference signal, the AFD shall fault and/or operate at a user defined speed set between software programmed low speed and high speed settings.

I. The AFD shall have solid state $I^2t$ protection that is UL listed and meets UL 508C as a Class 10 overload protection and meets IEC 947. The minimum adjustment range shall be from 0.45 to 1.05 percent of the current output of the AFD.

J. The AFD shall have a thermal switch with a user selectable pre-alarm that will provide a minimum of 60 seconds delay before overtemperature fault.

K. The AFD shall utilize bonded fin heatsink construction for maximum heat transfer.

L. The AFD shall have a programmable fold-back function that will anticipate a controller overload condition and fold back the frequency to avoid a fault condition.

M. The output frequency shall be software enabled to fold back when the motor is overloaded.

N. There shall be three (3) skip frequency ranges that can each be programmed with a selectable bandwidth of 2 or 5 Hertz. The skip frequencies shall be programmed independently, back-to-back or overlapping.

O. The AFD shall be equipped with Metal Oxide Varistors (MOV's) wired to the input line terminals.

2.09 Adjustments and Configurations:

A. The AFD shall self-configure to the main operating supply voltage and frequency. No operator adjustments will be required.

B. Upon power-up, the AFD shall automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hertz. The AFD will automatically optimize the operating characteristics according to the stored data.

C. The AFD will be factory pre-set to operate most common applications.

D. A choice of three types of acceleration and deceleration ramps shall be available in the AFD software; linear, S curve and U curve.

E. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.

F. The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high torque machine applications.

G. The memory shall retain and record run status and fault type of the past eight (8) faults.

H. Slip compensation shall be a software enabled function.

I. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hertz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

J. The AFD shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current shall be adjustable between 50-150% of rated current and available from 0.0 - 30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.

K. Sequencing logic shall coordinate the engage and release thresholds and time delays for the sequencing of the AFD output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2.10 Operator Interface:

A. The operator interface terminal shall allow the modification of AFD adjustments through a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, adjustment storage, self-test and diagnostics shall be in English.

B. The display shall be a high resolution, LCD backlighted screen.

C. The AFD model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.

D. A single keystroke scrolling function shall allow dynamic switching between display variables.

E. The terminal keypad shall consist of programmable function keys. The functions shall allow both operating commands and programming options to be preset by the operator. A hardware selector switch shall allow the terminal keypad to be locked out from unauthorized personnel.

F. The operator terminal shall offer a general menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock shall limit access to the main menu. The main menu shall consist of keypad configuration, drive configuration, general configuration, diagnostic mode and drive initialization screens.

G. There shall be arrow keys that shall provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.

H. A data entry key shall allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.

I. An escape key shall allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function shall also return to a previous menu display.

J. A RUN key and a STOP key shall command a normal starting and stopping as programmed when the AFD is in keypad control mode. The STOP key shall be active in all control modes.

K. The AFD shall have LED's mounted on the front panel to indicate functional status. An LED shall verify that the AFD power supply is on. An LED indicator shall indicate an AFD fault. An LED indicator shall designate a pending fault condition.

L. The status LED's shall be able to be remotely mounted up to 3 meters from the AFD.

M. A user interface shall be available that is a Windows-based personal computer, serial communication link or detachable operator interface.

N. The keypad and all door mounted controls shall be NEMA Type 1 rated.

2.11 Control:

A. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AFD, speed control and displaying operating status. All control inputs and outputs shall be software assignable.

B. 2-wire or 3-wire control strategy shall be defined within the software. Additionally, the AFD shall include a Yaskawa Modbus TCP/IP communication card CM090 for all control and monitoring functions, in addition to the hardware interfaces specified. External relays or logic devices will not be allowed.

C. The control power for the digital inputs and outputs shall be as designated in the drawings. Appropriate interface modules shall be provided as required.

D. The internal power supply shall incorporate an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs shall be current limited and not be damaged if shorted or excess current is pulled.

E. All logic connections shall be furnished on pull apart terminal strips.

F. There shall be two (2) software assignable, analog inputs. The analog inputs shall be software selectable and consist of the following configurations: 0-20 mA, 4-20 mA, 20-4 mA, x-20 mA (where x is user defined) 0-5 v, 1-5 v or 0-10 v.

G. There shall be four (4) software assignable, isolated logic inputs that can be selected and assigned in the software. The selection of assignments shall consist of run/reverse, jog, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 2 inputs), auto/manual control, controlled stop, terminal or keypad control, bypass (2 inputs required), motor switching and fault reset.

H. There shall be two (2) software assignable analog outputs that can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power torque, voltage and thermal state. The output signal shall be selectable from 0-20 mA or 4-20 mA.

I. Two (2) voltage-free Form C relay output contacts shall be provided. One of the contacts shall indicate AFD fault status. The other contact shall be user assignable.

J. There shall be a hardware input/output extension module which also provides interlocking and sequencing capabilities. The module shall be fully isolated and housed in a finger safe enclosure with pull apart terminal strips. The module shall provide four (4) logic inputs, two (2) analog inputs, two (2) relay outputs and one (1) analog output. All of the I/O shall be user assignable in the software as previously defined.

K. The AFD door mounted controls shall include a power ON, Drive RUN, Drive Fault Light and Hand-Off-Auto selector switch with Manual Speed Potentiometer.

2.12 Arc Flash Warning: An arc flash hazard warning label shall be affixed to the front and back of each section of the AFD, each hinged door or compartment in the AFD and each removable panel on the AFD. Reference NFPA 70E and ANSI Z535 for appropriate warning label guidelines.

2.13 Harmonic Analysis and Measurement:

A. The point of common coupling (PCC) for this project for the current and voltage distortion analysis and measurement shall be at the load side of the main circuit breaker.

B. Analysis:

1. Calculations and analysis through computer modeling shall be provided for the harmonic distortion anticipated at the point of common coupling (PCC). This analysis shall include values for both voltage and current distortion. Calculations and analysis shall take into account the specific parameters of the distribution system.

2. Harmonic analysis calculations shall be provided for all AFD units operating simultaneously at 85% load while on utility power and on generator power. The harmonic analysis calculations for the AFD units on generator power shall use the specific characteristics of the generator planned for this installation.

3. The harmonic distortion values shall not exceed 5% for the voltage and those listed in IEEE 519-1992, table 10.3 for the current distortion.

4. If the calculations determine that harmonic distortion values are higher than the voltage and current values specified, the drive manufacturer shall provide additional equipment, such as line reactors, isolation transformers, multi-pulse input drives or trap filters to mitigate the harmonic distortion to meet the intent of IEEE 519-1992 guidelines.

5. The harmonic analysis report shall be part of the approval drawing process, submitted to the engineer for approval and shall be included in the project operation and maintenance (O&M) manuals.

C. Measurement:

1. As part of the installation and commissioning of the AFD units, a harmonic distortion field test shall be performed by an independent third party.

a. Measuring Equipment: Submit the following:

1) Equipment cut sheets.
2) Equipment accuracy of measurement.
3) Equipment selectivity of frequency.
4) Equipment bandwidth.
5) Accuracy and burden of current transformers (CT's).
6) Wiring configuration - number of CT's, etc.

b. Analysis and Measurement Protocol: Submit the following:

1) The formulas for calculating each Total Harmonic Distortion (THD) result.
2) Details on the analysis technique. Define whether the technique for analysis is a digital technique or a Fast Fourier Transform technique.
3) Type of measurement. Define whether the measurements for analysis are to be averaging or a snapshot. If averaging, specify the period.
4) Diagram of testing connections and component configuration.

2. Prior to performing this test, the Contractor shall submit for approval a procedural outline that includes work sheets and details for the field tests. After approval is given for testing procedures, measuring equipment and analysis protocol; data collection, testing and analysis shall be performed as described herein using the approved testing procedures, equipment, and analysis protocol.

3. Make voltage and current harmonic distortion measurements at the point of common coupling (PCC). Gather data on the following while operating the AFD units on utility power and generator power.

a. Background harmonic test with no AFD equipment operating.
b. For each AFD operating individually, conduct harmonic tests at 50%, 75%, and 100% of full speed/load.
c. While AFD units are in operation simultaneously, conduct harmonic tests with each AFD set at 50%, 75%, and 100% of full speed/load.

4. Tabulate the results of this test showing the magnitude of the of the first 16 harmonics and calculate the Total Harmonic Distortion (THD) and the Total Demand Distortion (TDD) for each test measurement made at the PCC. Compare results with the requirements of IEEE 519-1992.

5. Make voltage and current harmonic distortion measurements at motor terminals T1, T2, T3 (or closest accessible terminal box) to document the output of each AFD unit. Gather data on the following:

a. Harmonic test at 50% speeds (30 Hertz fundamental).
b. Harmonic test at 75% speeds (45 Hertz fundamental).

c. Harmonic test at 100% speeds (60 Hertz fundamental).

6. Tabulate the results of the measurements made at each motor, showing the magnitude of the first 16 harmonics and calculate the Total Harmonic Distortion (THD) and the Total Demand Distortion (TDD) for each measurement made at each of the motors. Compare results with the AFD and motor/pump manufacturer's specifications and recommendations.

7. The harmonic measurement report shall be included in the project Operation and Maintenance (O&M) manuals.

## 3.0 EXECUTION

### 3.01 Inspection:

A. Verify that the location is ready to receive work and the dimensions are as indicated.

B. Do not install AFD until the building environment can be maintained within the service conditions required by the manufacturer.

3.02 Protection: Before and during the installation, the AFD equipment shall be protected from site contaminants and weather elements.

3.03 Installation:

A. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.

B. The AFD manufacturer shall provide for two (2) days a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AFD equipment. The start-up services shall be included in the cost of the equipment.

3.04 Training: An on-site training course of one (1) training day shall be provided by a representative of the AFD manufacturer to OWNER's operations and maintenance personnel. The cost of training shall be included in the total bid price.

(End of Section 26 29 23)

# SECTION 26 33 53

# CIRCUIT BREAKER UNINTERRUPTIBLE POWER SUPPLY (UPS)

## 1.0 GENERAL

1.01 Scope: This section includes requirements for uninterruptible power supplies (UPS) as indicated in the drawings.

1.02 Related Work:

A. Section 26 24 13; Switchboards.
B. Section 26 28 16.2; Low Voltage Encased Power Circuit Breakers.

## 2.0 PRODUCTS

2.01 Uninterruptible Power Supply (UPS): During normal operation, the switchboard circuit breaker control power and the remote circuit breaker panel power shall be connected through the UPS, which acts as a voltage regulator for each control circuit. When the panelboard power source, providing 208 VAC power to the UPS, is not available, the UPS shall provide control power from its battery for a limited time.

2.02 The uninterruptible power supply (UPS) shall include the following features.

A. The uninterruptible power supply (UPS) shall include three (3) 5000 VA / 4500 watt, rack-mounted modules. Each module shall include the following:

1. 208 VAC, single-phase, hardwired input.
2. 120/208 VAC, single-phase, hardwired output.
3. Sealed, lead acid, maintenance-free batteries.
4. Advanced battery replacement warning.

B. Each uninterruptible power supply (UPS) shall include a five (5) button graphical LCD control panel for displaying and programming UPS load status, events, measurements and settings.

C. Each uninterruptible power supply (UPS) shall be equipped with indicator lights to display the status of:

1. Online mode (green).
2. Battery mode indicator (orange).
3. Bypass mode indicator (orange).
4. Fault indicator (red).

D. Each UPS module shall include a rack-mounted maintenance bypass module to allow the loads to remain powered while the UPS is being serviced.

E. Each UPS module shall include a rack-mounted extended battery module to increase battery run-time capacity.

F. The rack-mounted UPS modules, the maintenance bypass modules, and extended battery modules shall be mounted in a free-standing NEMA 1 gasketed enclosure.

G. The uninterruptible power supply (UPS) shall be an Eaton Powerware 9PX Series (or equal) and shall be mounted in an Eaton Vantage Series enclosure. Coordinate the UPS selection with the control requirements of the switchboard manufacturer.

## 3.0 EXECUTION

3.01 Locate the uninterruptible power supply (UPS) as indicated in the drawings. Provide conduit and wiring connections as shown in the drawings. Provide typewritten directory for each UPS module.

(End of Section 26 33 53)

# SECTION 26 36 23

# AUTOMATIC TRANSFER SWITCHES

## 1.0 GENERAL

### 1.01 Summary:

A. Section Includes: Requirements for providing automatic transfer (bypass-isolation) switches including control modules to provide completely automatic operation.

B. Related work specified in other sections includes, but is not limited to, the following:

1. Section 26 05 26 - Electrical System Grounding.
2. Section 26 05 53 - Electrical Equipment Identification.

### 1.02 References:

A. Codes and standards referred to in this Section are:

1. NFPA 70 - National Electrical Code (NEC).
2. NEMA ICS 10 - AC Automatic Transfer Switches.
3. UL 1008 - Standard for Automatic Transfer Switches.

### 1.03 System Description:

D. Design Requirements: Provide equipment capable of operating in an ambient temperature range of 0 to 40°C and humidity of up to 90% noncondensing.

5. Arrange the equipment for convenient and ready accessibility from the front, for inspection and maintenance of all devices, terminals and wiring.

### 1.04 Submittals:

A. General: Furnish all submittals, including the following, as specified in Specific/General Provisions.

B. Product Data and Information: Furnish manufacturer’s data for all associated equipment and devices indicating dimensions, size, voltage ratings, current ratings, withstand and interrupting ratings.

C. Shop Drawings: Furnish shop drawings for automatic transfer switches to include the following:

1. Outline drawings showing arrangement, elevations and identification of components.
2. Bill of Materials, including manufacturers' name and catalog number.
3. Interconnecting wiring diagrams, where required.
4. Individual schematic and wiring diagrams.

D. Quality Control: Furnish the following test reports and certificates as specified in the Specific Provisions:

1. Certified Shop Test Reports for the automatic transfer switch and related components.

E. Operation and Maintenance Manuals: Furnish operation and maintenance manuals as specified in the Specific/General Provisions.

1.05 Quality Assurance:

A. Codes: Manufacture all automatic transfer switches in accordance with NEMA ICS10 and UL 1008.

1. Manufacture and install each automatic transfer switch in accordance with the NFPA 70 and local codes.

A. UL Label: Provide a UL label on each automatic transfer switch.

1.06 Delivery, Storage and Handling:

A. General: Deliver, store and handle all products and materials, as specified in Specific/General Provisions.

B. Shipping and Packing: Provide all structures, equipment and materials rigidly braced and protected against weather, damage and undue strain during shipment.

C. Storage and Protection: Store all equipment and materials in a dry, covered, heated and ventilated location. Provide any additional measures in accordance with manufacturer's instructions.

1.07 Spare Parts:

A. General: Furnish the following spare parts:

1. Two (2) complete replacements of all indicating lamps and fuses used in the installation.
2. Two (2) of each special tool required for maintenance.
3. Three (3) 12-ounce spray cans of the final finish.

B. Packaging: Pack spare parts in containers bearing labels clearly designating contents and related pieces of equipment. Deliver spare parts in original factory packages. Identify all spare parts with information needed for reordering.

## 2.0 PRODUCTS

2.01 Manufacturers:

A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.

B. Automatic Transfer Switch:

ASCO Controls 7000.
General Electric Zenith ZTS.
Russelectric RMT.

C. Automatic Transfer Bypass-Isolation Switch:

ASCO Controls 7000
General Electric Zenith ZBTS
Russelectric RTB

2.02 Automatic Transfer Switches:

A. Description: Provide enclosed, double-throw automatic transfer (bypass-isolation) switches with single operating mechanism.

B. Configuration: Electrically-operated, mechanically held with required relays, controls and contacts.

2.03 Ratings

A. Voltage: 480V

B. Switched Poles: 3

C. Amperage: 225A

D. Loads: Combination tungsten, ballast, resistance, and inductive loads.

E. Withstand and Closing Ratings: 42,000 minimum RMS symmetrical amperes at 480V, when used with molded-case circuit breaker.

F. Thermal capacity: 20 times continuous ampere rating at 60 cycles.

2.04 Components:

A. Phase Sequence: A-B-C, left-to-right, front-to-back, top-to-bottom.

B. Contacts: Provide silver surfaced main contacts protected by a separate renewable arcing contact. Mechanically lock normal and emergency contacts by the operating linkage when in the open or closed position. Provide an operating linkage that will not permit a neutral position when a failure of any coil or disarrangement of any part occurs.

C. Bypass-Isolation Switch: Provide a manual bypass-isolation switch to connect the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors, design the bypass-isolation switch to have the following features:

1. Switch and all components to be front accessible for all switch ratings.

2. Provide separate bypass and isolation handles for clear distinction between the functions.

3. Provide a bypass handle that operates without opening the enclosure door.

4. Accomplish the bypass to the load-carrying source without interruption of power to the load (make before break contacts).

5. Provide a bypass handle with three operating modes: “Bypass to Normal,” “Automatic,” and “Bypass to Emergency.” The operating speed of the bypass contacts shall be independent of the speed at which the manual handle is operated. Provide the bypass contacts that are out of the power circuit when in the “Automatic” mode.

6. Provide an isolation handle with three operating modes: “Closed,” “Test,” and “Open.” In the “Test” mode, the entire emergency power system, including the automatic transfer switches can be tested with no interruption of power to the load. In the “Open” mode, the automatic transfer switch will be completely isolated from all source and load power conductors allowing the automatic transfer switch to be completely withdrawn for inspection or maintenance without removal of power conductors. Provide an automatic transfer switch that will operate manually when the isolation switch is in either the “Test” or “Open” position.

D. Operating Mechanism: Isolate the mechanical driving system and mechanical interlocks to be electrically dead. Do not use molded plastic parts for the operating linkage between the electrical operator and the main operating shaft of the switch.

E. Main Bearings: Radial, ball-bearing type.

F. Sensing and Control Relays: Continuous-duty, industrial type with wiping contacts rated 10 amperes minimum.

G. Control Logic: Solid-state, microprocessor-based with generator exercise accessories.

H. Arc Barriers: Provide arc barriers and arc suppression for each pole.

2.05 Accessories:

A. Indicating Lights: Provide 30.5 mm, LED type indicating lights mounted in the cover of the enclosure to indicate the following:

1. Bus A source available.
2. Bus B source available.
3. Load connection to Bus A source.
4. Load connection to Bus B source.

B. Test Switch: Mount in the cover of the enclosure to simulate failure of normal source.

C. Preferred Source Selector Switch: Mount in the cover of the enclosure to select the preferred power source.

D. Transfer Switch Auxiliary Contacts: Provide the following auxiliary contacts rated for 10 amperes at 120 volts.

Bus A power position: 2 set N.O., 2 set N.C.
Bus B power position: 2 set N.O., 2 set N.C.

E. Bus A Source Monitor: Monitor voltage and frequency on each phase of the normal source.

F. Bus B Source Monitor: Monitor voltage and frequency on each phase of the standby source.

G. In-Phase Monitor: Monitor phase timing of the Bus A and Bus B sources.

H. Adjustable Time Delay Transfer Logic: Provide adjustable, solid-state, time delays for the following functions:

1. Bus A to Bus B: 0-5 minutes
2. Bus B to Bus A: 0-5 minutes

2.06 Enclosure:

A. Enclosure: NEMA Type 12 - Industrial.

B. Accessibility: Provide an enclosure with all current carrying contacts and parts readily accessible from the front for maintenance and inspection without removal of the switch panel, disconnecting of the operating linkage, or disconnecting of power conductors.

2.07 Automatic Sequence Of Operation:

A. Controller: Provide a programmable, microprocessor-based controller to provide an automatic sequence of operation as a “power seeking” transfer configuration. The operations shall be as follows:

1. Initiate transfer load to Bus B source: Signals from Bus A source monitor, Bus B source monitor, and in-phase monitor.

a. Bus A Source Monitor: Initiate when Bus A source voltage drops below 70% from rated nominal value or frequency varies more than 10% percent from rated nominal value.

b. Bus B Source Monitor: Initiate when Bus B source voltage is at least 90% of rated nominal value and frequency is within 5% of rated nominal value.

c. In-Phase Monitor: If Bus A and Bus B sources are energized, initiate when sources are synchronized to within 15 electrical degrees.

d. Time Delay to Transfer Load to Bus B Source: Adjustable from 0 to 5 minutes, initially set at 10 seconds.

2. Initiate load to Bus A Source: Signals from Bus A source monitor and in-phase monitor.

   a. Bus A Source Monitor: Initiate when Bus A source voltage is at least 90% of rated nominal value and frequency is within 5% or rated nominal value.

   b. Bus B Source Monitor: Initiate when Bus B source voltage is at least 90% of rated nominal value and frequency is within 5% or rated nominal value.

   c. In-Phase Monitor: Initiate when sources are synchronized to within 15 electrical degrees.

   d. Time Delay To Transfer Load to Bus A Source: Adjustable from 0 to 5 minutes, set at 10 seconds.

3. After the loss of power on a source (Bus A or Bus B) and the load is transferred to the alternate source (Bus A or Bus B) the load shall not be re-transferred again until a power outage is experienced on the active source and power is then provided from the alternate source. Neither the Bus A source or the Bus B source is considered the preferred or primary source.

## 3.0 EXECUTION

### 3.01 Installation:

A. General: Install all equipment in accordance with the manufacturer's recommendations and approved shop drawings and as specified in the Specific Provisions.

B. Cable Connections: Terminate and label all field wiring per the approved diagrams.

C. Torque Requirements: Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturers' published torque tightening recommendations. Where manufacturers' torqueing requirements are not available, tighten connectors and terminals in accordance with UL Standard 486 A.

### 3.02 Field Quality Control:

A. Inspections: Inspect, adjust and check the installation for physical alignment, cable terminations and ventilation.

B. Adjustments: Make all necessary adjustments to the equipment to provide complete and satisfactory operation upon completion of the Contract.

C. Tests: Perform field tests as follows:

1. Inspect and test the installation with respect to the safety requirements of NFPA 70 pertaining to grounding and insulation resistance.

2. Demonstrate proper operation of the automatic transfer switch by simulating conditions.

3. Repair or replace defective materials at no cost to the OWNER.

3.03 Operation Demonstration:

A. Manufacturer's Representative: Provide the services of the automatic transfer switch manufacturer's representative to assist in installation, startup, field testing, calibration, placing into operation and providing training, as specified in the Specific/General Provisions. The representative is required to carry out a thorough inspection of the installation and certify the installation is correct and complete in accordance with the manufacturer's instruction and to confirm the automatic transfer switch is ready for the final acceptance. Also to instruct operating personnel in the operation and maintenance of the automatic transfer switch.

B. Training: Following completion of installation and field testing, provide training for six (6) employees of the OWNER in the proper operation, troubleshooting and maintenance of the equipment as outlined below. All training will be at the OWNER's facilities at a time agreeable to the OWNER:

1. Operational Training: A minimum of two (2) 4-hour sessions combining both classroom and hands-on instruction, excluding travel time.

2. Maintenance Training: A minimum of two (2) 4-hour sessions combining both classroom and hands-on instruction, excluding travel time.

3.04 Cleaning And Painting:

A. Field Painting: Clean and touch up any scratched or marred surface to match original finish.

(End of Section 26 36 23)

SECTION 26 36 33

AUTOMATIC THROWOVER SYSTEM

## 1.0 GENERAL

### 1.01 Automatic Throwover System:

A. Provide an automatic transfer, open transition control system for control of three (3) circuit breakers - main circuit breaker A, main circuit breaker B and tie circuit breaker. The logic of the transfer control system functions shall be provided with a programmable logic controller (PLC).

B. The PLC shall include the processor, power supply and discrete input/output points, as required, to determine presence of source, quality of source and execute automatic transfer and retransfer as required based on the available sources. The PLC discrete outputs will be wired to interposing relays that will operate the circuit breakers or provide indication. Source detection will be through discrete inputs from overvoltage and over/under frequency relays. The PLC will provide a link to a touchscreen HMI.

C. The utility power on Bus A and the utility power on Bus B shall be monitored and displayed through the use of electronic metering/power quality meters, one (1) for utility power provided to Bus A and one (1) for utility power provided to Bus B. The set points shall be field adjustable without the use of special tools.

D. A digital readout on the HMI touchscreen shall display each parameter as it is functioning. The readout shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the microprocessor shall display the timer counting down. All set points shall be capable of being re-programmed from the front of the HMI touchscreen when the transfer control system is in the program mode. A test pushbutton shall be included as part of the microprocessor. The programmable logic controller (PLC) and the HMI touchscreen shall be compatible and shall have a compatible communication protocol with the customer metering specified in Section 26 24 13 of these Specifications and as shown on the Drawings.

E. The Automatic Throwover System shall be included in the switchboard lineup specified in Section 26 24 13 of these Specifications and as shown on the Drawings.

1.02 HMI Color Touchscreen: A 15" HMI color touchscreen shall be provided with a VGA 1024 x 768 resolution and 16 BIT color graphics. The HMI touchscreen shall provide the operator with the ability to operate and display the status of the automatic throwover system. The HMI touchscreen shall be a Maple Systems HMI 5150X touchscreen or equal. The touchscreen shall provide the following features:

A. The following touchscreen graphics shall be developed and provided with the automatic throwover system:

1. Main Screen: The main screen shall include graphics and descriptions for system status indicators, circuit breaker control buttons, system control switches, password access, date and time display, and screen access buttons.

2. Settings Screen: The settings screen shall contain touchpads for changing the delay and timer settings, time and date settings, access to touchscreen system configuration, and password administration.

3. Programmable Logic Controller Input/Output (PLC I/O) Map Screen: The PLC I/O screen shall show the PLC input/output (I/O) point listing each with indicators to display the current status.

4. Alarm Log Screen: The alarm log screen shall contain a running list of alarms generated by system events (e.g., circuit breaker faults, circuit breaker connection status, automatic fail mode).

5. Event Log - The event log screen contains a running list of system events (i.e., switch activation, circuit breaker status, etc.).

B. Controller and Screen Features:

1. Personnel can set password-protected time delays from the touchscreen. There shall be no requirement for laptop computers, complicated online PLC program changes, specialized software, or cables.

2. Alarm conditions shall contain specific information instead of being limited to a general summary alarm.

3. Optional event logging with time and date stamp is available. This feature shall allow personnel to track when and why transfers occurred.

4. Two levels of password protection shall be available to limit personnel access. This will ensure that only authorized personnel can access control buttons and switches for transfer operations. A second level of password protection shall allow adjustment of time delays and password administration.

A. The display shall be illuminated with a backlight, to allow for manual operation in low ambient light conditions.

1.03 UPS for System Control Power:

A. During normal operation, control power shall be connected through the UPS, which acts as a voltage regulator for the control circuit. When the Bus A source and the Bus B source are not available, the UPS shall provide control power from its battery for a limited time.

B. The UPS shall be equipped with indicator lights to display the alarm status of:

1. Batteries require service.
2. Low battery voltage.

C. The uninterruptible power supply (UPS) assembly shall include three (3) primary elements that shall be included with the automatic throwover system. The UPS, UPS bypass relay, and the control power source contactor shall be connected through the control power source contactor, then through the UPS, and out to the control system.

D. Control Power Source Contactor: The control power source contactor shall provide 120 volt power to the UPS from an available utility source (Bus A or Bus B) from the control power transformers (CT's). When two sources are available, either source may be the control power source. Mechanical interlocking of the contactor shall keep the sources from paralleling through the control power circuit.

E. UPS Bypass Relay: The UPS bypass relay shall activate automatically to bypass the UPS to maintain the power flow to the control power system when the UPS is not functioning properly.

F. The "CHECK UPS OR UPS LOW BATTERY VOLTAGE" shall be indicated as a pop-up on the HMI touchscreen alarm graphics alarm when one of the UPS batteries needs service. The "Low Battery Voltage" indicator light on the UPS shall also illuminate when the UPS battery becomes inoperative.

G. Provide a control power transformer with an uninterruptible power supply (UPS) and control power transfer scheme for each source.

1.04 Transfer Control System:

A. The transfer control system shall include the following features for operation and indication of the automatic throwover system through the touchscreen graphics panel:

1. Time delay Bus A to Bus B, adjustable.
2. Time delay Bus B to Bus A, adjustable.
3. Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads.
4. Graphic indication the BUS A SOURCE is available.
5. Graphic indication the BUS B SOURCE is available.
6. Graphic indication of a UPS FAILURE.
7. Graphic indication of a SYSTEM FAILURE.
8. Graphic indication the system is in AUTOMATIC MODE.
9. Graphic indication the system is in MANUAL MODE.
10. Three-position selector switch to select BUS A, OFF or BUS B source.
11. Two-position selector switch to select AUTOMATIC RETRANSFER, OFF or ON.
12. Bus A lockout relay with manual reset.
13. Bus B lockout relay with manual reset.
14. Bus A circuit breaker TRIP/CLOSE control switch.
15. Bus B circuit breaker TRIP/CLOSE control switch.
16. Graphic indication the Bus A circuit breaker is open.
17. Graphic indication the Bus A circuit breaker is closed.
18. Graphic indication the Bus A circuit breaker is tripped.
19. Graphic indication the Bus B circuit breaker is open.
20. Graphic indication the Bus B circuit breaker is closed.
21. Graphic indication the Bus B circuit breaker is tripped.
22. Two-position selector switch to select AUTOMATIC or MANUAL MODE. This switch shall be a hardware switch, not part of the touchscreen graphics. This hardware switch shall allow for manual control in the event the touchscreen fails.

B. Test Transfer Switch: A test transfer switch shall have three positions:

1. Test Transfer Bus A: Shall simulate a Bus A source power loss causing a transfer to the Bus B source. During proper operation, the Bus A source indication is off and the Bus B source indication is on.

2. Test Transfer Bus B: Shall simulate a Bus B source power loss causing a transfer to the Bus A source. During proper operation, the Bus B source indication is off and the Bus A source indication is on.

3. Normal: Standard operating mode shall be provided where the switch is in the "Normal" position and no source power loss is being simulated.

C. Circuit Breaker Control and Status: The circuit breaker control and status for the Bus A utility source main circuit breaker, the Bus B utility source main circuit breaker and the tie circuit breaker. Each of the three (3) circuit breakers shall have graphics and controls as described below:

1. Indicators: Each circuit breaker shall have an amber "Fault" indicator. The "Fault" indicator shall illuminate when the circuit breaker trips as a result of a fault condition (e.g., long time, short time, instantaneous, or ground fault).

2. Pushbuttons: Each circuit breaker shall have two (2) illuminated pushbuttons - a green "Open" indicator and a red "Closed" indicator. In Manual mode, these buttons shall open or close the circuit breaker to which they correspond. In Automatic mode, the "Open" and "Close" pushbuttons shall not control the circuit breakers.

D. The following touchscreen graphics and controls shall be included for the Automatic Throwover System:

1. Indicators:

a. A white graphic indication shall show the system is in Automatic mode. A blue graphic indication shall show the system is in Manual mode. An auto/manual keyed switch determines the operating mode.

b. An amber graphic indication shall show an automatic mode failure, indicating a system irregularity. The amber automatic mode failure indication shall display under any of the following circumstances:

1) Either drawout main or tie circuit breaker has been racked to the "test" or "disconnect" positions.
2) Either main or tie circuit breaker has tripped while the system was in Automatic mode for a reason (such as ground fault) that prevents transfer of source.

3) A mechanical Open pushbutton has been pressed.
4) The internal diagnostics have detected an error.

c. A green graphic indicator for “Bus A Source” or “Bus B Source” shall show when the corresponding source is available. A red graphic indicator “CHECK UPS OR UPS LOW BATTERY VOLTAGE” shall display when the UPS battery needs service.

2. Preferred Source Selector (PSS): The PSS is a three-position switch that shall determine whether the Bus A or Bus B utility source is the normal source. The center position shall be the “off” position.

3. Auto/Manual Selector Switch: The auto/manual selector switch shall have two positions:

a. “Automatic” for automatic operation.

b. “Manual” to use the pushbuttons on the HMI touchscreen or on the Remote Circuit Breaker Panel (RCBP) to control the system manually.

Two (2) sets of contacts are provided from the RCBP to indicate whether the RCBP is in the “Automatic” or “Manual” position.

4. Automatic Retransfer: The automatic retransfer selector shall be a two-position switch that determines the automatic retransfer mode. In the “on” position, retransfer shall occur automatically after a source returns and becomes stable. In the “off” position, the system shall remain in the transferred state after the source returns, allowing the operator to manually initiate the retransfer. Moving the switch from the “off” position to “on” shall begin the transfer sequence. When transfer is complete, returning the switch to the “off” position shall disable the automatic transfers.

E. The following features shall also be provided for future connections of two (2) emergency generators:

1. Engine/generator #1 start contact. Close contact to start, open contact to stop.

2. Engine/generator #2 start contact. Close contact to start, open contact to stop.

3. Frequency/voltage relay for engine/generator #1 source, frequency adjustable from 45 to 60 Hertz and voltage fixed at 90% pickup, 70% dropout.

4. Frequency/voltage relay for engine/generator #2 source, frequency adjustable from 45 to 60 Hertz and voltage fixed at 90% pickup, 70% dropout.

5. Automatic exerciser programmable for selection of a schedule to exercise the engine/generator set on a weekly, bi-weekly or calendar (365 days) basis. The day of the week, time-of-day and duration of the engine/generator set starting and running shall be programmable. The option to run the engine/generator set under load or unloaded shall be selectable. All selectable and programmable options shall be entered through the touchscreen, which is part of the automatic throwover system.

F. Sequence of Operation - Manual Mode: While in manual mode, circuit breakers shall be capable of being opened and closed using control switches. Electrical interlocking shall be provided to prevent the closing of both Bus A main circuit breaker and the Bus B main circuit breaker when the tie circuit breaker is closed.

G. Provide electrically-operated circuit breakers as shown on the drawings.

H. Provide a PLC-based automatic transfer controller.

1.05 Automatic Transfer Switch Operation:

A. Normal Conditions:

1. The utility main circuit breaker (Bus A) is closed.
2. The utility main circuit breaker (Bus B) is closed.
3. The tie circuit breaker is open.
4. The Automatic/Manual switch is in the “AUTOMATIC” position.

B. Normal Power Failure:

1. Undervoltage/phase imbalance/reversal is detected by device 47/27-1 relay (source loss) on either or both of the utility sources for Bus A or Bus B.

2. After five (5) seconds of a sustained source loss, the utility main circuit breaker on the affected source (Bus A or Bus B) opens.

3. If only one (1) utility source sustains a source loss, the tie circuit breaker closes after one (1) of the utility main circuit breakers opens. After a ten (10) second delay, the tie circuit breaker shall close only after a contact signal is received acknowledging the utility main circuit breaker is open and the voltage relay (device 27) on the bus, incurring the source loss confirms no voltage is detected by voltage relay 27 on the bus with the open main circuit breaker.

4. The tie circuit breaker shall not close if a source loss is present on both Bus A and Bus B.

C. Normal Power Returns (Automatic Retransfer - Open Transition):

1. Normal voltage is detected by device 47/27-1 voltage relay on the bus incurring the source loss. After a ten (10) second source stabilization delay after normal voltage is detected, the tie circuit breaker opens.

2. Ten (10) seconds after the tie circuit breaker opens, the main circuit breaker that opened after the source loss shall close. The closing of the main circuit breaker shall occur only after a contact open signal is received, acknowledging the tie circuit breaker is open and the voltage relay (device 27) on the bus incurring the source loss confirms no voltage is detected by voltage relay 27.

D. Normal Power Returns (Manual Retransfer - Open Transition):

1. Turn the Automatic/Manual switch to the “MANUAL” position.

2. Normal voltage is detected by device 27/47-1 voltage relay on the bus incurring the source loss.

3. The tie circuit breaker may be opened with the manual close pushbutton on the touchscreen.

4. The utility main circuit breaker may be closed with the manual close pushbutton on the touchscreen after the ten (10) second source stabilization delay of device 27/47-1 has expired.

5. Return the Automatic/Manual switch to the “AUTOMATIC” position to resume normal operation.

E. Simulation of Abnormal Main Voltage Condition (Transfer Test):

1. Turn the Main Test switch to the “Test Transfer Utility Bus A” position.

2. Undervoltage/phase imbalance/reversal is detected by device 47/27-1 relay.

3. After a five (5) second simulated source loss time delay, the utility main circuit breaker for Bus A opens.

4. After a ten (10) second delay, the tie circuit breaker shall close only after a contact open signal is received acknowledging the utility main circuit breaker for Bus A is open and the voltage relay (device 27) on Bus A confirms no voltage is detected on the bus.

5. The tie circuit breaker shall not close if both main circuit breakers are closed.

6. To retransfer to the normal power source, turn the Main Test switch back to the “NORMAL” position.

7. The system will transfer back to utility power in accordance with the procedures detailed in Item D., Normal Power Returns (Manual Retransfer - Open Transition).

8. Turn the Main Test switch to the “Test Transfer Utility Bus B” position.

9. Undervoltage/phase imbalance/reversal is detected by device 47/27-1 relay.

10. After a five (5) second simulated source loss time delay, the utility main circuit breaker for Bus B opens.

11. After a ten (10) second delay, the tie circuit breaker shall close only after a contact open signal is received acknowledging the utility main circuit breaker for Bus B is open and the voltage relay (device 27) on Bus B confirms no voltage is detected on the bus.

12. The tie circuit breaker shall not close if both main circuit breakers are closed.

13. To retransfer to the normal power source, turn the Main Test switch back to the “NORMAL” position.

14. The system will transfer back to utility power in accordance with the procedures detailed in Item D., Normal Power Returns (Manual Retransfer - Open Transition).

15. The “Main Test” switch is keyed to prevent tampering.

1.06 UPS Status: The power source and uninterruptible power supply (UPS) for the automatic failover system shall include graphics and controls for system operation and status.

1.07 Timing Instructions: A software interface package shall be provided to permit an IBM compatible PC to be used to monitor the PLC system or change time delays. Adjustable timer values shall be stored in non-volatile RAM memory registers which are accessible in the PLC application program.

A software package shall be provided to allow revisions to the touchscreen displays and graphics.

The following table designates the settings of the timing values for the Automatic Throwover System that shall be programmed into the RAM memory registers:

| Function | Setting | Comment |
|---|---|---|
| Source Loss Delay | 3 seconds | Timing begins after source loss is detected by 27/47 relay |
| Source Stabilization Delay | 10 seconds | Timing begins after source is detected by 27/47 relay |
| Transfer timer (open transition) | 10 seconds | Time between opening one circuit breaker and closing the other |
| 27/47 relay<br>% undervoltage | 15% of nominal | Non-Adjustable |
| 27/47 relay<br>% phase unbalance | 7.5% | Adjustable 5 - 15% |
| 81 relay<br><br>Over frequency<br>Differential | <br><br>62 Hertz<br>0.1 Hertz | Relay activates when frequency exceeds setpoint<br>Adjustable: 50 - 70 Hertz<br>Adjustable: 0.1 - 3 Hertz |
| 81 relay<br><br>Under frequency<br>Differential | <br><br>50 Hertz<br>0.1 Hertz | Relay is activated when frequency drops below setpoint<br>Adjustable: 50 - 70 Hertz<br>Adjustable: 0.1 - 3 Hertz |
| 59 relay<br><br>% overvoltage<br>Differential | <br><br>105%<br>1% | Relay is activated when voltage exceeds setpoint<br>Adjustable: 100 - 125%<br>Adjustable: 1 - 15% |

1.08 Control Power and Monitor Assembly: Each utility (Bus A and Bus B) source shall provide power to the control power system through a 1000 volt-ampere control power transformer. The disconnecting means for control power and the power quality monitor shall be located within each main circuit breaker instrument compartment.

A. Control Power Subassembly: The control power transformer (CPT) shall connect to the source line side bussing of the main circuit breaker through a fused disconnect switch. The control power transformer line voltage to 120 volts for the system controls. Control power shall be distributed from the secondary side of the transformer through DIN-rail mounted fuses.

B. Power Quality Monitoring: A power quality metering device shall constantly monitor and evaluate the line voltage for an under-voltage, phase imbalance, phase loss, or phase reversal condition. When the power quality monitor senses an abnormal condition, a voltage input alerts the PLC.

1.09 Programmable Logic Controller (PLC) Assembly: The programmable logic controller assembly shall be located in a separate compartment and behind the operator door in the switchboard. This compartment shall contain the PLC central processing unit (CPU), PLC power supply, and input/output (I/O) modules. The interposing relays and terminal blocks shall be located in this same compartment.

(End of Section 26 36 33)

# SECTION 26 50 00

# LIGHTING

## 1.0 GENERAL

1.01 Scope: Installation of lighting fixtures shall include all hangers, supports, frames and brackets necessary to provide a safely supported lighting fixture at each fixture location. Lighting fixtures are indicated by Mark Number (e.g.; F1, F2, F3) on drawings and are described in the Lighting Fixture Schedule included on the drawings.

1.02 Submittals:

A. Submit to Engineer, manufacturer's descriptive data for each type fixture.

B. Manufacturer's Data and Information:

1. Furnish catalog data for all equipment provided under this section.

2. Furnish complete photometric data report from an independent testing laboratory with shop drawings for each luminaire. Luminaries submitted without photometric data will not be reviewed.

1.03 Common Requirements:

A. Design: Fixture shall be of the highest standards of electrical and mechanical design with maximum efficiency obtainable and subject to acceptance by Engineer. All fixtures shall be factory wired.

B. Plaster Frames: Furnish necessary "plaster" frames for lighting fixtures recessed in stucco ceilings and for other non-lay-in installations. Coordinate delivery to job site so that units will be available in time for scheduled installation.

C. Installation Standards: All lighting units, when installed, shall set true and be free of light leaks, warps, dents, and other irregularities.

D. Location of Fixtures: Fixtures shall be as indicated on the drawings.

E. Auxiliaries: Fixtures shall be complete with all auxiliaries necessary for proper operation.

## 2.0 PRODUCTS

### 2.01 Fixture Construction:

A. General: The lighting fixture descriptions and catalog numbers listed in the Lighting Fixture Schedule are used to indicate the acceptable quality, design and distribution characteristics of approved lighting fixtures.

B. Labels: Fixtures shall have UL and manufacturer's label.

C. Housings: Fixture housings shall be constructed of steel treated to prevent corrosion and finished with baked on white enamel, except where otherwise indicated.

D. Mounting Accessories: Provide mounting accessories complete for the type ceiling or mounting involved. Refer to other sections of the specifications for requirements of suspension systems and other support requirements.

### 2.02 Light Source:

A. General: Provide appropriate type and number of light emitting diode (LED arrays) with solid state electronic drivers for each lighting fixture.

B. Heat Sinks: Provide appropriate type and number of heat sinks for the LED array to ensure the LED does not exceed the manufacture's temperature ratings across all ambient conditions for the application of the fixture.

C. Louvers, Lenses, Globes and Frames: Provide louvers, lenses, globes and frames as specified for each lighting fixture. Each fixture requiring a lens shall be complete with the appropriate framed lens. All frames shall be positively latched and equipped with a removable hinge capable of hinging from either side of fixture. All hardware shall be concealed. Carefully clean lenses in accordance with manufacturer's recommendations prior to occupancy by OWNER.

D. Security Clips: Provide security clips for all lay-in type lighting fixtures to prevent fixtures from dislodging and falling from ceiling supports.

E. Flexible Connections: All fixtures designed for recessed installation in accessible ceiling systems shall be provided with appropriate wiring in flexible conduit for connection between lighting fixtures and outlet boxes.

F. Voltages: Lighting fixtures shall be designed for proper operation at the voltages indicated under specific fixture description or as indicated on the drawings.

## 3.0 EXECUTION

3.01 Each lighting fixture shall be installed using appropriate hangers, framing, fixture studs, bases and other materials as necessary. When complete, fixture shall register flush with surfaces of walls, ceilings and other surfaces as necessary. Ensure that all doors and lens or diffuser frames operate freely and are free of light leaks and irregularities. Carefully clean each fixture and lens, globe or diffuser in accordance with the manufacturer's instructions.

(End of Section 26 50 00)

# SECTION 41 22 14

# TRANSFER CART

## 1.0 GENERAL

### 1.01 THE REQUIREMENT

A. The Contractor shall furnish, install and make fully operational the transfer cart system in the location and conditions of service, as shown on the Drawings and as specified in this section.

B. These Specifications shall be considered as minimum requirements. The Contractor shall add such additional features as are necessary for satisfactory operation.

C. All equipment supplied under this Specification shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, including all standards promulgated under the authority of such Act, and shall also meet all applicable industrial codes in the State in which the project is located.

D. The manufacturer and ultimately the Contractor shall be totally responsible for structural design of the transfer cart system, for the compatibility of all equipment, and for verification of required operating clearances.

E. All parts of the mechanism furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation.

### 1.02 CAPACITY AND DESIGN LOADS

A. The cart shall be designed to withstand the dead load (caused by the weight of the components themselves), and the live load during standard operation.

B. Standard capacity ratings shall represent the net rated load.

C. The design load for stress calculations shall be based upon the capacity plus 15% for impact.

D. The rated load transfer cart shall be clearly labeled on the cart

1.03 TRANSFER CART SCHEDULE

A. The unit shall be designed for the following conditions:

Schedule

| Location | |
|---|---|
| General | |
| Indoor / Outdoor | Indoor & Outdoor |
| Capacity, tons | 6 |
| | |
| Min. Operating Speeds | |
| Speed, fpm | 10 |

1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes and standards refer to the most current issue available at the time of the Bid.

1. AISC "Manual of Steel Construction"

2. ASTM A48 Standard Specifications for Gray Iron Castings

3. ANSI B30.13 Storage/Retrieval (S/R) Machinery and associated equipment

4. OSHA 1910-179 Occupation Safety and Health Administration

1.05 SUBMITTALS

A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in the General provisions:

B. Certification that the equipment has been field tested and passed.

2.0 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The equipment covered by these Specifications is to be MHS part number MAT066064S or engineer approved equal.

## 2.02 TRANSFER CART

A. All load carrying parts shall be of steel. The wheels shall have machined and hardened 5 inch end truck wheels, not cast (375 – 420 BHN) . Wheels and axles shall be equipped with antifriction bearings which are permanently sealed and lubricated. The gear head of the motor shall have an alloy steel, heat-treated gear train operating in a fully enclosed oil bath. The gear shaft shall have precision, oil lubricated ball bearings.

## 2.03 ELECTRICAL AND CONTROL REQUIREMENTS

A. Electrical power wiring and connection to the electrical system integral to the equipment shall be provided under Division 26, Electrical.

B. All electrical appurtenances furnished by the equipment manufacturer shall be rated for installation in classified areas as specified herein.

C. All wiring between motor, limit switches and starters shall be short, compact and protected by rigid galvanized steel conduit or flexible steel neoprene jacketed cable

D. Starting equipment shall be integral with the transfer cart unit and shall be of the full voltage, magnetic-reversing type with three overload elements. Equipment shall be housed in an enclosure suitable to the conditions of service and as specified herein.

E. Control panel shall be UL approved and have a UL508A approval label on the outside of the panel.

F. Electrical Requirements:

| Pump Station Building | |
|---|---|
| Area Classification | Unclassified |
| NEMA Rating of Components | NEMA 4 |
| Electrical System | Power cable with 20 amp plug (NEMA L16-20 male) |
| Motors | |
| Rating | 460V, 3 ph, 60 Hz |
| Motor HP | 2 X 0.5 HP |
| Enclosure | TEFC |
| Insulation | Class F |
| Inverter Duty | No |
| Service Factor | 1.15 |
| Space Heater | No |
| Motor Winding Temperature Switches | No |

2.04 CONTROLS

A. Pendent control for travel shall be provided complete with heavy-duty push-button station of constant pressure type with silver-to-silver contact elements, and sufficient control cable operator to stand 5 feet from the cart and operate.

B. Control power shall be 120 volt, provided by a control power transformer within the starter units. One side of this transformer shall be grounded; the other side shall be connected via a fuse of adequate rating.

2.05 TRACK

A. Track shall be flush mount track embedded into the concrete with angles on both sides to keep concrete from chipping. Track shall be MHS part number ATT6401U or engineer approved equivalent. The track shall be embedded into the exiting or proposed concrete surface, and shall be designed and installed under the responsibility of the equipment provider.

(END OF SECTION)

# SECTION 43 12 00

# BLOWERS, COMPRESSORS, AND VACUUM PUMPS GENERAL

## 1.0 GENERAL

### 1.01 SUMMARY

A. The CONTRACTOR shall provide blowers, compressors, and vacuum pumps and appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to blowers, compressors, and vacuum pumps, except where otherwise indicated.

C. The CONTRACTOR shall assign to a single manufacturer full responsibility for the furnishing and functional operation of the blower, compressor, or vacuum pump unit, including drives, drive motors, speed control equipment (where variable speed drives are required), and accessories. The designated single manufacturer, however, need not manufacture more than one part of the unit (blower, or motor and drive), but shall coordinate the design, assembly, testing, and erection of the unit.

### 1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800

2. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

3. ASME PTC 9 Performance Test Code - Displacement Compressors, Vacuum Pumps and Blowers

4. ASME PTC 10 Performance Test Code - Compressors and Exhausters

5. ASME B31.1 Power Piping

6. IEEE 112 Test Procedure for Polyphase Induction Motors and Generators

7. ASTM A 48 Gray Iron Castings

1.03 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with General Provisions. Shop Drawings: Shop Drawings shall contain the following information:

1. Equipment name, identification number, and specification number

2. Performance curve and data

B. The CONTRACTOR shall require the manufacturer to indicate points on the H/Q curves, and the limits recommended for stable operation between which the blowers may be operated without surge and vibration. The stable operating range shall be as wide as possible based on actual tests, performed at the factory in accordance with the ASME PTC 9 and 10 test codes.

1. Equipment detailed description and specification.

2. Electrical data including control and wiring diagrams

3. Assembly and installation drawings including shaft size, seal, coupling, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

4. Equipment drive and motor in accordance with Section 260510 - Electric Motors.

C. Certification: The CONTRACTOR shall obtain written certification from the designated single manufacturer, addressed to the OWNER, stating that the equipment will efficiently and thoroughly perform the required functions and that the designated single manufacturer accepts the CONTRACTOR’s assignment of full responsibility for coordination of all equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed unit(s). The CONTRACTOR shall submit such certificates to the ENGINEER.

D. O & M Manuals: Prior to start-up, furnish complete operations and maintenance manuals in accordance with the Special Provisions. Printed instructions relating to proper maintenance, including lubrication, and parts lists indicating the various parts by name, number, and diagram where necessary, shall be furnished in duplicate with each unit or set of identical units in each station. A recommended spare parts list shall be included. Instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of each piece of equipment.

1.04 QUALITY ASSURANCE

A. Equipment Testing: The CONTRACTOR shall be responsible for the coordination of the following tests of each blower, compressor, and vacuum pump, drive, and motor:

B. General: Tests shall be performed in accordance with the ASME PTC 9 and 10 Performance Test Codes. Tests shall be performed on the actual assembled unit from surge condition to 25 percent above the required design capacity. Prototype model tests will not be acceptable. Equipment shall be tested, as defined herein.

C. Factory Tests of Blowers and Compressors: Blowers, compressors, and motors of sizes 10 to 125 hp (inclusive) shall be factory-tested in accordance with the above requirements. Seven sets of certified test data shall be submitted to the ENGINEER.

D. Factory Tests of Motors: Motors of size 10 hp and larger shall be assembled, tested, and certified at the factory and the working clearances checked to insure that parts are properly fitted. The tests shall be in accordance with IEEE 112 standards, including heat run and efficiency tests. Computations shall be recorded and 7 certified and dated copies of the test results shall be furnished to the ENGINEER.

E. Factory Tests: Blowers and compressors, variable speed drives, and motors 150 hp and larger, shall be factory-tested as complete, assembled units, as indicated above. Test results in triplicate shall be submitted to the ENGINEER and no equipment shall be shipped until the test data have been approved by the ENGINEER.

F. Acceptance: In the event of failure of any blower or compressor to meet any of the above requirements or efficiencies, the CONTRACTOR shall make necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the equipment shall be re-tested at no additional compensation until found satisfactory.

G. Field Tests: Units shall be field tested after installation, in accordance with the Contract Documents, to demonstrate satisfactory operation, without causing excessive noise, vibration, and overheating of the bearings. The field testing shall be performed by the CONTRACTOR in the presence of a factory-trained, experienced field representative of the manufacturer, who shall supervise the following tasks and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation:

H. Start-up, check, and operate the equipment over the entire speed range. The vibration shall be within acceptable limits.

I. Equipment performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, and discharge head. Each power lead to the motor shall be checked for proper current balance.

J. Bearing temperatures shall be determined by a contact-type thermometer. A running time of at least 20 minutes shall be maintained for this test.

K. Electrical and instrumentation testing shall conform to other applicable Sections of the Specifications.

L. The field testing will be witnessed by the OWNER and/or ENGINEER. In the event any of the equipment fails to meet the above test requirements, it shall be modified and retested in accordance with the requirements of this Section. The CONTRACTOR shall then certify in writing that the equipment has been satisfactorily tested, and that final adjustments thereto have been made. Certification shall include date of final acceptance test, as well as a listing of persons present during tests, and resulting test data. The costs of work by factory-trained representatives shall be borne by the CONTRACTOR. The OWNER will pay for power costs. When available, the OWNER's operating personnel will provide assistance in the field testing.

1.05 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Erection and Startup Assistance: Service and instruction assistance by the manufacturer's service representative for each blower and compressor unit 10 hp and larger shall be provided by the CONTRACTOR during the following periods:

1. One day (minimum) during installation.

2. One day (minimum) during startup.

B. Instruction of OWNER's Personnel: The CONTRACTOR shall provide for the services of a factory service representative to instruct the OWNER's personnel in the operation and maintenance of the equipment.

1.06 GUARANATEES AND WARRANTIES

A. After completion, the CONTRACTOR shall furnish to the OWNER the manufacturer's written guarantees, that the equipment will operate with the published efficiencies, heads, and flow ranges and meet these specifications. The CONTRACTOR shall also furnish the manufacturer's warranties as published in its literature.

## 2.0 PRODUCTS

### 2.01 GENERAL

A. Wherever it is required that a single designated manufacturer shall be responsible for the compatible and successful operation of the various components of any equipment, it shall be understood to mean that the CONTRACTOR shall provide only such equipment as the manufacturer will certify is compatible with its equipment and with the further understanding that this in no way constitutes a waiver of any requirements.

B. Manufactured items provided under this Section shall be new, current models, and the products of reputable companies specializing in the manufacture of such products, with previous experience in such manufacture. The CONTRACTOR shall, upon request of the ENGINEER, furnish the names of not less than 5 successful installations of its equipment of comparable nature to that offered under this Contract.

C. Where 2 or more units of the same type and/or size of equipment are required, such units shall be from the same manufacturer.

### 2.02 MATERIALS

A. Materials employed in the blower, compressor, and vacuum pump equipment shall be suitable for the intended application; material not indicated shall be high-grade, standard commercial quality, free from any defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron casings shall be of close-grained gray cast iron, conforming to ASTM A 48, or equal.

2. Miscellaneous stainless steel parts shall be Type 316.

3. Anchor bolts, nuts, and washers shall be Type 316 stainless steel.

### 2.03 APPURTENANCES

A. Nameplates: Each blower, compressor, vacuum pump, and motor shall be equipped with a stainless steel nameplate indicating rated head and capacity, impeller size, speed, and manufacturer’s name, serial, and model number.

B. Solenoid Valves: Solenoid valves shall be provided on the water or oil lubrication and cooling lines. Solenoid valve electrical rating shall be compatible with the motor control voltage and shall be provided complete with all necessary conduit and wiring installation from control panel to solenoid.

C. Gauges: Blowers, compressors, and vacuum pumps shall be equipped with pressure or vacuum gauges, respectively, installed in the discharge lines. Pressure gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings. Where subject to shock or vibrations, the pressure gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

D. Lubrication: Blowers, compressors, vacuum pumps, and motors shall be oil- or-grease-lubricated per individual specifications.

2.04 TOOLS AND SPARE PARTS

A. Tools: Special tools necessary for maintenance and repair of the equipment and one pressure grease gun for each type of grease required for blowers, compressors, and motors shall be furnished as a part of the WORK hereunder; such tools shall be suitably stored in metal tool boxes, and identified with the equipment number by means of stainless steel or solid plastic name tags attached to the box.

B. Spare Parts: The CONTRACTOR shall furnish spare parts subject to wear, such as seals, packing, gaskets, nuts, bolts, washers, wear rings, etc., as well as a set of spare bearings, and one year's supply of filter elements. Furnish parts suitably packaged and labeled in a box as described above for tools.

3.0 EXECUTION

3.01 INSTALLATION

A. General: Blowers, compressors, and vacuum pump equipment shall be installed in accordance with the Shop Drawings and as indicated.

B. Alignment: Equipment shall be field tested to verify proper alignment and operation as indicated, and freedom from binding, scraping, excessive noise, overheating, vibration, shaft run out, or other defects. Drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Piping and Mounting: Piping shall be provided with sufficient expansion joints, guides, and anchors and be supported so as to preclude the possibility of exerting undue forces and moments on the equipment flanges. Suitable flexible connectors shall be provided to isolate the equipment from the piping system. Each unit shall be mounted on a flat and level concrete pad capable of supporting the dead weight of the unit, by means of restrained vibration isolators or resilient pads of suitable design.

D. Lubricants: The installation work shall include furnishing the necessary oil and grease for initial operation and for one year's operation.

(END OF SECTION)

SECTION 43 12 30

COMPRESSED AIR EQUIPMENT

## 1.0 GENERAL

### 1.01 SUMMARY

A. Section Includes: Requirements for furnishing and installing two air compressors with receivers and a dryer with all accessories and appurtenances necessary for a complete installation. Locate the equipment as shown on the plans. Provide simplex reciprocating, pressure lubricated, belt driven air compressor unit on an air receiver tank, tank mounted control panel, and all accessories including automatic tank drain, pressure switches, receiver tank pressure relief valve, pressure gauges and all other components needed for a complete system. Provide refrigerated Air Drying unit as shown or specified.

### 1.02 REFERENCES

A. Codes and standards referred to in this Section are:

1. AFBMA 9 - Load Ratings and Fatigue Life for Roller Bearings

2. AFBMA 11 - Load Ratings and Fatigue Life for Ball Bearings

3. ASME Boiler and Pressure Vessel Code, Sec. VIII, Div 1 - Pressure Vessels

4. ANSI B93.45 (NFPA T3.27.3) - Pneumatic Fluid Power - Compressed Air Dryers - Methods for Rating and Test

### 1.03 SYSTEM DESCRIPTION

A. Air Compressor Units: Design air compressor unit for intermittent operation under the following conditions with the specified characteristics:

| Item | | |
|---|---|---|
| Inlet air conditions | | |
| Temperature range, degrees F | | 25 to 120 |
| Relative humidity, percentage | | 1 to 100 |
| Factory Set Operating Pressure, psig | | 90 to 130 |
| Mounting | | Tank Mounted |
| Rated discharge pressure, psig | | 100 |

| Item | |
|---|---|
| Minimum capacity at rated discharge pressure, scfm | 15 |
| Motor horsepower, hp | 5 |
| Relief valve setting, psig | 135 |

B. Receivers: Provide air receivers meeting the following requirements:

| Item | |
|---|---|
| Minimum capacity, gallons | 80 |
| Position | Horizontal |
| Working pressure, psig | 200 |

C. Refrigerated Air Dryers: Rate air dryers in accordance with the standard rating conditions of the National Fluid Power Association for Class H Dryers ie. 33 to 39 degrees F pressure dew point range at 100 psig and 100 degrees F inlet air, and 100 degrees F ambient air with a maximum pressure drop of 5 psi. Provide air dryers to operate satisfactorily under the following conditions:

| Rating Data | |
|---|---|
| Number Required | 1 |
| Minimum ambient air temperature, F | 41 |
| Maximum ambient air temperature, F | 110 |
| Maximum inlet air temperature, F | 120 |
| Maximum air pressure, psig | 175 |
| Maximum capacity, scfm | 100 |

1.04 SUBMITTALS

A. General: Provide all submittals, including the following:

B. CONTRACTOR's Drawings: Submit shop drawings, including arrangement and erection drawings of the compressed air equipment and control equipment; installation templates; schematic control diagrams, electrical connection diagrams, and complete description of the control system.

C. Quality Control Submittals: Submit the following:

1. Manufacturer's certified performance and material records as specified.

2. Manufacturer's certified copies of Field Test Reports.

D. Operation and Maintenance: Submit operation and maintenance manuals for the compressed air equipment.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle compressed air equipment in accordance with the Specific Provisions.

1.06 SPARE PARTS

A. Provide one manufacturer's recommended spare parts kit for each air compressor system furnished. Provide the following additional spare parts for the air compressor equipment:

1. Two V-belts for each compressor

2. One set of intake and discharge valves for each compressor

2.0 PRODUCTS

2.01 MANUFACTURER

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. Compressor units:

a. Champion (Champion Model HPL5-12)
b. Ingersoll-Rand Company

2. Flexible connectors for compressor:

a. Anaconda
b. Metraflex

3. Pressure regulators for Pressure Reducing Station:

a. A.W. Cash Type A31
b. Fischer Controls Type 67

## 2.02 AIR COMPRESSOR UNITS

A. General: Assemble each simplex air compressor unit to include a compressor, electric motors, V-belt drives with belt takeup and suitable belt guards, air receiver tank with automatic drain, inlet air filter and silencer, adjustable pressure switches for stop start control, safety relief valve, check valve, pressure gauge, vibration isolators and flexible pipe connection.

B. Design: Provide air compressors of the oil lubricated, reciprocating, air cooled with integral air-cooled after-cooler, vertical or vertically inclined, single or two stage, tank mounted type, equipped with an automatic pressure regulator, automatic pressure unloader providing no load starting, and oil level or oil pressure protection. Provide two stage units with an intercooler and interstage safety valve.

C. Tank Mounted: Mount each tank mounted compressor with its motor on a common structural steel base plate which is mounted on an air receiver tank.

D. Relief Valve: Install an ASME safety relief valve as an integral part of the compressor or between the compressor and the discharge check valve.

E. Inlet Filter and Silencer: Provide each inlet air filter and silencer of the dry filter, radially pleated type enclosed in a steel housing, adequately sized for the capacity of the compressor.

F. Vibration Isolators: Set each base mounted air compressor on a minimum of four vibration isolators which are attached to the base plate. Provide each isolator comprising steel springs, steel top and bottom plates, leveling bolts and resilient chocks. Design the isolators to control oscillation and to withstand all lateral forces.

G. Pipe Connections: Provide piping connections to each compressor through corrugated type flexible connectors with a braided protective covering to prevent vibration transmission.

## 2.03 RECEIVERS

A. General: Construct each air receiver tank of welded steel meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, for unfired pressure vessels and bearing an ASME stamp. Provide each tank with dished ends and with feet or a base for mounting in a vertical position as specified.

B. Appurtenances: Equip each air receiver with a pressure gauge, plugged inspection openings, an automatic drain valve, an ASME pressure relief valve, and all necessary pipe connections.

1. Fit each air receiver with an automatic moisture eliminator to remove condensate at each starting of the compressor.

2.04 PARTICULATE FILTER

A. General: Install a particulate filter with a manual drain after the coalescing filter with a 0.5 micron rating.

2.05 PRESSURE RELIEF VALVES

A. General: Provide threaded pressure relief valves of the spring-loaded, bronze, pop-safety type designed for compressed air service. Design the valves to "pop" wide open at the specified or scheduled set pressure capable of relieving the specified or scheduled air flow at 10 percent overpressure. Mount the pressure relief valve on the air receiver to relieve the full capacity of the compressors at 10 percent overpressure above the set pressure. Furnish valves meeting the requirements of the ASME Code for unfired pressure vessels and bearing the Code stamp.

2.06 GAUGES

A. Provide pressure gauges of the Bourdon tube type with minimum 2-inch diameter dials, plainly marked. Connect each gauge with red brass pipe, fittings and isolating stopcocks. Equip each gauge with a snubber and threaded protective diaphragm seal. Furnish gauges with a range of 0 to 150 psig, with an accuracy of 0.5% of range.

2.07 BEARINGS

A. General: Manufacture each compressor with bearings of the antifriction ball or roller type of ample size to carry the loads imposed under continuous service without overheating.

B. Radial and Thrust: Equip compressors with radial and thrust bearings. One of the bearings in each case may be combined with the thrust bearing.

C. Life: Design all bearings to be accessible and located for convenient repair or replacement with an average B-10 operating life of not less than 100,000 hours according AFBMA 9 and AFBMA 11.

2.08 LUBRICATION

A. General: Provide oil lubricated compressor bearings.

B. Reservoir: Use a reservoir system or other approved method. Provide all bearings with oil reservoirs to insure a constant supply of clean oil and with suitable gauges to give visual indication that an adequate supply of lubricant is available and is being supplied to the bearings.

C. Drip and Drain: Make provisions to prevent throwing or dripping of lubricant from the bearings and properly drain all oil sumps and pockets.

D. Oil Supply: Supply such oil of the kind and quality specified by the compressor manufacturer, as is necessary to place each compressor unit in regular operation for a period of one year.

## 2.09 PRESSURE REDUCING STATIONS

A. General: Provide each with a pressure reducing station consisting of a pressure regulating valve, bypass, and pressure gauge. Arrange the pressure reducing station to reduce the supply air pressure to the downstream pressure specified. Provide pressure reducing valve outlet pressures and capacities as shown or scheduled.

B. Pressure Regulating Valves: Provide direct acting, spring loaded, diaphragm operated, single seated pressure regulating valves designed for compressed air service. Design the valves to maintain the selected downstream pressures with inlet pressures up to 125 psig. Provide downstream pressure settings to be field adjustable.

C. Other Requirements: Provide pressure gauges as specified herein.

## 2.10 ACCESSORIES

A. Simplex Control Panel: Provide a local control panel from the compressor manufacturer located at each compressor station. Manufacture the simplex control panel to include, but not limited to, the following equipment:

1. HAND/OFF/AUTO switch for compressor

2. Running contacts for compressor

3. Low oil level or pressure indicating light for compressor

4. Low system pressure indicating light

5. Discharge pressure gauge

6. Starters

B. Safety Requirements for Control Panels: Provide all accessories and appurtenances required for the safe, proper operation of the air compressor equipment as described herein whether or not such components have been specifically shown or specified. Provide compressor controls, duplex control panel and wiring meeting applicable requirements of Section 26 24 16 Panelboards of the Specifications.

C. Control Panel Components: Equip the control panel with an alarm reset push button and alarm indicating lights for low system pressure, motor overload for the compressor, low oil level or pressure for the compressor. Provide auxiliary dry contacts at the control panel for remote annunciation of low compressed air system pressure alarm based on the adjustable set points.

D. Motors: Design air compressor drive motors for operation at 480 volts, 3 phase, 60 hertz, in accordance with Section 11 05 13 Electric Motors.

2.11 SYSTEM CONTROL

A. Adjustable Pressure Switch: Provide adjustable, heavy duty pressure switches for starting and stopping the compressors and a low pressure alarm switch on the air receiver. Equip the switches with double-pole, double-throw contacts rated at 10 amperes for 120-volt a-c power.

1. Arrange the switches to start the compressor at a falling pressure of 90 psig and stop it at a rising pressure of 130 psig. Set the low system pressure switch to actuate an alarm at a falling pressure of 80 psig.

B. Oil Switches: Equip compressor with a low oil level or low oil pressure switch. Design the switch to shut off the compressor and actuate a compressed air system control panel mounted indicating light. Provide a lubricating oil system switch as recommended by the compressor manufacturer.

3.0 EXECUTION

3.01 INSTALLATION

A. Install all compressed air equipment in accordance with the manufacturer’s recommendations and approved shop drawings.

## 3.02 FIELD QUALITY CONTROL

A. Testing: After the installation of the air compressor and all appurtenances, subject the compressor to a field running test under actual operating conditions. Perform field tests as directed and in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation the unit:

1. Has not been damaged by transportation or installation
2. Has been properly installed
3. Has no mechanical defects
4. Has been properly connected
5. Is in proper alignment
6. Is free of overheating of any parts
7. Is free of all objectionable vibration
8. Is free of excessive noise
9. Is free of overloading of any parts
10. Operates as specified with the control system

B. Defects: Promptly correct any defects in the equipment or failure to meet the requirements of the Specifications.

C. Manufacturer's Field Services: Furnish the services of a qualified representative of the compressed air equipment manufacturer to inspect the installation of the compressed air equipment, place it in operation, make any necessary adjustments, and instruct the operating personnel in its operation and maintenance.

## 3.03 CLEANING AND PAINTING

A. Paint the compressed air equipment as specified in Workmanship and Material Section 24 headed "Painting".

END OF SECTION

SECTION 43 12 97

VACUUM PRIMING SYSTEM

## 1.0 GENERAL

### 1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide an automated duplex vacuum priming system, complete and operable, in accordance with the Contract Documents. The vacuum priming system shall include:

1. Two Air-cooled, oil-lubricated rotary vane vacuum pumps.
2. One 60-gallon galvanized air receiver.
3. Four Vacuum Priming Valves with water level sensors.
4. Two Vacuum Priming System Control Valves.
5. Two Automatic Duplex System Control Panels
6. One inline water trap
7. All accessories necessary for complete installation.

B. The requirements of Section 43 12 00 - Blowers, Compressors, and Vacuum Pumps, General, apply to the WORK of this Section.

C. The supplier shall examine the site conditions, intended application, and operation of the vacuum priming system and recommend equipment that will best satisfy the indicated requirements.

### 1.02 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 43 12 00.

## 2.0 PRODUCTS

### 2.01 SYSTEM

A. Provide all components of the system from a single supplier who regularly supplies systems of the type required, with at least 5 years of successful projects of similar scope and complexity. The supplier shall provide all components, less any field piping and wiring that may be required. All field devices, with the exception of the Suction Pipe Vent Valves shall be connected to the Vacuum System Control Panel for control.

B. System Suppliers, or Equal:

1. Q-Vac

## 2.02 VACUUM PUMPS

Design: Two required, tank mounted as a duplex system. The system shall be capable of priming an 80 cu.ft. inlet volume of to a 9 foot vertical lift in approximately 2.5 minutes with two vacuum pumps running. The prime will then be automatically sustained with only one vacuum pump normally running, as needed.

A. Pump Manufacturers, or Equal:

1. Q-Vac

## 2.03 VACUUM TANK/ AIR RECIEVER

A. Design: One horizontal ASME receiver tank, with a 60 gallon capacity, made of carbon steel. Finish tank inside and out with manufacturer's primer and finished coatings for corrosion resistance. Provide tank capable of taking a perfect vacuum. Equip tank with sight level gauge, high water level switch for automatic shutdown, system isolation valve, drain valve, vacuum release valve with silencer and a 4" face, liquid filled vacuum gauge.

## 2.04 VACUUM PRIMING VALVES

A. Design: Four 2-inch FPT inlets, heavy duty vacuum priming valves, Model QV-38P2-WLCS Priming Valve or equal by Q-VAC. Provide priming valves that have been designed specifically for priming applications and that comply with AWWA C512. Provide priming valves with a cast iron body (ASTM A126, Class B) with fusion bonded epoxy coating inside and out, 316 stainless steel trim, and weatherproof SPDT level switch kit for proof of prime signal.

## 2.05 INLINE WATER TRAPS

A. Design: One inline water trap Model CVA-075R or equal by Q-VAC, with ¾" FPT ports, corrosion resistant aluminum head, clear polycarbonate housing to show accumulated liquid, internal baffle, stainless steel separator screen, float ball for emergency shutoff, and drain valve, and a vacuum gauge.

## 2.06 AUTOMATIC DUPLEX SYSTEM CONTROL PANELS

Provide Two Automatic Duplex System Control Panels for control of the vacuum system. Provide tank mounted panels with NEMA 4X enclosure. For each panel provide two full voltage motor starters with overload protection and reset switch; two Green LED pump running lights; two H-O-A selector switches; one Red LED alarm light with a reset button; on vacuum flooded receiver alarm that initiated emergency shutdown; one alarm horn with silence button (90 dB A); one set of dry contact for remote alarm; one vacuum transducer; one micro-processing controller with lead/lag control; automatic alternation and frequent start protection. Also provide an illuminated LCD panel display for the following:

1. System operation status
2. Running Hours for each pump
3. Current vacuum level
4. Low vacuum alarm
5. Vacuum receiver flooded alarm
6. Pump start failure alarm

Provide interface monitoring and control, signals to the PLC-based SCADA.

## 2.07 MISCELLANEOUS ACCESSORIES

A. Design: Provide drain piping downstream of the air receiver drain valve, route drain pipe to the nearest floor drain.

## 2.08 SPARE PARTS

A. Furnish the following spare parts for the vacuum priming system:

1. Two Vacuum Priming Valve with level sensor.
2. One inline water trap.

# 3.0 EXECUTION

## 3.01 INSTALLATION

A. General: Equipment shall be installed in accordance with the Shop Drawings and as indicated.

B. General installation requirements shall be as indicated in Section 460100 - Equipment General Provisions.

3.02 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustment: The service representative of the manufacturer shall be present continuously at the Site to furnish the services required by Section 43 20 00.

B. Instruction of OWNER'S Personnel: The training representative of the manufacturer shall be present at the Site for 2 Days to furnish the services required by Section 432000.

C. For the purposes of this paragraph, a Day is defined as an 8 hour period, excluding travel time.

D. The ENGINEER may require that the inspection, startup, and field adjustment services above be furnished in 2 separate trips.

(END OF SECTION)