

CITY OF
TAMPA, FLORIDA

NOTICE TO BIDDERS, INSTRUCTIONS TO BIDDERS
PROPOSAL, BID BOND, AGREEMENT, PUBLIC CONSTRUCTION BOND AND
SPECIFICATIONS

FOR

Contract 08-C-00039

**HOWARD F. CURREN AWTP ADMINISTRATION
BUILDING IMPROVEMENTS**

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

APRIL 2009

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.: 08-C-00039; Howard F. Curren AWTP Administration Building HVAC Improvements

BID DATE: April 21, 2009 **ESTIMATE:** \$450,000 **DEPOSIT:** \$20 **SCOPE:** The project provides for the replacement of 2 air handlers, air duct cleaning, installation of access doors on ductwork, testing and balancing of HVAC system, replacement of the existing boiler, installation of new 200 ton chiller, all associated piping, electrical work. **PRE-BID CONFERENCE:** Tuesday, April 7, 2009, 10:00 a.m., at the Howard F. Curren AWTP Administration Building Training Room. Please fax copies of driver's licenses for all attendees a minimum of 24 hours in advance to Rich Birchmire (813) 242-5312 to obtain security clearance. Attendance is not mandatory, but recommended.

CONTRACT NO.: 09-C-00008; Manhole Rehabilitation by Structural Coating System

BID DATE: April 14, 2009 **ESTIMATE:** \$340,000 **DEPOSIT:** \$20 **SCOPE:** The project provides for furnishing all labor, materials, and equipment to rehabilitate 67 manholes on the Bayshore Blvd Interceptor by installation of a structural coating system including surface preparation, elimination of active infiltration, application of structural coating system, restoration of benches, replacement of cast iron frame and covers, disposal of debris, maintenance of traffic, surface restoration and all appurtenant work. **PRE-BID CONFERENCE:** N/A

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 for this work may be examined at the Contract Administration Department, 306 E. Jackson Street, 4th Floor North, Tampa, Florida 33602. Copies may be obtained upon payment of the refundable deposit indicated for each set. Deposits are refunded if documents are returned in good condition within 15 days after bid opening. Mailing fee should be in the form of a separate check and is available for an additional \$10.00 per set. Delivery via certain other parcel services may be available by providing an account number. Checks should be made payable to the City of Tampa. Subcontracting opportunities may exist for City certified Women/Minority Business Enterprises (W/MBE's). A copy of the current W/MBE directory may be obtained at www.Tampagov.net. Phone (813) 274-8456 for assistance. **Fax 813/274-8080 For Technical Questions.** Visit; http://www.tampagov.net/dept_contract_administration/programs_and_services/construction_project_bidding/index.asp for **Project Listings and any Addenda.**

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NOTICE TO BIDDERS
CITY OF TAMPA, FLORIDA
Contract 08-C-00039; Howard F. Curren AWTP Administration Building HVAC Improvements

Sealed Proposals will be received by the City of Tampa no later than 1:30 P.M., April 21, 2009, 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, the replacement of 2 air handlers, air duct cleaning, installation of access doors on ductwork, testing and balancing of HVAC system, replacement of the existing boiler, installation of new 200 ton chiller, all associated piping, electrical work 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 Performance Bond and Payment Bond, Specifications, Plans and other Contract Documents may be examined at the office of the Contract Administration Department, Municipal Office Building, Fourth Floor North, City Hall Plaza, Tampa, Florida 33602. Copies of the Plans and Specifications may be obtained upon the refundable payment of \$20.00 for each set. Deposits are refunded if documents are returned in good condition within 15 days after bid opening. Mailing is available for an additional charge of \$10 per set. Checks should be made payable to the City of Tampa. (Refundable deposits to be in check form. Each project requires a separate deposit check.)

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 Performance and Payment Bonds 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.

"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 Statutes.

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.

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INSTRUCTIONS TO BIDDERS
SECTION 1 - SPECIAL INSTRUCTIONS

I-1.01 GENERAL:

The proposed work is the Howard F. Curren AWTP Administration Building HVAC Improvements 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 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 faxed to 813/274-8080. 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 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-1.03 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 with its bid 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 with its bid 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-1.04 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 180 consecutive calendar days. The period for performance shall start from the date indicated in the "Notice To Proceed".

I-1.05 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-1.06 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.

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

INSTRUCTIONS TO BIDDERS
SECTION 1 - SPECIAL INSTRUCTIONS

I-1.07 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-1.08 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-1.09 EQUAL BUSINESS OPPORTUNITY PROGRAM / SLBE / REQUIREMENTS

In accordance with the City of Tampa's Equal Business Opportunity Ordinance, a goal of 4.7% 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 GFECF 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-1.10 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.

I-1.11 PUBLIC CONSTRUCTION:

The Bidder who is awarded the Contract will be required to furnish a Public Construction Bond upon the forms provided herein, each equal to 100 percent of the Contract price, such Bonds 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.

I-1.12 AGREEMENT

INSTRUCTIONS TO BIDDERS
SECTION 1 - SPECIAL INSTRUCTIONS

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.

Section 5 – Subcontracts and Assignments
Page A-7, Last Paragraph:

Change "...twenty-five (25) percent..." to "fifty-one (51) percent..."

Section 10-Payments
Article 10.05 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 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 item 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 *****

TAMPA INSURANCE REQUIREMENTS

REQUIRED INSURANCE - The Contractor shall maintain the following type of insurance for the duration of its agreement with the City. Contracts above \$1,000,000 and contracts involving unusual operations such as U.S.L.H., aircraft, watercraft or explosives shall be referred to Risk Management for insurance requirements.

COMMERCIAL GENERAL LIABILITY INSURANCE - Must be written on Accord 25 form for proof of insurance coverage to cover liability arising from premises and operations, independent contractors, products and completed operations, personal and advertising injury, contractual liability, and XCU exposures, if XCU perils exist. Completed operations liability coverage shall be maintained for a minimum of one-year following completion of the work.

If your total proposal price is:	A. \$25,000 or less	B. \$25,001 - \$100,000	C. \$100,001 - \$1,000,000
Your General Liability limit must not be less than:	\$1,000,000 each occurrence	\$1,000,000 each occurrence	\$2,000,000 each occurrence

AUTOMOBILE LIABILITY INSURANCE - Not required if use of vehicles limited to driving to and from the job site. When required, such policy must 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 and hired vehicles.

If your total proposal price is:	A. \$25,000 or less	B. \$25,001 - \$100,000	C. \$100,001 - \$1,000,000
Your General Liability limit must not be less than:	\$1,000,000 each occurrence	\$1,000,000 each occurrence	\$1,000,000 each occurrence

WORKERS' COMPENSATION/EMPLOYERS LIABILITY INSURANCE - Workers' Compensation insurance shall cover all employees engaged in work for the Contractor in accordance with the laws of the State of Florida.

If your total proposal price is:	A. & B. \$100,000 or less	C. \$100,001 - \$1,000,000
The Workers Compensation limit shall be:	Statutory	Statutory
Your Employers Liability limit must not be less than:	\$1,000,000 disease each employee \$1,000,000 disease aggregate \$1,000,000 each accident	\$1,000,000 disease each employee \$1,000,000 disease aggregate \$1,000,000 disease each accident

OWNERS & CONTRACTORS PROTECTIVE LIABILITY INSURANCE – Required for all contracts exceeding \$100,000.00, shall be maintained by the Contractor with the City of Tampa as the named insured in a separate original policy to be furnished to the City.

If your total proposal price is:	A. & B. \$100,000 or less	C. \$100,001 - \$1,000,000
Your OCP coverage must not be less than:	Not Required	\$1,000,000 bodily injury and property damage combined single limit each occurrence

BUILDERS RISK INSURANCE/ INSTALLATION FLOATER -Required for all contracts exceeding \$100,000.00, shall be maintained until final payment is made and shall insure against loss of or damage to the work by perils insured under an "All Risk" replacement cost form acceptable to the City, including but not limited to fire, lightning, extended coverage perils, collapse, transit, debris removal required by law, ordinance or regulation, sinkhole, and architects and engineers fees. Flood insurance may also be required. Earthwork may be excluded at the discretion of the City, therefore projects where no building is involved 30% of the contract amount is required. Policy shall show City, Contractor, and subcontractors as their interests may appear as named insureds with losses payable to the City for the benefit of all insureds. Subrogation rights of the insurer against the Contractor and all subcontractors shall be waived by the insurer. Any perils not insured under the policy for which the Contractor is not relieved from responsibility shall be the responsibility of the Contractor.

If your total proposal price is:	
A. & B. \$100,000 or less	C. \$100,001 and Above
Optional at Contractor's discretion. Contractor is responsible for all damages to work until final acceptance by the City.	Limit can be no less than the replacement cost of the work, 30% for earthwork where no building is involved, with a maximum deductible of \$25,000 each occurrence. Deductibles are the responsibility of the Contractor.

ADDITIONAL INSURED - The City must be included as an insured by way of ISO endorsement CG 20 10 or its equivalent on the general and excess liability policies. Alternatively, the Contractor may purchase a separate owners protective liability policy in the name of the City in the amounts specified above for general liability which shall be excess over any insurance of the Contractor.

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.

CANCELLATION/NON-RENEWAL - Thirty (30) days written notice by registered or certified mail 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 Contract Administration Department, 306 E. Jackson Street 4N, Tampa, FL 33602.

NUMBER OF POLICES - 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 policy.

EVIDENCE OF INSURANCE - Within ten (10) working days of receipt of notification of intent to award, the City must receive a certificate of insurance acceptable to the City. Failure to furnish by the 10th working day may disqualify proposer. Certified copies of the policies evidencing the coverages required herein are also acceptable, and if requested shall be furnished to the City. Renewal certificates shall be provided to the City at least ten (10) days prior to expiration of the current coverages.

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 VI (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.



SLBE Goal Setting Worksheet

8-C-00039, HFC AWTP Administration Bldg. HVAC Improvmts.
Estimated Project Amount \$425,000.00

ELECTRICAL SERVICES

Total Available Companies = 6

Black 0 Hispanic 0 Woman 0 Other 6 Percentage 4.71%

- All-In-One Electric - Small Business
- Hector Delgado Electric Inc. - Small Business
- JDP Electric, Inc. - Small Business
- Pratt's Electric, Inc. - Small Business
- Reliability Consulting Services, Inc. - Small Business
- Romero & Gray Electric, Inc. - Small Business

Total
4.7%

SLBE

Instructions Regarding Use of the SLBE Goal Setting List

Bidders must solicit a subcontracting bid from ALL of the firms listed on the list provided 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)

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PROPOSAL

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

Name of Bidder _____

Business Phone Number _____

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 _____

NO TEXT FOR THIS PAGE

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. 11245 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:

NO TEXT FOR THIS PAGE

Contract Item No.	Estimated Quantity	Description and Price in Words	Computed Total Price for Item in Figures
BASE BID	LS	<p>This includes the furnishing of all labor, equipment, and material for the replacement of 2 air handlers, air duct cleaning, installation of access doors on ductwork, testing and balancing of HVAC system, replacement of the existing boiler, installation of new 200 ton chiller, all associated piping, electrical work, any allowances that may be listed in Section 01020, and with all associated work required for a complete project in accordance with Contract Documents.</p>	

		_____ dollars	
		and _____ cents	
		(BASE BID) LS \$ _____	

NO TEXT FOR THIS PAGE

Computed Total Price In Words:

_____ dollars and _____ cents.

Computed Total Price in Figures: \$ _____

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

The bidder acknowledges the requirements of the City of Tampa 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.

NO TEXT FOR THIS PAGE

Accompanying this Proposal is a certified check, cashier's check or Bid Bond (from included herein must be used) on the for 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 _____, 2009

(Name of Bidder)

(Address of Bidder)

(Signature)

(Title)

Where Bidder is a Corporation:

Attest:

Secretary

AFFIX
CORPORATE
SEAL

NO TEXT FOR THIS PAGE

(ACKNOWLEDGMENT OF PRINCIPAL)

STATE OF _____)
) SS:
COUNTY OF _____)

For a Corporation:

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ____ of _____, 200__ 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 _____, 200__ 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 _____, 200__ by _____ who signed on behalf of the said firm. He/she is ____ personally known or has ____ produced _____ as identification.

Notary

My Commission Expires:

NO TEXT FOR THIS PAGE

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:

GFCEP

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.

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

This form must be submitted with all bids or proposals. All subcontractors solicited and subcontractors from whom unsolicited quotations were received must be included on this form. The instructions that directly follow are for the form heading information pertaining to the project and prime.

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 Opportunities existed for this Contract. Checking the box indicates that your business will not use subcontractors and will self-perform all work. If during the administration of the contract you use subcontractors, the "Sub-(Contractors/Consultants/Suppliers) Payments" form must be submitted with your invoices.

No Firms were contracted because. Provide brief explanation as to why no subcontractor were used.

See attached documents. Check if you have provided any additional documentation relating to the payment data.

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

SLBE. Enter "S" for firms Certified by the City of Tampa as Small Local Business Enterprises. Change order.

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.

Contract 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.

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

This form must be submitted with all bids or proposals if subcontracting will be performed. 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.

See attached documents. Check if you have provided any additional documentation relating to the payment data.

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

Federal ID. FIN. A number assigned to a business for tax reporting purposes. This information is critical in proper identification of the subcontractor.

SLBE. Enter "S" for firms Certified by the City as Small Local Business Enterprises.

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 Women/Minority Business Enterprises)

Percent of Contract. Indicate the percent of the total contract price the subcontract(s) represent.

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 08-C-00039; Howard F. Curren AWTP Administration Building HVAC Improvements

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 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 08-C-00039, Howard F. Curren AWTP Administration Building HVAC Improvements.

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 _____, 2009.

Principal

BY _____

TITLE _____

BY _____

TITLE _____

Countersigned:
(SEAL)

Local Resident Producing Agent

Local Resident Producing Agent's Address

Name of Local Agency

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

NO TEXT FOR THIS PAGE

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 08-C-00039 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 _____, 2009, 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 08-C-00039; Howard F. Curren AWTP Administration Building HVAC Improvements, shall include, but not be limited to, the replacement of 2 air handlers, air duct cleaning, installation of access doors on ductwork, testing and balancing of HVAC system, replacement of the existing boiler, installation of new 200 ton chiller, all associated piping, electrical work 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.

NO TEXT FOR THIS PAGE

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 Contract.

(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 condition(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 items 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 Contract 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 or 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 or 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 indemnify 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 Contract 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.

* * * * *

NO TEXT FOR THIS PAGE

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: _____

NO TEXT FOR THIS PAGE

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.

NO TEXT FOR THIS PAGE

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)

(Name of Surety)

(Principal Business Address)

(Surety Address)

By _____

By _____
(As Attorney in Fact)*

Title _____

Telephone Number of Surety

Telephone Number of Principal

Accepted by City of Tampa:

Countersignature:

By _____
Pam Iorio, Mayor

(Name of Local Agency)

Date: _____ 20__

(Address of Resident Agent)

By _____

Approved as to legal sufficiency:

Title _____

By _____
Assistant City Attorney

Telephone Number of Local Agency

Date: _____, 20__

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

NO TEXT FOR THIS PAGE

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 the 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.

TEMPORARY STRUCTURES

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 constructed in accordance with the requirements of the Contract Documents.

SECTION 6

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.

**SECTION 13
CLEANING**

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.

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.

SUPPLEMENTARY GENERAL PROVISIONS

1.0 GENERAL:

- 1.1 This Section sets forth modifications to the "General Provisions" of the Contract Documents which are referred to as Specifications, General Provisions.
- 1.2 Paragraph numbers and titles used herein refer to similarly numbered and titled articles in the General Provisions.
- 1.3 Only those paragraphs contained herein shall be assumed to be modified. Paragraphs not appearing herein shall apply as written in the General Provisions.
- 1.4 Any portion of the General Provisions, whether or not modified herein, may be further modified in Special Conditions and in the Instructions to Bidders of these Specifications.
- 1.5 Where the Supplementary General Provisions, Special Conditions and Instructions to Bidders conflict with the General Provisions, the Supplementary General Provisions, Special Conditions and the Instructions to Bidders shall take precedence.

2.0 MODIFICATIONS TO THE GENERAL PROVISIONS AS FOLLOWS:

2.1 SECTION 1 SCOPE AND INTENT

G-1.02 WORK INCLUDED

The first paragraph shall be deleted in its entirety and replaced by the following paragraph:

"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 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 incidental thereto. He shall repair or restore all during performance of the work."

2.2 SECTION 3 WORKING DRAWINGS

- a. Change to read as follows:

SECTION 3 SHOP DRAWINGS

- b. Replace the existing paragraphs in their entirety with the following paragraphs:

G-3.01 SCOPE

Shop drawings, schedules, etc., shall be submitted to the Engineer and/or Architect in quadruplet, accompanied by a letter of transmittal. Subcontractors and suppliers shall submit shop drawings and make requests for approvals through their respective prime Contractors.

The drawings shall be numbered consecutively and shall accurately and distinctly present the following:

- (1) Names of equipment or materials, and the locations at which the equipment or materials are to be installed in the work.

- (2) All working and erection dimensions.
- (3) Arrangement and sectional views.
- (4) Necessary details, including complete information for making connections between work under this contract and work under other contracts.
- (5) Kinds of materials and finishes.
- (6) Parts list and description thereof.

The Engineer and/or Architect may decline to consider any shop drawing that does not contain complete data on the work and full information of related matters.

Fax submittals will not be reviewed.

G-3.02 APPROVAL:

Shop drawings shall be examined by the Contractor prior to his transmitting them to the Engineer and/or Architect. Shop drawings submitted to the Engineer and/or Architect shall bear the Contractor's stamp of approval evidencing that he has examined and checked each drawing and that he has found said drawings to be in accordance with the Contract requirements. Any drawings submitted without this stamp will not be considered by the Engineer and/or Architect and will be returned to the Contractor for re- submission.

If the shop drawings show departures from the Contract requirements, the Contractor shall make specific mention thereof in his letter of submittal and the following shall be submitted:

- (1) Each request shall include a complete description of the proposed substitute and the name of the material or equipment for which it is to be substituted.
- (2) Furnish drawings, cut, manufacturer's printed specifications, performance and test data and any other data or information necessary for a complete evaluation of both the item specified and the proposed substitute item.

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.

Approval of the drawings shall be general and shall not relieve the Contractor of responsibility for the accuracy of such drawings, nor for the quantities of materials and equipment, nor for the proper fitting and construction of the work, nor for the furnishing of materials, tools, equipment, etc., required by this contract and not indicated on the drawings.

No work called for by Shop Drawings shall be done until the said drawings have been approved by the Engineer and/or Architect.

The Contractor shall revise and resubmit the shop drawings as required by the Engineer and/or Architect until approval thereof is obtained.

The City shall retain four (4) copies of all submittals unless the Engineers and/or Architect makes a specific request for additional copies.

<u>Items</u>	<u>Submittals</u>	<u>*Approval</u>
All trade	Fourteen (14) Days	Fourteen (14) Days

*From date of receipt of submittal.

Delays on account of tardy or untimely submittals will not be considered as causes of extension of time of the Contract or increases to the Contract Sum.

G-3.03 JOB SITE:

One (1) copy of all approved submittals SHALL BE available at the Contractor's Office at the job site.

2.3 SECTION 4 MATERIALS AND EQUIPMENT

G-4.01 GENERAL REQUIREMENTS

In the first paragraph, second line, delete the word "specifications" and substitute the words "Contract Documents".

G4.03 REFERENCE TO STANDARDS

The following paragraph shall be added in its entirety:

"Compliance with the Standard Building Code, latest edition, and all local electrical and plumbing codes shall be required. In the event of a conflict in code requirements, the most stringent code or standard shall apply."

G-4.05 EQUIVALENT QUALITY

Add the following sentence to paragraph two: "Any professional fees associated with shop drawing review of materials or equipment submitted for approval as equivalent to that specified shall be borne by the Contractor.

2.4 SECTION 5 INSPECTION AND TESTING

G-5.06 PRELIMINARY FIELD TESTS

G-5.07 FINAL FIELD TEST

A. Add the following sentence to BOTH of the above paragraphs:

The Contractor shall provide, at NO EXTRA COST to the City, ALL labor, tools, equipment, materials, etc., for the Engineer and/or Architect to make any field test that may be required in the judgement of the Engineer and/or Architect.

2.5 SECTION 6 TEMPORARY STRUCTURES

G-6.03 CONTRACTOR'S FIELD OFFICE

a. In the last sentence of this paragraph, add the following words: "...and Shop Drawings".

G-6.03 CONTRACTOR'S FIELD OFFICE

A. Delete this paragraph G-6.03 in its entirety.

2.6 SECTION 7 TEMPORARY SERVICES

G-7.01 WATER, G-7.02 LIGHT AND POWER, AND G-7.03 SANITARY REGULATIONS

The City of Tampa shall provide, at no cost to the Contractor, water, electricity and washroom/toilet facilities for installation of this project. All water and electricity shall be applied and/or connected by the Contractor.

G-7.07 TELEPHONE

The Contractor shall furnish the Engineer with a telephone number(s) by which the Engineer may contact the site.

2.7 SECTION 14 MISCELLANEOUS

G-14.04 USE OF EXPLOSIVES:

Explosives will not be used on the work except when authorized by the Engineer and/or Architect. The use of same, if authorized, shall conform to laws or ordinances which may pertain to the use of same and the utmost care will be exercised by the Contractor so as not to endanger life or property. The Contractor will assume full responsibility in connection with use of any explosives even though authorized. Explosives will not be stored within the City limits.

G-14.05 OWNERSHIP OF MATERIALS:

The removal of any underground and surface structures as required shall be performed in a careful manner to permit salvaging of as much material, such as pipe and brick, also broken section of sidewalk, as practical for use in repair and maintenance of City-owned facilities.

Such acceptable salvaged material remains the property of the City and shall be placed in stock piles so as not to interfere with new construction work but accessible for loading and hauling by the City or by the Contractor within the free haul limit of six (6) miles. The Engineer and/or Architect shall direct the Contractor as to the location of stockpile.

The paving material, such as vitrified brick, asphalt block and other paving materials removed from the excavated areas and suitable for reuse but not reused in the work, shall also be considered the property of the City. The handling of such materials shall be as set forth elsewhere in the Specifications or Special Provisions.

G-14.06 NOTICE OR SERVICE THEREOF:

All notices, which shall include demands, instructions, requests, approvals and claims, shall be in writing.

Any notice to or demand upon the Contractor shall be sufficiently given if delivered to the office of the Contractor specified in the bid (or to such other office as the Contractor may, from time to time, designate to the City in writing), or if deposited in the United States mail in a sealed, postage-prepaid envelope, or delivered, with charges case addressed to such office.

All notices required to be delivered to the City shall, unless otherwise specified in writing to the Contractor, be delivered to the Engineer and/or Architect, Department of Public Works, Municipal Office Building, 4th Floor North,

City Hall Plaza, Tampa, Florida 33602, and any notice to or demand upon the City shall be sufficiently given if delivered to the office of the said Engineer and/or Architect, or if deposited in the United States mail in a sealed, postage- prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to said Engineer and/or Architect or to such other representative of the City or to such other address as the City may subsequently specify in writing to the Contractor for such purposes.

Any such notice or demand shall be deemed to have been given or made as of the time of actual delivery or (in the case of mailing) when the same should have been received in due course of post or (in the case of telegram) at the time of actual receipt, as the case may be.

G-14.07 REQUIREMENTS FOR CONTROL OF THE WORK:

Prior to the start of the work included in this contract, a Preconstruction Conference will be held by the Engineer and/or Architect to be attended by the Contractor and representatives of the various utilities and others for the purpose of establishing a schedule of operations which will coordinate the work to be done under this contract with all related work to be done by others within the limits of the project. The Contractor shall be prepared for this meeting and shall present a comprehensive construction schedule for all items of work to be accomplished by him, which will be used as the basis for the development of an overall operational schedule and a list of subcontractors to be used on this work.

All items of work on this contract shall be coordinated so that progress on each related work item will be continuous from week to week. The progress of the work will be reviewed by the Engineer and/or Architect at the end of each week, and if the progress on any item of work during that week is found to be unsatisfactory, the Contractor shall be required to adjust the rate of progress on that item or other items as directed by the Engineer and/or Architect.

The Contractor shall conduct his operations in such a manner as will result in a minimum of inconvenience to occupants of adjacent homes and business establishments and shall provide temporary access as directed or as conditions in any particular location may require.

G-14.08 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 a Work Directive Change 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."

G-14.09 RESERVED PARKING SIGNS IN PARKING METER AREAS

Not Applicable.

G-14.10 EROSION AND SEDIMENT CONTROL:

During construction, the Contractor shall provide adequate erosion and sediment controls to prevent adverse effects to the environment and public and private property. He shall construct and maintain control structures necessary to prevent erosion and sediment. He shall conduct and schedule construction operations to avoid, prevent, and minimize erosion and sediment. He shall comply with City, County, State, and Federal codes, laws, and

regulations and the plans and specifications for this project pertaining to erosion and sediment prevention and control.

At the Preconstruction Conference, the Contractor shall present a plan for erosion and sediment prevention and control. This plan shall include the operations methods, also temporary and permanent control measures and structures to be used on this project.

G-14.11 ENGINEER'S FIELD OFFICE:

The Contractor shall provide and maintain an adequate field office, which shall be a structure completely separated from the Contractor's field office, for the exclusive use of the Construction Engineer and/or Architect and engineering technicians within the project limits. No additional payment shall be made for this item. Location of said field office shall be as directed by the Engineer and/or Architect.

Contractor shall provide one (1) desk with chair, one (1) four-drawer metal file cabinet with lock, plan rack to hold a minimum of eight (8) separate sets of plans and one (1) plan table, top shall be minimum of 3'-0" wide x 6'-8" long; also adequate heating, air conditioning, lighting and one (1) window, 36"x36" minimum size, in each of four (4) walls.

G-14.12 PROJECT SIGNS:

The Contractor shall furnish and install, as directed by the Engineer and/or Architect, a project sign of design, size, color, etc., as per drawing page SIGN-1 and SIGN-2.

G-15.0 NOTIFICATION TO CONTRACTORS:

All Contractors working in City of Tampa buildings and facilities that contain ACM will be provided with a written notice, including contract custodial firms. The notice when applicable will advise Contractors about the possibility of encountering ACM while working for the City and will require Contractors to become familiar with locations of ACM within their work areas. The Contractor Notice shall include the name and phone number of the designated Building Asbestos Contact Person assigned to that building/facility. This notice is provided in Appendix C.

Appendix C

Contractor Notification Requirements

Asbestos-Containing Material (ACM) may be present in the facility. The presence of ACM does not necessarily mean that a hazard exists; however, a hazard may be created when ACM is disturbed and asbestos fibers become airborne. The best way to maintain a safe environment is to avoid the disturbance of ACM.

It is possible that you may encounter ACM while working in the facility. On the bulletin board, there is a summary of known locations of ACM in that building. The summary may or may not be all inclusive. Therefore, workers must exercise caution and be watchful for materials that might contain asbestos. Avoid disturbing ACM or suspected ACM as you carry out your work.

If your work necessitates the disturbance of ACM you shall take whatever precautions that are necessary to protect human health and the environment from asbestos fibers. At minimum, you will comply with all Federal, State, and Local responsible for assuring that you are medically certified, trained, and equipped with the proper personal protective devices for safe handling of ACM. You must notify the designated Building Asbestos Contact Person before disturbing any asbestos-containing materials in City-Owned buildings. The designated Building Asbestos Contract Person is listed on the bulletin board with the asbestos location summary.

If you need additional information regarding ACM in a particular building or would like to see a copy of the Operations and Maintenance Plan, contact the Building Asbestos Contact Person responsible for the building for which you will be working.

Comply with all regulatory requirements for removal and disposal.

NO TEXT FOR THIS PAGE

SPECIFIC PROVISIONS

SP-1.P 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.TP.C Permits

The Contractor shall have in his possession the proper license to perform the work before submittal of his bid and shall obtain any required 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.

County permit fees will 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, and with Hillsborough County building regulations.

The Contractor is responsible to schedule and coordinate with the Hillsborough County Building Department all required inspections and tests for all phases of work to obtain final approval thereof.

The Contractor is encouraged to contact the County's Building Department prior to commencement of work to ascertain its respective requirements.

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-8 Construction Start

Construction will 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-12 Releasing Facilities for Use

It is the intent of these Specifications that all newly constructed 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.

SP-14 Contractor Emergency Response Time

The Contractor must 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.

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.PS Salvage

All salvageable material, as determined by the Engineer, shall be removed by the Contractor and shall remain the property of the City.

All such salvaged items shall be removed by the Contractor, delivered, and unloaded at a location within the Department's service area, as directed by the Engineer. The Contractor shall include all necessary labor and equipment to unload the materials at a location designated by the City. The cost of removing, disposing, delivering, and unloading as salvage items of pipe and appurtenances shall be included in the various Contract Unit Prices or the Lump Sum Price, as applicable, and no separate payment will be made therefor.

SP-17 Sequence of Operations

The Contractor shall develop with the Engineer a complete schedule of operations which, in the opinion of the Engineer, will permit use of the facility at the earliest possible date.

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-23 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-68 Water, Light and Power

Delete Article G-7.01 Water and G-7.02 Light and Power on Page G-14 from GENERAL CONDITIONS. The City currently provides water and electrical power facilities to the sites. The Contractor may use the electrical and water sources as presently configured. If necessary to modify, extend, or relocate either the electrical or water facilities to facilitate construction, all costs shall be the responsibility of the Contractor.

SP-70 Electrical Equipment Certification

All equipment and materials shall be UL listed or listed and labeled as complying with the requirements of a Southern Building Code Congress International, Inc. (SBCCI) recognized testing laboratory, for the particular application, whenever available.

An electrical/mechanical system that is not available as a standard UL listed assembly (e.g. industrial equipment of unique configuration or custom design) shall be composed of listed components, whenever they are available, and constructed in accordance with the design documents, and the latest nationally recognized industry standards. The Contractor shall certify in writing that the equipment satisfies the above requirements and that it has been installed in compliance with the latest edition of the National Electrical Code (NEC) and Chapter 5 of the City of Tampa Code. The certification shall be submitted to the City's Electrical Inspection Bureau, with a copy sent to the Sanitary Sewer Department's Resident Engineer, prior to final inspection. A sample certification document is attached to these Specific Provisions as a formatting guide.

The Contractor shall secure all required permits and arrange for progress and final inspections as the work develops.

SP-71 Electrical Work

Where definite requirements are not set forth in the Specifications, all electrical equipment, materials, and work under this Division shall comply with the requirements of the Occupational Safety and Health Act (OSHA) and shall be in accordance with applicable ANSI, IEEE, IPCEA, and NEMA standards. The work shall be performed in compliance with the latest issue of the NEC, all applicable state and municipal regulations and codes, and the service rules of the Tampa Electric Company, unless otherwise specified or directed. All equipment and materials shall be listed and labeled as complying with the requirements of a Southern Building Code Congress International (SBCCI) recognized testing laboratory for the particular applications wherever available.

Where listing is not available for the device as a whole, refer to the provision entitled "Electrical Equipment Certification" for submittal requirements.

SP-72 Operation and Maintenance Manual

The Contractor shall prepare and submit to the Engineer nine copies of an Operation and Maintenance Manual for all equipment and associated control systems furnished and installed under this Contract. When the work reaches 75 to 80 percent completion, the Contractor shall submit to the Engineer for approval two copies 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 two-copy submittal, the Contractor shall furnish to the Engineer the remaining seven copies 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 with the request for final payment.

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 Type No. S-43772 as manufactured by Marshall-Jackson Co., Chicago, IL, or equal. 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 nine copies 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.

SP-73 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-75 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-81 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 such equipment, and instructing City personnel in the operation and maintenance of such equipment for which such specialized services are specified, directed, or required.

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 various Contract Unit Price Items, or in the total Lump Sum Price, as applicable, and no separate payment will be made therefor.

SP-82 Access

GENERAL

Access to the site of the work shall be from Guy Verger Boulevard. The Contractor shall construct, as required for his purposes or as necessary, such temporary access roads between the public roads and the site as may be required for movement of heavy construction equipment and material delivery vehicles at locations approved by the Engineer.

Access facilities shall be adequate for equipment movement and shall provide for surface drainage. Areas used for temporary access, haul roads and access from public or plant roads shall be graded and restored to proposed site grade conditions, all to the satisfaction of the Engineer.

Access to existing plant roads by the Contractor will be restricted to those roads so designated. The Contractor will not be permitted to use any existing plant roads not designated for such use. All existing plant roads which are designated for use by the Contractor shall be maintained in serviceable condition by the Contractor during construction. Any damage to such roads caused by construction operations shall be promptly repaired to keep the road in serviceable condition. Any accumulations of soil, gravel or any other debris deposited on such plant roads as a result of construction operations shall be promptly removed by the Contractor to his own place of disposal.

Additionally, all existing plant roads which are designated for use by the Contractor shall be open at all times for unrestricted use by plant operations, maintenance and inspection service.

In NO case will the Contractor be permitted to use the monitored plant entrances for the passage of heavy construction equipment, concrete trucks or any other large vehicles.

PARKING

All employees of the Contractor shall park personal vehicles within the Contractor's storage and field office site. Contractor employees will not be permitted to drive personal vehicle onto the construction site. The Contractor shall provide transportation for all employees between the Contractor's storage and field office site and the work areas on the construction site.

IDENTIFICATION

The Contractor shall provide a Photo I.D. card for each employee. Each photo I.D. card shall be encapsulated in plastic and be provided with a clip for fastening to each employee's apparel. Each photo I.D. card shall be approximately 2 inches by 3 inches in size and shall include the following:

1. Employee photograph mounted on the left half of the card.
2. Name of employee and name of Contractor located on the right half of the card.

Each employee shall display the photo I.D. card on outer apparel at all times when on the plant site.

Any person found on the site without the required photo I.D. card will be directed to leave the site immediately.

The cost of construction, modification, maintenance, removal and restoration of all access facilities, and existing plant roads including excavation, backfilling, select fill material, paving material, grading, drainage and other such work, and all costs associated with limited access to the site, employee parking and transportation and photo I.D. cards, except as specified otherwise shall be included in the lump sum Contract Item for Structures and Equipment and no separate payment will be made therefor.

SP-84 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 include painted or plastic tape banding at 10-foot intervals. The Engineer will select the colors. Underground pipelines with plastic tape wrapping shall be wrapped with colored tape and include additional colored bands as directed. Polyethylene or hot bituminous wrapped underground pipelines shall have plastic tape bands. Polyethylene wrapping for ductile iron sewage or force main piping shall be green. Tape bands shall be placed at 10-foot intervals and all colors shall be selected by the Engineer.
2. All equipment and slide gates 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. Nameplates shall be attached to equipment bases in accessible locations. Nameplates shall be fastened, in a permanent manner arranged not to damage equipment, with not less than four stainless steel fasteners. All nameplates shall be of the same size (approximately 3- by 8-inch) and shall conform to the following standard sample:

Sewage Pump	(Name of item)
SC-P-1	(General type of designation, final list furnished by Engineer)
(12 digit number)	(Furnished by Engineer)

Lettering shall be block style in size and spacing to suit the nameplate. A sample nameplate including fastenings shall be submitted to the Engineer for approval prior to manufacture of any of the nameplates. Stainless steel identification nameplates shall not be painted.

3. Piping shall be identified with a designation and directional flow arrow. The designation will be furnished by the Engineer. The designation will comprise a maximum of 20 letters. The designations and flow arrows shall be painted on after completion of color coding using suitable stencils and colors. Designations and flow arrows shall be arranged to be clearly in view from the normal operating or access space all as directed and approved by the Engineer. Designations and flow arrows shall be located along straight runs at intervals of not more than 50 feet, near valves, branches and junction points, and where pipes pass through walls or ceilings. Underground piping wrapped with polyethylene shall be provided with colored material selected by the Engineer.

The cost of piping and equipment identification 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.

SP-87.TP Use of Site for Storage and Field Office

Space, on the site, for storage and field office for the Contractor shall be as directed by the Engineer. Any structures or facilities needed for storage or field office shall be constructed by the Contractor at his own expense and no separate payment will be made therefor. All security requirements for such facilities shall be provided and maintained by the Contractor.

Upon completion of the work, and as directed, the Contractor shall clean up the areas, remove any temporary facilities and finish grade as necessary, all as approved.

SP-129.TP 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 two (2) sets of "As-Built" plans. 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.

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.

SP-133 Tampa Port Authority Access

The Tampa Port Authority has restricted access in accordance with Florida Statute 311.12. Procedures for Tampa Port Authority access are available at <http://www.tampaport.com/>. All costs to comply with these procedures shall be included in the total Price for this project, and no separate payment shall be made therefore.

* * *

NO TEXT FOR THIS PAGE

SPECIAL CONDITIONS

1.0 PRECONSTRUCTION BRIEFING:

The Contractor, upon receiving notice that he has been awarded the contract for the construction of the project, shall make an appointment with the Engineer and/or Architect for said briefing. The Contractor shall bring to this meeting the following:

1. Contract Documents not yet submitted.
2. A detailed Job Progress Schedule.
3. Samples, questions, etc., he feels necessary.
4. List of subcontractors.

Failure to bring the above items to the meeting will result in cancellation of meeting. Once items have been submitted, meeting will be rescheduled by the City. Site access and commencement of work will not be allowed during period between meetings.

Contractor shall have representatives present at meeting that are familiar with, and conversant on, the scope of the work and Contract Document requirements. Failure to have such persons present will also result in cancellation and rescheduling of meeting until such a time when condition is corrected.

Elapsed time as a result of the Contractor's failure to comply with above will not result in an extension of contract time.

2.0 SITE REVIEW:

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 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.

The Contractor shall immediately, upon entering project site for the purpose of beginning work, review project site with the Engineer and/or Architect for the purpose of selecting area(s) to place materials for storage.

The Contractor must exercise proper precaution to verify all figures shown or indicated on the drawings, all existing trees, paved areas; utilities, etc., shall be located before beginning any work, and he shall be held responsible for any error resulting from his failure to exercise such precaution.

2.1 LAYING OUT WORK:

The Contractor shall locate all general reference points and take necessary action to prevent their destruction; lay out his own work and be responsible for all lines, elevations, measurements, grading, trenching, backfilling, utilities and other work to be executed by him for a complete project under this contract.

The Contractor shall lay out all work and have final approval by the Engineer and/or Architect before installation begins. Contractor shall be held responsible for any error resulting from his failure to exercise such approval. Said errors shall be corrected by the Contractor at NO EXTRA COST to the City.

The Contractor shall coordinate with the Parks Department and shall identify each and every tree to remain prior to the start of work. The specific trees to remain shall be approved by the Parks Department.

The final location of all work to be performed shall be made jointly by the Engineer and/or Architect and the Contractor at the project site.

3.0 SAFETY AND HEALTH STANDARDS:

The performance of all construction under this contract shall conform to ALL Local, State, Federal Occupation Safety and Health Act Standards.

At the end of each work day, all work areas shall be left in a safe condition. Barricades and/or warning devices shall be provided for at any open excavations or barriers on the project site.

The Contractor's attention is directed to paragraphs Article 3.07 (page A-10) and Article 12.03 (page A-31) of the Agreement, and paragraph G-7.04 (page G-18) of the General Provisions.

4.0 INFORMATION FOR COLOR SCHEDULES:

Not later than thirty (30) calendar days after authorization to proceed with contract work, the Contractor shall submit to the Engineer and/or Architect the names of all manufacturers and trade names for all materials involving selection based upon color or texture or other design appearance features which are to be used in this project. Where samples are necessary for such selection, furnish same.

If such information is not furnished by Contractor within thirty (30) day period, the Engineer and/or Architect will select colors and textures from products named in the Contract Documents.

5.0 RESPONSIBILITY OF CONTRACTOR:

The Contractor shall take all necessary precautions to protect all project surfaces and adjoining areas from mechanical damage from tools, equipment, materials, supports, etc., and shall provide adequate protection from leaking lubricants or fluids from his equipment.

Damage to said project surfaces and adjoining areas caused by a lack of protection or negligence by the Contractor shall be repaired and/or replaced at NO EXTRA COST to the City and to the full satisfaction of the Engineer and/or Architect.

The Contractor and all subcontractors are charged with the protection of the work and property, but the final responsibility for these provisions rests with the Contractor who shall take complete charge of the project site from start to finish of work.

The Contractor shall take particular precautions to protect existing trees and plant material. All trees and other plant material to remain shall be marked by the City prior to start of work.

Excavation, earthwork or sitework within the drip line of existing trees shall be done either manually or by methods approved by the City of Tampa Parks Department.

If the Contractor damages any tree or plant material in any way he shall be required to replace the damaged tree or plant material as follows:

1. Trees
 - a. Replace a 6" caliper or less with a 6" caliper of the same species.
 - b. Replace a 7"-10" caliper with two (2) 6" caliper of the same species.
 - c. Replace a 10"-15" caliper with three 6" caliper of the same species.

- d. Replace a 16"-20" caliper with five (5) 6" caliper of the same species.
- e. Replace a 21"-36" caliper with ten (10) 6" caliper of the same species.

2. Plant Material

Replace any damaged plant material with an equal size and quantity of the same material.

The replaced trees and plant material shall be guaranteed by the Contractor for a period of six (6) months.

6.0 COORDINATION WITH N.I.C. ITEMS:

The Contractor shall give to the Engineer and/or Architect, in writing, a time schedule for the installation or removal of all N.I.C. items at the beginning of the project. Failure of the Contractor to supply the Engineer and/or Architect with said schedule shall not be used for reason of time extension by the Contractor.

7.0 ELECTRICAL SERVICE LOCATION:

The Contractor shall verify and coordinate the service location with the local power company and the Engineer and/or Architect.

The Contractor shall coordinate with the local power company and shall include in his bid all costs for electrical service to work area(s) under this Contract, including but not limited to new service, connections from existing and/or new service and all required labor, equipment, materials etc. and all other associated electrical work.

8.0 SCHEDULING:

The Contractor shall provide the City with a detailed schedule prior to start of work.

The schedule shall be a fully developed, horizontal bar- chart type Contractor's construction schedule. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".

Unless otherwise directed or approved, prepare schedule on a single 8-1/2" X 14" sheet of plain bond white paper.

Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

Contractor shall also prepare schedule in accordance with applicable portions of Section 4.02 of the Agreement.

9.0 ASSIGNMENT OF CONTRACT: Not applicable.

10.0 WORKMANSHIP AND MATERIALS:

Workmanship and materials shall be installed in accordance with accepted standards of the specific trade, as defined by the applicable recognized trade association(s). In the event of a conflict between these trade standards and the Contract Documents, the conflict shall be brought to the Engineer's and/or Architect's attention writing and the final decision shall be made by the Engineer and/or Architect.

11.0 RECORD DRAWINGS:

During the course of the work, Contractor shall maintain, at the site, a clean undamaged set of the Contract Documents. Contractor shall mark set, on a daily basis, with location and progress of all contract work, including but not limited to:

1. Sewer, water, stormwater and irrigation fabrication drawings showing to scale all manholes, all distances and angles between manholes, line dimension, grid co-ordinates, trunk lines, inverts and cleanouts,
2. Fencing, roadway, parking and sleeving,
3. Electrical service, and
4. General building location.

Drawings shall be on site at all times and available for review by the City. Failure of Contractor to have drawings on site and/or up to date may result in suspension of work until situation is corrected. Extension of contract will not be granted for such condition.

At conclusion of work, the Contractor shall provide the City with a complete set of mylar Record Drawings incorporating changes described above. The marked set of drawings shall also be submitted to the City at the same time.

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.

END OF SC



City of Tampa - Sub-(Contractors/Consultants/Suppliers) Payments

[] 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	Company Name Address Phone & Fax	Total Sub Contract Or PO Amount	Dollar Amount Previously Paid	\$ To Be Paid For This Period
Trade/Work Activity				Sub Pay Period Ending Date
<input type="checkbox"/> Sub <input type="checkbox"/> Supplier				
Federal ID				
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$

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: _____

DMI form 30 (rev. 02/02/09) Pg __ of __ [] See attached documents

Instructions for completing The Sub-(Contractors/Consultants/ Suppliers) Payment Form

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 directly follow are for the form heading information pertaining to the project and prime.

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. 05/01/07 – 05/31/07)

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 if 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.

Dollar Amount Previously Paid. Indicate all dollars paid to a subcontractor as of the payment request. (Do not include amount to be paid for this period)

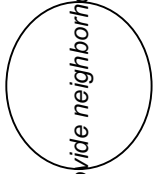
\$ To Be Paid for this Period. Provide dollar amount of dollars requested for the pay period.

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.

City to provide neighborhoods decal



Project Manager :

Don Cermeno

DPW Construction Engineer

City of Tampa

Phone : (813) 635-3400

Email : don.cermeno@tampagov.net

contractor name here

City of Tampa Improvement Project

brief project description (2 - 3 lines)

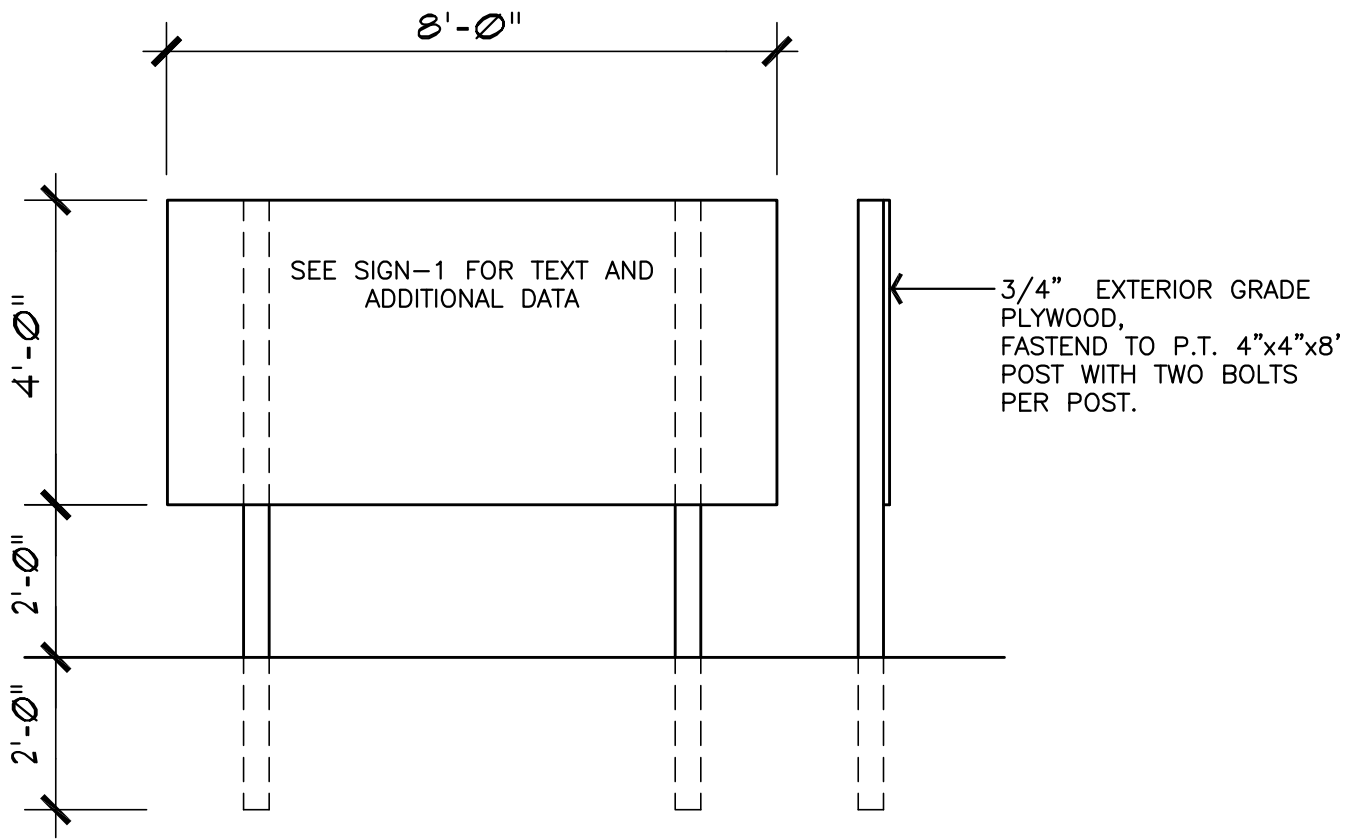
total appropriated cost (round off) - duration of construction

Scheduled for completion in (date)

supplemental project description (max. 2 lines)

For information, please call : (813) 635-3400

- NOTES :
1. Letter Color : Black, Font : Times New Roman, bold.
 2. Background Color (front, back and edges) : Benjamin Moore Paint, Natural Wicker OC-1.
 3. Post Color : Black.
 4. Contractor shall verify text with the City prior to sign fabrication.



SECTION 01010 - SUMMARY OF WORK

1.0 GENERAL:

The work shall consist of furnishing all materials, labor, equipment, tools, and all items and services required for the complete construction in conformity with Contract Documents of:

Howard F. Curren AWTP Administration Building HVAC Improvements
at
2700 Maritime Boulevard
for the
City of Tampa

All construction work and materials, in addition to complying with requirements of Contract Documents, shall fully comply with all requirements of local building codes, all ordinances, and regulations of other Federal, State and public authorities having jurisdiction over this type of work in the given area.

2.0 SCOPE:

The work shall include but not be limited to, the replacement of 2 air handlers, air duct cleaning, installation of access doors on ductwork, testing and balancing of HVAC system, replacement of the existing boiler, installation of new 200 ton chiller, all associated piping, electrical work with all associated work required for a complete project, as shown and indicated on the Drawings and in the Specifications.

3.0 LEGAL DESCRIPTION OF PROJECT SITE:

Legal description as shown on the drawings, Sheet 0.1.

4.0 VERIFICATION OF OWNER'S SURVEY DATA:

Prior to commencing any work, the Contractor shall satisfy himself as to accuracy of all survey data which shall affect his work as indicated in these plans and specifications and/or provided by the City.

Should the Contractor discover any inaccuracies or errors which will affect his work, he shall notify the Engineer and/or Architect in order that proper adjustments can be ordered.

The exact location of the building and related items shall be determined on site jointly by the Contractor and the Engineer and/or Architect. NO work shall commence until said final approval of the locations is made by the Engineer and/or Architect.

5.0 CONTRACT DOCUMENTS:

- a. BIDDING REQUIREMENTS
- b. GENERAL PROVISIONS, SUPPLEMENTARY GENERAL PROVISIONS, AND SPECIAL CONDITIONS

6.0 SPECIFICATIONS: (DATED: March, 2009)

Divisions: 1, 15, 16.

7.0 DRAWINGS: (DATED: March, 2009)

Sheets:

Cover Sheet, 0.1, M0.1, MD1.1, MD1.3, M1.1, M1.1A, M1.1B, M1.2A, M1.2B, M1.2C, M1.3, M2.1, M2.2, M3.1, M4.1, E1.1, E1.2.

8.0 ADDENDA AND LETTERS OF CLARIFICATION:

All addenda and letters of clarification issued prior to bid opening time date.

SECTION 01020 - ALLOWANCES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

SUMMARY

This Section includes administrative and procedural requirements governing allowances.

Types of allowances include the following:

Contingency allowances.

SELECTION AND PURCHASE

SUBMITTALS

Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

CONTINGENCY ALLOWANCES

Use the contingency allowance only as directed by the Owner.

Work Directive Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

At Project closeout, credit unused amounts remaining in the contingency allowance to the Owner by Change Order.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

EXAMINATION

Examine products covered by an allowance promptly upon delivery for damage or defects.

PREPARATION

Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

SCHEDULE OF ALLOWANCES

Allowance No. 1: Include a contingency allowance of \$20,000.00 for use according to the Owner's instructions. The allowance shall be included in the Base Bid.

END OF SECTION 01020

SECTION 01040 - PROJECT COORDINATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

SUMMARY

This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

- Coordination.
- Administrative and supervisory personnel.
- General installation provisions.
- Cleaning and protection.

COORDINATION

Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.

Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

Make adequate provisions to accommodate items scheduled for later installation.

Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

- Preparation of schedules.
- Installation and removal of temporary facilities.
- Delivery and processing of submittals.
- Progress meetings.
- Project Close-out activities.

Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

SUBMITTALS

Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

Show the interrelationship of components shown on separate Shop Drawings.

Indicate required installation sequences.

Refer to Division-15 Section "Basic Mechanical Requirements," and Division-16 Section "Basic Electrical Requirements" for specific coordination Drawing requirements for mechanical and electrical installations.

Staff Names: At the Preconstruction Conference, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

GENERAL INSTALLATION PROVISIONS

Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

Recheck measurements and dimensions, before starting each installation.

Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

CLEANING AND PROTECTION

During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

- Excessive static or dynamic loading.
- Excessive internal or external pressures.
- Excessively high or low temperatures.
- Thermal shock.
- Excessively high or low humidity.
- Air contamination or pollution.
- Water or ice.
- Solvents.
- Chemicals.
- Light.
- Radiation.
- Puncture.
- Abrasion.
- Heavy traffic.
- Soiling, staining and corrosion.
- Bacteria.
- Rodent and insect infestation.
- Combustion.
- Electrical current.
- High speed operation,
- Improper lubrication,
- Unusual wear or other misuse.
- Contact between incompatible materials.
- Destructive testing.
- Misalignment.
- Excessive weathering.
- Unprotected storage.
- Improper shipping or handling.
- Theft.
- Vandalism.

END OF SECTION 01040

SECTION 15010

BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Requirements of the Contract Forms, Conditions of the Contract, Specifications, Drawings, and Addenda and Contract Modifications (the Contract Documents), apply to the requirements of each Section of Division 15.
- B. Conflicts: Nothing contained in this Section shall be construed to conflict in any way with other provisions or requirements of the Contract documents. The intent is that this Section will take precedence. Where differences arise, the Engineer shall decide which directions or instructions take precedence.

1.02 SUMMARY

- A. General: Unless an item is specifically mentioned as being provided by others, the requirements of Division 15 Contract Documents shall be completed. The systems, equipment, devices and accessories shall be installed, finished, tested and adjusted for continuous and proper operation. Any apparatus, material or device not shown on the Drawings but mentioned in these Specifications, or vice versa, or any incidental accessories necessary to make the project complete and operational in all respects, shall be furnished, delivered and installed without additional expense to the City. Include all materials, equipment, supervision, operation, methods and labor for the fabrication, installation, start-up and tests necessary for complete and properly functioning systems.

1.03 APPLICABLE STANDARDS

- A. Code Compliance: Refer to Division 1. As a minimum, unless otherwise indicated, comply with all rules, regulations, standards, codes, ordinances and laws of local, state and federal governments and the amendments and interpretation of such rules, regulations, standards, codes, ordinances and laws of local, state and federal governments by the authorities having lawful jurisdiction.
- B. ADA: Comply with the requirements of the Americans with Disabilities Act (ADA).
- C. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- D. Florida Building Code 2004: Conform in strict compliance to the Florida Building Code (FBC), 2004 Edition and the amendments which are enforced by the local authority having jurisdiction.
 - 1. Florida Building Code – Mechanical 2004 Edition (with latest revisions)
 - 2. Florida Building Code – Plumbing 2004 Edition (with latest revisions)

3. Florida Building Code – Fuel Gas 2004 Edition (with latest revisions)
 4. Florida Building Code – Chapter 13 Florida Energy Efficiency for Building Construction 2004 Edition (with latest revisions)
- E. NATIONAL FIRE PROTECTION (NFPA) Standards
1. NFPA-70, National Electrical Code, 2002 Revision
 2. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilation Systems, 2002 Revision
 3. NFPA-101A, Guide to Alternative Approaches to Life Safety, 2001 Revision
- F. Notification: Comply with all of the requirements of the Federal "Right-To-Know" Regulations and the Florida "Right-To-Know" Law and provide notification to all parties concerned as to the use of toxic substances.

1.04 DRAWINGS AND SPECIFICATIONS

- A. Intent: The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
- B. Equipment Placement: The drawings are diagrammatic, intended to show general arrangement, capacity and location of various components, equipment and devices. Each location shall be determined by reference to the general building plans and by actual measurements in the building as built. Reasonable changes in locations ordered by the Engineer prior to the performance of the affected Work shall be provided at no additional cost to the City.
- C. Drawing Scale: Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets, transitions and fittings may not be shown but shall be provided at no additional cost.
- D. Conflict: In the event of a conflict, the Engineer will render an interpretation in accordance with the General Conditions.

1.05 DEFINITIONS

- A. Provide/Install: The word "provide" shall mean furnish, install, connect, test, complete, and leave ready for operation. The word "install" where used in conjunction with equipment furnished by the City or under another contract shall mean mount, connect, complete, and leave ready for operation.
- B. Concealed: The surface of insulated or non-insulated piping, ductwork or equipment is concealed from view when standing inside a finished room, such as inside a chase or above a ceiling.

- C. Exposed: The surface of insulated or non-insulated piping, ductwork or equipment is seen from inside a finished room, such as inside an equipment or air handling unit room.
- D. Protected: The surface of insulated or non-insulated piping, ductwork or equipment on the exterior of the building but protected from direct exposure to rain by an overhang, eave, in an unconditioned parking garage or building crawl space.
- E. Unprotected: The surface of insulated or non-insulated piping, ductwork or equipment on the exterior of the building and exposed to rain.
- F. Abbreviations: Abbreviations, where not defined in the Contract Documents, shall be interpreted to mean the normal construction industry terminology, as determined by the Engineer. Plural words shall be interpreted as singular and singular words shall be interpreted as plural where applicable for context of the Contract Documents.

1.06 SHOP DRAWINGS

- A. General: Refer to paragraph entitled "SUBMITTAL" in this section. Include the following data:
 - 1. Shop Drawings:
 - a. Submit shop drawings for the following:
 - (1) Each piping system

1.07 SHOP DRAWINGS FOR PIPING SYSTEMS

- A. Requirements: Make Shop Drawings for piping systems at a minimum scale of 1/4 inch per foot in AutoCAD Version 2000 (or later) and print on reproducible transparencies to verify clearances and equipment locations. Show required maintenance and operational clearances. Identify Shop Drawings by project name and include names of Engineer, Engineer, Contractors, Subcontractors and supplier, date in Shop Drawing title block. Number drawings sequentially and indicate:
 - 1. Architectural backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.
 - 2. Fabrication and erection dimensions.
 - 3. Arrangements and sectional views.
 - 4. Necessary details, including complete information for making connections to equipment.
 - 5. Descriptive names of equipment.

6. Modifications and options to standard equipment required by Contract Documents.

- B. Stamp Area: Leave 4 inch by 2-1/2 inch blank area near title block for Engineer's shop drawing stamp. The acceptance of a shop drawing by indicating "APPROVED" does not relieve the contractor from full compliance with the sizes and equipment connections shown on the contract documents unless the changes are specifically indicated on the shop drawing.
- C. Reference Key: Indicate by cross-reference the Contract Drawings, notes, or Specification paragraph numbers where item(s) occur in the Contract Documents.
- D. Additional Requirements: See specific Sections for additional requirements.

1.08 MANUFACTURER'S CHECKOUT

- A. Start-up and Checkout: At completion of installation and prior to performance verification, a factory-trained representative of the manufacturer shall provide start-up and checkout service. After the performance verification the manufacturer's representative shall examine performance information and check the equipment in operation, and sign "Check-Out Memo" for the record. Submit a copy of Memo on each item of equipment where indicated in individual sections of these specifications for inclusion in each Technical Information Brochure. The "Check-Out Memo" shall be included with the performance verification data. Do not request "Instruction in Operation Conference" or request final inspection until Memos have been submitted and found acceptable.

1.09 INSTRUCTION TO City

- A. General: Instructions to the City shall be by competent representatives of the manufacturers involved, with time allowed for complete coverage of all operating procedures. Provide classroom instruction and field training in the design, operation and maintenance of the equipment and troubleshooting procedures. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar provisions of the systems. On the date of substantial completion, turn over the prime responsibility for operation of the mechanical equipment and systems to the Cities operating personnel.
- B. Training Period: Unless otherwise indicated training periods shall encompass the following number of hours of classroom and hands-on instructions with a maximum period of 4 hours per day for either. Mixing classroom instructions and hands on training in the same day is preferable.
 - 1. Training periods:
 - a. 4 hours Classroom

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Specified Products: Manufacturer's names and product model numbers indicated on the drawings and in these specifications establish the type, style, quality, performance, and sound rating of the desired product. Listing of other manufacturers indicates that their equivalent products would be acceptable if they meet the specification requirements, the specific use and installation shown on the drawings, including space and clearance requirements, and the energy consumption and efficiency of the specified product. The listing of additional manufacturers in no way indicates that the manufacturer can provide an acceptable product.
- B. Space Requirements: All manufactured products furnished on this project must have the required space and service areas indicated in the manufacturer's printed literature or shown on their shop drawing. When the manufacturer does not indicate the space required for servicing the equipment, the space shown on the drawings or as required by the Engineer must be provided.

2.02 MATERIAL AND EQUIPMENT

- A. General: Material and equipment used shall be produced by manufacturers regularly engaged in the production of similar items, and with a history of satisfactory use as judged by the Engineer.
- B. Specified Equipment: Equipment shall be the capacity and types indicated or shall be equivalent in the opinion of the Engineer. Material and equipment furnished and installed shall be new, recently manufactured, of standard first grade quality and designed for the specific purpose. Equipment and material furnished shall be the manufacturer's standard item of production unless specified or required to be modified to suit job conditions. Sizes, material, finish, dimensions and the capacities for the specified application shall be published in catalogs for national distribution. Ratings and capacities shall be certified by a recognized rating bureau. Products shall be complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- C. Compatibility: Material and equipment of one and the same kind, type or classification and used for identical or similar purposes shall be made by the same manufacturer. Where more than one choice is available, select the options which are compatible with other products already selected. Compatibility is a basic general requirement of product selection.

PART 3 - EXECUTION

3.01 WORKMANSHIP

- A. General: The installation of materials and equipment shall be done in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and

craftsmanship needed to produce a first-quality installation. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks. All materials and equipment shall be installed per the manufacturer's written requirements.

- B. **Acceptable Workmanship:** Acceptable workmanship is characterized by first-quality appearance and function which conforms to applicable standards of building system construction and exhibits a degree of quality and proficiency which is judged by the Engineer as equivalent or better than that ordinarily produced by qualified industry tradesmen.
- C. **Performance:** Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Engineer, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship in the opinion of the Engineer, shall be removed and reinstalled by qualified craftsmen at no change in the contract price.

CLEANING AND PROTECTION

- D. **Coordination of Cleaning of Existing coils:** Protection of existing facilities and personnel during cleaning is mandatory. Some special areas are "clean rooms" and need extra care. Coordination with lab operations must occur prior to work commencing with a schedule of work provided.
- E. **Installation of New Air Handling units:** AHUs units will have to be broken apart to move into the Mechanical Room. Contractor and supplier shall have replacement gaskets to reseal unit. The reuse of existing gaskets will not be allowed. Change out of AHUs shall be coordinated to occur on weekends. Only one existing AHU will be taken out service at a time. Demolition of an existing unit will not start before 5PM on Friday and installation of the replacement unit shall be completed by 7PM Sunday. No work shall begin unless all equipments and all personnel are available and ready at the schedule start.
- F. **Equipment Protection:** Protect fan motors, switches, equipment, fixtures, and other items from dirt, rubbish and foreign matter. Do not operate air-handling equipment if the building is not clean or if dust can enter the coils or the fan housings.
- G. **Equipment Cleaning:** Thoroughly clean equipment and entire piping systems internally upon completion of installation and immediately prior to final acceptance. Open dirt pockets and strainers, blow down each piping system and clean strainer screens of accumulated debris. Remove accumulated dirt, scale, oil and foreign substances. Thoroughly wipe clean internal surfaces of ductwork and air handling units prior to request for substantial completion. (See para. 3.2 above.)

- H. Building Cleanup: Remove debris, rubbish, leftover materials, tools and equipment from work areas and site. Clean tunnels and closed off spaces of packing boxes, wood frame members and other waste materials used in the installation. Final acceptance shall not be approved until site is cleaned.
- I. Fixture Cleanup: Remove temporary labels, stickers, etc., from fixtures and equipment. Do not remove permanent nameplates, equipment model numbers, ratings, etc.
- J. Filter Replacement: Provide filters, with the same efficiency rating as required for the final installation, for the protection of the air moving equipment and ductwork continuously throughout the construction phase. Provide a new set of clean filters for the test and balance of the air side equipment.
- K. Protection of Finished Installation: Where installation is required in areas previously finished by other trades, protect the area from marring, soiling or other damage.
- L. Air Handling Unit Operation During Construction Phase: Do not operate air handling equipment during building construction phase unless filter fabric is fastened to all duct systems' inlets and all specified and scheduled air filters are installed to minimize dirt entry into ductwork and air moving equipment. When running air handling units to dry out the building, control the building temperature to drop very slowly, and verify all HVAC insulation is completed and doors and windows are installed and closed, to prevent condensation of water from humid air on building interior surfaces, equipment, materials and ductwork.

3.02 CORRECTION OF WORK

- A. General: At no additional cost to the City, rectify discrepancies between the actual installation and contract documents when in the opinion of the T&B Agency or the Engineer the discrepancies will affect system balance and performance.
- B. Drive Changes: Include the cost of all pulley, belt, and drive changes, as well as balancing dampers, valves and fittings, and access panels to achieve proper system balance recommended by the T&B Agency.

3.03 COORDINATION AND ASSISTANCE

- A. General: Provide all labor, equipment, tools and material required to operate the equipment and systems necessary for the testing and balancing of the systems and for the adjustment, calibration or repair of all electric or pneumatic automated control devices and components. These services shall be available on each working day during the period of final testing and balancing.
- B. Drawings and Specifications: Provide to the T&B Agency a complete set of project record drawings and specifications and an approved copy of all HVAC shop drawings and equipment submittals. The T&B Agency shall be informed of all changes made to the system during construction, including applicable change orders.

- C. Coordination: Coordinate the work of all trades and equipment suppliers to complete the modifications recommended by the T&B Agency and accepted by the Engineer. Cut or drill holes for the insertion of air measuring devices as directed for test purposes; repair to as-new condition, inserting plastic caps or covers to prevent air leakage. Repair or replace insulation and re-establish the integrity of the vapor retardant.

3.04 PREPARATIONS FOR PERFORMANCE VERIFICATION

- A. Verification: Prior to commencement of the balancing by the T&B Agency, the Contractor shall verify in writing:
1. That air filters have been replaced and are in clean condition.
 2. That linkages between dampers and their actuators are secure, non-overloading and non-binding.
 3. That ductwork specialties are in their normal operating positions.
 4. That fans are operating at the correct rotation and specified RPM.
 5. That ductwork has been pressure tested and accepted.
 6. That strainers have been removed, cleaned and replaced, and that temporary construction strainers have been removed.
 7. That compression or expansion tanks have been inspected, are not air-bound or water-logged and are pre-charged, and that the piping systems have been completely vented and filled with water.
 8. That air vents at coils and high points of the piping systems have been inspected and installed and operating freely.
 9. That automatic valves, hand valves, and balancing valves have been placed in a fixed open position for full flow through all devices.
 10. That linkages between valves and their actuators are secure, non-overloading and non-binding.
 11. That pressures for hydronic reducing valves have been set.
 12. That operating temperatures have been set for chillers, regulating valves, etc.
 13. That pumps are operating at the correct rotation and specified horsepower.
 14. That piping has been pressure tested and accepted and piping systems have been cleaned, flushed, sterilized and refilled with chemicals and prescribed treated water and vented.
 15. That operating temperatures have been set for boilers, regulating valves, etc.

16. That the operating safeties (thermal overloads, firestat/freezestats, smoke detectors, relief valves, etc.), are installed and fully functional.
17. That equipment has been lubricated and can be operated without damage.
18. That the systems are operational and complete.
19. That no latent residual work remains to be completed.

3.05 PROTECTION OF MATERIALS AND EQUIPMENT

- A. Requirements: Do not store fiberglass insulation or any equipment within the building until it has been "dried in". If dry space is unavailable and the insulation and equipment must be installed or stored before the building is "dried in" and completely enclosed, provide polyethylene film cover for protection.
- B. Replacement of Damaged Stored Material and Equipment: Any material and equipment that has been wet or otherwise damaged prior to installation, in the opinion of the Engineer, shall be replaced with new material regardless of the condition of the material and equipment at the time of installation.
- C. Repair of Damaged Installed Material and Equipment: After installation correct or repair dents, scratches and other visible blemishes. At the direction of Engineer replace or repair to "as new" condition equipment which has been damaged during construction.
- D. During construction, all piping and ductwork system openings shall be capped with at least two layers of polyethylene film, fastened tightly in place with banding material or foil tape until connection of the continuation of such piping or ductwork is occurring.

3.06 ASBESTOS AND HAZARDOUS MATERIALS

- A. General: Should asbestos or other hazardous material be encountered during execution of the work, or should the presence of asbestos or other hazardous material be suspected, immediately notify the Engineer and suspend work in the affected area. The Cityr will initiate a study to determine if asbestos or other hazardous materials are present and will determine what action will be taken. Removal of asbestos or other hazardous materials will be done under a separate contract.

B. COORDINATION OF SERVICES

- C. General: Coordinate interruption of existing services in writing at least 1 week in advance with theEngineer. Shutdown time and duration of services interruption shall be decided by the City. Provide shutoff valves at points of interconnection to minimize downtime. Procedures incidental to the outage shall be prepared in advance to minimize downtime.

- D. Fire Safety in Existing facilities: Do not decrease the fire rating of walls, partitions, ceilings, floors, doors or combinations thereof in adjacent areas or means of egress. Do not interrupt fire sprinkling or life safety systems without prior coordination with the Engineer. Inform all necessary parties (Fire Department, City insurance carrier, etc.) in advance, prior to and immediately after shutdown, disconnection or isolation of any portion of life safety or fire sprinkler system.
- E. Protection of Facilities: Portions of the building may be operational during construction. Maintain operation of the equipment and systems whenever the installation interfaces with existing equipment or systems. Provide protection for the building, its contents and occupants wherever installation under the contract is performed. As necessary, move, store, and protect furniture, office fixtures and carpets. Provide acoustical isolation of the work area with temporary doors, partitions, etc., to allow normal work functions. Provide exhaust fans, temporary dust barrier partitions and any containment measures required to prevent dirt, dust or fumes from reaching adjacent occupied spaces as required by the City or Engineer. Access to the building, including exit stairs, doors and passageways, and loading dock and other delivery areas shall be kept open and continuously accessible to the occupants. Workmen shall be confined to those areas directly involved in the project installation, and only during time periods indicated and approved by the City.

3.07 LAYOUT OF EXISTING EQUIPMENT

- A. General: Existing equipment, piping, ductwork, etc., as indicated on the drawings have, for the most part, been provided to the Engineer through existing drawings. The layouts shown may not be from as-built drawings and may be from partial copies of original design documents not produced by the Engineer. The Engineer is not responsible for the accuracy nor completeness of the existing installation and all layouts are shown for reference only. It is to be understood that unforeseen conditions probably exist and that existing and new work may not be field located exactly as shown on the drawings. Verify existing conditions in the field and notify the Engineer of any deviations required to install the work as shown. Coordinate new work with existing equipment, including removing, relocating, rerouting, extending with new materials, and reinstall existing piping, ductwork, conduits, wiring, tubing, supports and other equipment. The Engineer shall make the final decision on all deviations or modifications required by the existing conditions.

3.08 OWNERSHIP OF REMOVED EQUIPMENT

- A. General: Construction materials and items of mechanical and electrical equipment which are removed and not reused shall be removed from the job-site unless indicated as to be retained for the City. Include rigging, removal and hauling cost, as well as any salvage value, in the contract.

3.09 CLEAN-UP

- A. General: Debris and rubbish shall not be disposed into the Cities containers.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 15030
ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are part of this Section.

1.02 SUMMARY

- A. General: Provide electric motors and related electric material and equipment required for all mechanical work.

1.03 RELATION TO OTHER WORK

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15035, VARIABLE FREQUENCY DRIVES
2. 15050, BASIC MECHANICAL MATERIALS AND METHODS
3. 15483, FUEL PIPING SYSTEM
4. 15550, HOT WATER BOILER AND ACCESSORIES
5. 15680, WATER CHILLER
6. 15800, AIR HANDLING UNIT
7. 15950, BUILDING CONTROL SYSTEM
8. 15990, PERFORMANCE VERIFICATION

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

1. Division 1, ALTERNATES
2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following material and performance data:

1. Manufacturer Literature:
 - a. Dimensional outline drawing showing the operating weights of the equipment with all connection locations and requirements.
2. Installation Instructions:
 - a. Manufacturer's printed installation instructions including copies shipped with the equipment.

3. Maintenance Instructions:
 - a. Manufacturer's printed maintenance instructions for equipment covered in this Section.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
 1. NFPA: NFPA-70, National Electrical Code, 2002 Revision.
 2. NEMA: National Electric Manufacturer's Association Standard MG-2.

PART 2 - PRODUCTS

2.01 ELECTRIC MOTOR

- A. Manufacturers: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.
 1. General Electric
 2. Westinghouse
 3. Baldor Electric Co.
 4. Lincoln
- B. General:
 1. Provide motors for continuous duty conditions in which they will be required to perform; i.e., general purpose, splash-proof, explosion proof, standard load, high torque, or any other special type as required by the equipment motor manufacturer's recommendations. Unless otherwise indicated or required, motors shall be open drip-proof type.
 2. Motors installed outdoors shall be totally enclosed fan cooled (TEFC) type.
 3. Motor enclosures shall be of the type recommended by the equipment manufacturer for the specific application.
 4. All motors shall be furnished for starting in accordance with electric utility company's requirements and shall be compatible with the motor starter and driven load. Motors shall not exceed full-rated nameplate load when operated at any point along the driven equipment's characteristic performance curve. The motor service factor shall not be used to justify exceeding nameplate amperage.

5. Unless otherwise indicated, motors 1/2 horsepower and less shall be single phase. Motors 3/4 horsepower and larger shall be 3 phase, squirrel-cage induction type.
 6. Sound power levels for motors shall be no greater than the guidelines recommended by NEMA MG 1-12.49. A motor which, in the opinion of the Engineer, generates excessive noise within the occupied area of the building shall be replaced with a quieter operating motor at no additional cost to the City.
 7. Motors designated to operate with a variable frequency drive shall be approved by the manufacturer of the variable frequency drive equipment and the manufacturer of the motor to insure quiet and stable continuous operation over the entire speed range.
 8. Verify the circuit voltage and phase being furnished to the motor. All motors shall be 1750 rpm unless noted otherwise. Motors shall operate with electrical input voltage variations of plus or minus 1 percent of nameplate rating or frequency variations of plus or minus 5 percent of nameplate rating.
- C. Design: Provide NEMA Design B for normal starting torque with Standard MG1-12.42 Class B insulation unless noted otherwise or required by the equipment on which the motor is being used, except that motors for variable-speed service shall have Class F insulation. Motors shall be designed for operation in 40 degree C. ambient at 1.15 service factor on sine wave power at the base voltage and frequency and shall have all copper windings. Motors shall meet or exceed the locked-rotor (starting) and breakdown (maximum) torques for the NEMA rating. Locked rotor current shall not exceed 6 times full-load current. Motor current density and heating characteristics shall be such that the motor insulation will not fail if subjected to locked-rotor current for 20 seconds.
- D. Efficiency: Motors 1 horsepower and larger shall be high efficiency design. Nominal efficiency of each motor shall be tested in accordance with NEMA MG 1-12.54.1 and shall be labelled on the motor nameplate in accordance with NEMA MG 1.12.54.2. High-efficiency motors shall be different from the manufacturer's standard product through the use of premium materials, design and improved manufacturing processes to reduce motor losses.
- E. Power Factor: When required by the local electric utility, all equipment furnished utilizing a combined electrical load of greater than 1000 watts shall have a power factor of not less than 0.90 under rated load conditions.
1. Where motors are not available with a minimum 0.90 power factor, provide motor mounted power factor correction capacitor to improve power factor to at least 0.90 under rated load condition.
- F. Single Phase: Single phase motors for hard starting applications including air compressors and outdoor installations shall be capacitor start/induction run or capacitor start/capacitor run type designed for the application. Motors for fans and pumps located indoor may be split phase with permanently lubricated sealed ball bearings and shall be

selected for quiet operation. Motors 1/8 horsepower and below may be shaded pole type with permanently sealed bearings.

2.02 MOTOR STARTERS

- A. Compliance: Motor starters included as an integral part of a factory pre-wired control panel shall be provided by the manufacturer of the equipment it serves. All motor starters shall comply with the requirements of Section titled "MOTOR CONTROLLER" in Division 16.
- B. Overload Protection: Unless otherwise indicated, all 3 phase motor starters shall be provided with thermal overload relays on each phase sized in accordance with the actual nameplate full load ampere rating. Single-phase motors shall be furnished with built-in thermal protection.
- C. Chiller Starter: The starter for the water chiller is specified in Section 15680, WATER CHILLER.

2.03 FACTORY PRE-WIRED CONTROL PANEL

- A. Quality Assurance: Factory pre-wired control panels furnished with any equipment shall be UL Listed.
- B. Starter: Motor starters included in a factory pre-wired control panels shall comply with the paragraph included in this Section entitled "MOTOR STARTERS".
- C. Disconnect: Each control panel shall be provided with a disconnecting means for each motor and control circuit controlled by the panel. Where more than one motor or control circuit is controlled each shall be provided with a fused disconnect or circuit breaker.
- D. Wiring: Factory pre-wired control panels shall be provided with internal wiring to a single set of incoming lugs for a single point electrical power connection.
- E. Transformers: When control transformers are provided or other electrical voltages are required other than or in addition to the electrical power connection, provide fuse protection and disconnect switch.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Material and Equipment: Install material and equipment in accordance with details shown on the drawings, submittal drawings and manufacturer's instructions.

3.02 SCHEDULED HORSEPOWER

- A. Nominal Size: The horsepower scheduled or specified are those nominal sizes estimated to be required by the equipment when operating at specified duties and

efficiencies. In the case of pumps and fans, these motors shall be non-overloading at any point of the performance curve.

- B. Minimum Size: Motor horsepowers shall not be reduced from the scheduled size regardless of the requirements of the selected or submitted equipment.
- C. Increased Size: If the actual motor horsepower for the equipment furnished is larger than the scheduled size indicated, the proper size feeder, breaker, starter, etc. shall be provided at no additional cost to the City.
- D. Vibration: Motor vibration in any direction as measured at the bearing housings, when tested in accordance with NEMA Standard MG1-12.06, shall be within the following table:

TABLE - VIBRATION LIMITS

Speed (RPM)	Max. Amplitude (Inch)
3000-4000	0.0010
1500-2990	0.0015
1000-1499	0.0020
999-& below	0.0025

- 1. If balance weights are added to the rotor, they shall be permanently secured by welding or riveting. Machine nuts, bolts and screws are prohibited.

3.03 WIRING

- A. Power: All power wiring shall be installed according to the requirements of Division 16, ELECTRICAL.
- B. Interlock: Unless otherwise noted, all interlock wiring, such as remote line voltage thermostats, fan speed controllers, etc. shall be installed by the supplier of that equipment. Interlock wiring shall be installed according to the requirements of Division 16, ELECTRICAL.
- C. Control: All control wiring exposed in mechanical equipment rooms, fan rooms, return air plenums, etc. shall be in conduit. Low voltage control wiring may be installed without conduit in return air plenums provided the cable is plenum rated and the installation is acceptable to the authority having jurisdiction.
- D. Remote Panel: If the pre-wired control panel is designed for remote mounting, the wiring from the factory pre-wired panel to the controlled equipment shall be installed according to the requirements of Division 16, ELECTRICAL.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, are part of this Section.

1.02 SUMMARY

- A. General: Materials listed herein are general mechanical materials to be used for Division 15 sections of the specifications unless noted otherwise.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: This section relates to the requirements of all sections in Division 15.

1.04 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall comply with the paragraph entitled "Code Compliance" in Section 15010.
- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- C. ANSI: Color coding for piping systems shall comply with The American National Standards Institute, ANSI A13.1-1981, "Scheme for the Identification of Piping Systems".
- D. NFPA: NFPA 704, Standard System for the Identification of the Fire Hazards of Materials for Emergency Response, 2001 Revision.

1.05 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:
 - 1. Manufacturers Literature:
 - a. Access doors and panel data for each type of unit indicated.
 - b. Piping system identification markers and tags including a representative sample of each type.
 - c. Each type of pipe hanger and supporting device, including but not limited to attachment/interface to structure.

2. Installation Instructions
3. Operating Instructions
 - a. Valve tag list framed under glass and mounted in the each mechanical equipment room.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Acceptance: Materials and equipment shall be products which will meet with the acceptance to the authority having jurisdiction. Where acceptance is contingent upon having the products examined, tested and certified by Underwriters Laboratories or other recognized testing laboratory, the product shall be so examined, tested and certified.
- B. Material: Refer to the paragraph entitled "MATERIAL AND EQUIPMENT" in Section 15010.

2.02 HOUSEKEEPING PADS AND EQUIPMENT SUPPORTS

- A. General: Pads and supports shall extend a minimum of 4 inches and a maximum of 8 inches beyond the base or supporting member in all direction. It is the intent not to have the pad extend under the entire piece of equipment unless that equipment is located on the exterior of the building on the ground, or the weight of the pad is required for vibration control. Pads shall have 1/2 inch chamfered on all exposed edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the equipment, with no deviation in excess of 1/8 inch when tested with a 10-foot straight edge.
- B. Size: Coordinate length and width of pads and penetrations necessary for piping or conduit with the actual equipment approved for use on the project. Pad shall be 4" thick, unless noted otherwise.
- C. Concrete and Steel Requirements: All concrete and steel for housekeeping pads shall comply with the requirements of Division 3, CONCRETE.
- D. Housekeeping Pads:
 1. Location: Provide concrete housekeeping pads for all floor mounted equipment where indicated and where located in rooms where water piping exists. Unless otherwise indicated housekeeping pads shall be reinforced with a minimum of two layers of 6 by 6 inch, 10/10 welded wire mesh with an 1-1/2 inch cover from the bottom and any exposed surface. Pads less than 18 inches wide shall be reinforced with a minimum of two #4 bars at 6 inches on centers both ways set 1-1/2 inches above the bottom of the pad.
 2. Bonding: Housekeeping pads shall be bonded to the floor slab. If the equipment located on the pad must be anchored for support, the anchor bolts shall be anchored to the floor slab prior to the installation of the housekeeping pad.

E. Equipment Bases:

1. Location: Provide concrete equipment bases where rotating equipment is internally isolated by the equipment manufacturer. The equipment bases shall be the same as housekeeping pads except the Type EVS-2 isolation pads shall be provided between the top of the base and the equipment. Refer to Section 15240, VIBRATION ISOLATION, for recommended loading.

F. Isolated Concrete Bases:

1. Location: Unless otherwise indicated provide isolated concrete bases for all rotating and vibrating equipment, such as pumps and air compressors, located in a slab-on-grade equipment room within the building. Each isolated concrete base shall be a minimum of 6 inches thick and weigh at least 2 and 1/2 times the weight or the rotating mass of the equipment unless otherwise notes. All exposed edges shall be provided with 1/2 inch chamfer.
2. Reinforcement: Isolated equipment bases shall be reinforced with #3 bars, 8 inches on centers both ways, set 2 inches above the bottom to the base. Leveling type anchor bolts and non-shrink grout shall be provided to secure the equipment to the base.
3. Isolation Pads: Provide 3/4 inch thick Type EVS-5 isolation pads between the floor and the isolated concrete base. Refer to Section 15240, VIBRATION ISOLATION, for recommended loading.

G. Inertia Base:

1. Location: Unless otherwise indicated inertia bases shall be required for all rotating or vibrating equipment mounted on suspended floor construction.
2. Anchor Bolts and Grout: Coordinate to provide proper installation with equipment level and plumb, anchored and grouted in the final operating position after all springs and connections are adjusted. Inertia bases not filled with concrete shall not require grouting. Refer to paragraph entitled "INERTIA BASE" in Section 15240.

2.03 ACCESS DOORS AND PANELS

- A. Locations: Provide access doors and panels (access units) for access to concealed items which require service or maintenance or other reason for accessibility.
- B. Manufacturer: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.
 1. Milcor Division of Inland-Ryerson
 2. Bilco
 3. Nystrom
 4. Ventfabrics

TABLE - ACCESS DOORS AND PANELS

Location	Door/Panel Type
Drywall	Style DW
Masonry or Tile	Style M-Stainless
Acoustical Tile	Style AT
Plaster	Style K
Fire-rated Walls	Style Fire Rated (or as indicated below)

C. Non-Fire Rated Units:

1. Steel panels and frames.
2. Locks and latches shall be appropriate for the location and shall be cam-lock type latches, flush screwdriver operated locks or cylindrical locks.
3. Provide two keys for all doors. All doors shall be keyed the same.

D. Other Requirements:

1. Doors and panels installed in glazed or ceramic tiled surfaces, in toilet rooms or in kitchens shall be stainless steel.
2. Unless otherwise indicated, finish shall be rust inhibitive prime coat.

E. Sizes:

1. Minimum size: 8 inch x 14 inch.
2. Sizes of each unit shall be individually selected to allow the recommended and required service, maintenance and accessibility functions to be accomplished. These functions shall include, for example, valve removal, damper linkage resetting, control adjustment, lubrication, repair, replacement and similar tasks necessary and recommended for the concealed item.
3. No size smaller than 16 inch x 24 inch shall be allowed when a person must pass through the access opening. Access panels for heating equipment shall be minimum 22 inch x 36 inch as required by code.

2.04 PAINTING AND MARKING

- A. Prohibited Material: The use of red lead or any lead-based component in primer or paint is prohibited.

B. Marking: Refer also to sections describing identification of mechanical systems.

2.05 IDENTIFICATION OF PIPING AND EQUIPMENT

A. General: Comply with ANSI A13.1-1994, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.

B. Manufacturer:

1. Refer to paragraph entitled "MANUFACTURERS" in Section 15010. Model numbers or product type listed for one or more manufacturers are given to provide an example of the item required.

C. Markers: Legends or arrows painted with stencils are not acceptable. Markers must have approved color coded background, proper color of legend in relation to background color and flow arrow indicator. Markers higher than 12 feet above the floor shall have minimum 2 inch letters. Markers shall comply with the following table:

TABLE - IDENTIFICATION MARKER SIZES

O.D. of Pipe or Covering	Length of Color Field	Size of Letters
¾ to 1-1/4 inch	8 inches	1/2 inch
1-1/2 to 2 inches	8 inches	3/4 inch
2-1/2 to 6 inches	12 inches	1-1/4 inch
Above 6 inches	12 inches	2 inches

1. Manufacturer:

- a. Pipes 3/4 inch through 5 inch O.D.: Seton, Setmark Type SNA.
- b. Pipes 6 inch O.D. and Greater: Seton, Setmark Type STR.

D. Bands: Color coded in minimum widths of 2-1/4 inch for pipe through 12 inch O.D. and 4 inch for pipe 14 inch O.D. and greater.

1. Manufacturer:

- a. Brady, B-500 Vinyl Cloth, B-350 PermaCode or B-946 Outdoor Film.

E. Valve Tags: Each tag shall designate appropriate service and valve number. Secure attach with meter seals, 4-ply 0.018 copper smooth wire, brass "S" hooks, or brass jack chain to allow easy reading. All valve tags used on a project shall be the same type and manufacturer.

1. Manufacturer: Provide either of the following types:

- a. Brass Type: Minimum 19 gauge polished brass; 1-1/2 inch min. diameter. Seton, Style 250-BL.

F. Equipment Labels: Provide either of the following types:

1. Stainless Steel Type: Engraved, flexible, 0.020 inch thick stainless steel. Sized 3/4 inch x 2-1/2 inch, 1 inch x 3 inch, 1-1/2 inch x 4 inch or 3 inch x 6 inch as necessary to identify item.

2.06 CORROSION PROTECTION COATING

- A. Application: Mechanical units indicated with a corrosion protection coating shall be provided with corrosion protection for each applicable unit component where indicated.
- B. Uninsulated Interior Surfaces: All uninsulated interior surfaces (excluding coils, refer to paragraph entitled "Coil Protection" for corrosion protection coating for coils) shall be provided with a factory-applied spray-coating process for corrosion protection. Corrosion Protection coating material and process shall have passed a 2,000 hour salt spray test in accordance with ASTM Standard B117.85. Coating material shall consist of a synthetic resin material with properties including 5,000 PSI tensile strength and 400% flexibility. The corrosion protection coating shall be applied by spray-coating in three coats for a final 4.0-6.0 mils thickness when dry. An anti-microbial agent shall be added to the corrosion protection coating for interior surfaces exposed to either the ventilation air, return air, or supply air stream.

1. Manufacturer and Product:

- a. Bronz-Glow, Husky SPC Coat

- C. Insulated Interior Surfaces: All insulated interior surfaces shall be provided with a factory-applied spray-coating process for sealing and protection against moisture intrusion. Coating material shall consist of a vinyl material with properties including 1,000 PSI tensile strength and 350% elongation. Coating material shall be fire-retardant, and shall comply with NFPA 90A regarding flame spread rating of 25 or less and a smoke developed rating of 50 or less. The protective coating shall be applied by spray-coating in for a final 2.0-10.0 mils thickness when dry. An anti-microbial agent shall be added to the protective coating.

1. Manufacturer and Product:

- a. Bronz-Glow. Husky Insul Coat

2.07 PIPE HANGERS AND SUPPORTING DEVICES

- A. General: Pipe hangers and supporting devices shall comply with the requirements of this section unless specifically indicated otherwise in other sections of this division.

- B. Material: Pipe supporting devices apply to all piping unless modified in subsequent sections (i.e., vibration isolation) or detailed on the drawings.
1. Pipe hangers for copper pipe shall be PVC coated steel or copper, clevis type.
 2. Hangers for all other types of piping shall be galvanized steel clevis type or split ring. Pipe hangers shall be capable of vertical adjustment after erection of the piping. Hanger rods shall be galvanized.
 3. Vertical piping riser clamp supports shall be constructed of steel with rounded ears and two or four holes for clamping bolts. Riser clamps shall be galvanized steel, except that riser clamps for copper and brass piping riser clamps shall have PVC coating finish or copper.
 4. Manufacturer:
 - (1) Empire
 - (2) Grinnell/Anvil
 - (3) Tolco
- C. Beam Clamp: Beam clamps may be used when supporting piping from steel structures.
- D. Inserts: Concrete inserts shall be placed in forms prior to the time that concrete is poured.
- E. Drilled-in Anchors: Steel anchor set in existing or new concrete by drilling and the use of an expansion device is permitted. The anchor shall be provided with a NPT threaded rod connection.
- F. Trapeze: For parallel runs of above ground suspended piping, trapeze-type hanger may be used. Provide permanent, non-conductive wrapping between copper pipe and steel trapeze hangers.
- G. Prohibited Type: Powder set type fasteners or inserts shall not be used.

2.08 V-BELT DRIVE

- A. General: Each motor driven piece of equipment not direct connected shall be provided with a V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves and shall be carefully matched for each drive. Sheaves shall be cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. Drive rating shall be as recommended by the manufacturer for service but shall be at least 1.5 times the nameplate rating of motor.
- B. Fan Belt Drives: Fixed pitch sheaves shall be provided. Sheave-to-sheave centerline distances shall not exceed 3 times the sum of the sheave diameters, and shall not be less than the diameter of the larger sheave.

- C. Belt and Coupling Guards: Each belt drive shall be equipped with an OSHA approved guard. Guards shall be constructed of #12 U.S. standard gage 3/4 inch diamond mesh wire screen, or equivalent, welded to one inch steel angle frames, and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal or not less than #18 U.S. standard gage. Braces or supports must not "bridge" sound and vibration isolators. Guards shall allow adequate provision for movement of motor required to adjust belt tension. Provide means for oiling, use of tachometers, and other maintenance and testing operations with guard in place.
- D. Direct Driven Equipment: Direct-drive motor driven equipment shall have coupling guards in accordance with OSHA Regulations.

2.09 BEARINGS

- A. General: Under normal loading conditions per NEMA MG1-14.45, bearings shall be 100,000-hour rated unless otherwise specified. Bearings shall be AFBMA Standard sizes.
- B. Re-greasable: Bearings shall be re-greasable-type unless otherwise indicated as sealed-type non-re-greasable.
- C. Housing: Bearing housings shall have long, tight running fits or rotating shields to protect against foreign mater entering the bearings and leakage of grease out of the bearing cavity. Housings for re-greasable bearings shall have a capped grease inlet fitting, grease relief plug on the opposite side of the inlet, and a grease reservoir in the cast inner cap.
- D. Extended Lines: Provide extended lubrication lines and fittings to an accessible location for all bearings concealed by equipment housing, belt guards, etc.
- E. Factory Lubrication: Bearings shall be provided with grease from the manufacturer. Grease shall be premium moisture resistant containing rust inhibitors and suitable for operation in temperatures from 50 to 250 degrees F.

PART 3 - EXECUTION

3.01 GENERAL

- A. Concrete Bases and Structural Steel: Concrete bases and structural steel to support equipment and piping installed under each specification section of this division and not specifically shown on the structural or architectural plans shall be furnished.

3.02 HOUSEKEEPING PADS AND EQUIPMENT SUPPORT

- A. Housekeeping Pads: Provide reinforced concrete housekeeping pads where indicated and for all floor mounted equipment located in rooms where water piping exist. Pads shall be 4 inches high unless otherwise indicated. Ground mounted equipment shall have an 8 inch high reinforced concrete housekeeping pad unless otherwise indicated. The pad shall extend a minimum of 6 inches above finish grade.

- B. Equipment Bases: Equipment bases shall be 4 inches high unless otherwise indicated or required. Bases for air handling equipment shall be high enough to provide the required trap seal and insulation for the condensate drain.
- C. Isolated Concrete Bases: Unless otherwise indicated isolated concrete bases shall be a minimum of 6 inches and shall weigh at least 2-1/2 times the weight of the rotating assembly.
- D. Inertia Bases: Inertia bases shall be installed according to the requirements stated in Section 15240, VIBRATION ISOLATION.

3.03 EQUIPMENT ACCESS

A. Access Doors and Panels:

1. Locations: Provide access units at the following locations:
 - a. Where additionally specified in other sections of this Division 15 and where specifically indicated on the drawings.
 - b. Where not specifically indicated on the drawings but where the work to be provided will require accessibility for purposes as described or as recommended by the manufacturer of the concealed item.
 - c. At all locations where concealed equipment, fixtures, devices and similar items require accessibility for service, inspection, maintenance, repair, replacement and where such concealed item would not otherwise be accessible for such functions without the provision of an appropriately sized access unit.
2. Coordination of Determination of Locations: Coordinate the work as related to the determination of where access units are to be located.

- B. Rejection of Work: Access units which are not provided, furnished or installed in compliance with this Division shall be removed, replaced and/or relocated at the direction of the Architect.

3.04 PAINTING

- A. General: Paint all exposed piping, insulation, equipment, structural bases, racks, in equipment rooms and on roof, furnished under Division 15 of these specifications. All exposed metal surfaces shall be given one prime coat and two finish coats. All insulated surfaces shall be given one coat of glue sizing (omit this step if factory applied finish is suitable to receive prime coat), one prime coat and one finish coat. Factory painted or finished items do not require field painting but shall require "touch-up" with matching paint or finish where scratched. Follow manufacturers recommendations on ambient conditions for painting, coat thickness, and drying time between coats.
- B. Ancillary Items: Pipe hangers, saddles, supports, riser clamps and accessories shall be painted to match their piping.

- C. Inaccessible Items: Equipment not completely accessible for painting when set in place shall be thoroughly cleaned and painted before installation and suitably protected.
- D. Concealed Items: Concealed piping need not be painted.
- E. Metal Surfaces: Use a scraper or wire brush to remove rust and roughen metal surfaces prior to painting. After wire brushing, wash surfaces to remove particulates, apply primer coat after surface is dry but not more than 48 hours after wire brushing.
- F. Colors: Colors for piping systems and equipment which are required to be painted shall be as indicated in the following table:

TABLE - PIPING PAINTING SCHEDULE

Class	Paint Color
F – Fire Protection Equipment	Provided by the City
D – Dangerous Material	Provided by the City
S – Safe Material	Provided by the City
P – Protective Material	Provided by the City
V – Valuable Material	Provided by the City

3.05 IDENTIFICATION OF PIPING, DUCTWORK AND EQUIPMENT

- A. General: Apply after completion of insulation, painting and cleaning work so that final identification is not disfigured.
 - 1. Coordinate with composition and operating temperatures of surface for permanent adhesion of markers and labels to surface.
 - 2. Locate marking and banding to facilitate ease of visual tracking. (For example, mark and band parallel runs of pipe and duct which are side-by-side at the same general place.) Labels on vertical piping and ductwork shall be 7 foot above the floor.
 - 3. Pipes less than 3/4 inch diameter may be identified with tags similar to those specified for valves.
 - 4. Adhere or affix all identification items permanently except where removal may be necessary for maintenance or service. Where labels or arrows are used, overlap the label ends 2 inches with matching color bands completely encircling the pipe.
 - 5. Apply labels on the bottom lower quarters of overhead pipe. Pipe within 24 inches of a wall does not require a label on the quarter facing the wall.

B. Markers and Bands: Provide on piping as follows:

1. Pipe Concealed in Otherwise Inaccessible Locations (e.g., Chases, non-accessible ceilings): No identification required, except at access doors.
2. Pipe Concealed in Accessible Locations (e.g., Ceiling Plenums): Markers every 30 feet of pipe length. Bands every 15 feet of pipe length.
3. Pipe Exposed in Equipment Rooms: Markers and bands every 15 feet of pipe length for pipe through 12 inch O.D. and every 30 feet for pipe 14 inch O.D. and greater.
4. Exterior Pipe, Exposed: Markers and bands every 40 feet of pipe length.
5. Exterior Pipe, Underground: Place a color-coded 6 inch wide, 0.004 inch thick polyethylene printed identification tape directly above all underground piping systems. The tapes shall be located approximately 12 inches below finish grade. Each tape shall be continuously printed with the words "CAUTION" in large bold lettering, and with the type of service piping also indicated.

C. Valve Tags: Valve tags shall be installed on the following items:

1. All control valves (except those valves associated with direct control of flow to air handling apparatus whereby the valve may be identified by reference to the item of equipment it serves).
2. All fire protection system valves located in mains and branches (except those valves in fire hose cabinets).
3. Valves installed under this division of the specifications except check valves, drain valves, gauge valves, and manual air vent valves.
4. Small piping (other than domestic water) where markers are impractical.
5. Small but critical equipment items on which it is impractical to install labels.

D. Valve Tag List: Prior to substantial completion, provide a complete list of all valves having tags. Frame under glass and mount in the mechanical equipment room at a location acceptable to the Architect. Indicate the following:

1. Valve size.
2. Valve location.
3. Valve type.
4. Service application.
5. Valve manufacturer and model number.
6. Pressure class and allowable working pressure.
7. Safety warnings.
8. Sequencing information.
9. Seasonal operating position (normally open/normally closed).

- E. Labels: Provide labels of proper size on mechanical system equipment including but not limited to, pumps, chillers, tanks, major piping components such as air separators, air handling equipment, fans, control panels, terminal units, flow stations, reheat coils and similar items. Provide labels on access panels indicating the item accessible through the panel. Equipment labels shall be mechanically fastened with machine screws or rivets; adhesive securing is not acceptable.
- F. Identification: Coordinate colors and finishes with pipe identification markers.

3.06 CORROSION PROTECTION COATING

- A. Anti-Microbial Agent: Where indicated, an anti-microbial agent shall be added to the protective coating. The anti-microbial agent shall consist of Intersept microbiostat formulated to inhibit the growth of microorganisms including fungi, bacteria, mold, and yeast.
 - 1. Manufacture and Product:
 - a. Bronz-Glow, Husky Anti-Microbial

3.07 HANGERS AND INSERTS

- A. General: Refer also to other sections which may describe additional requirements for hanging and supporting.
- B. Location: Provide and properly locate hangers to adequately support piping and equipment. Arrange hangers to permit expansion and contraction. Do not hang piping from fire or smoke walls. Provide pipe hangers at each valve, strainer, and other piping accessory, and at each change of direction.
- C. Size: The size of hanger for non-insulated pipes shall be suitable for pipe size to be supported. For insulated piping, the size of the hanger shall be suitable for the pipe size, plus the insulation and an insulation shield. Refer to Section 15250, THERMAL INSULATION, for insulation shield requirements.
- D. Protection: Isolation of copper pipe from steel trapeze hangers shall consist of wrapping pipe and 1 inch each side of contact surface with not less than two layers of adhesive type plastic dielectric insulating tape.
- E. Spacing: Locate pipe supports as indicated in the following table unless noted otherwise in other sections of the specifications or on the drawings:

TABLE - HORIZONTAL PIPE HANGER SCHEDULE

Material	Pipe Size	Hanger Spacing
Steel Pipe	Under 1 inch	6 foot centers
	1 to 2 inches	8 foot centers
	2-1/2 to 4 inches	10 foot centers
	5 inches and larger	12 foot centers
Copper Tubing	up to 1-1/4	6 foot centers
	1-1/2 and above	10 foot centers
Cast Iron Pipe	All	5 foot centers

1. Vertical Pipe: Vertical piping shall be supported at the base of each vertical riser, and at intervals not exceeding those indicated in the following table:

TABLE - VERTICAL PIPE SUPPORT SCHEDULE

Material	Pipe Size	Support Spacing
Steel Pipe	All	Every other story (30 foot centers max)
Copper Tubing	up to 1-1/4	4 foot centers
	1-1/2 and above	Every story
Cast Iron Pipe	All	Every story (15 foot centers maximum)

- F. Hanger Rods: The size of the hanger rods shall be according to the following table. The rod sizes are based on the maximum hanger spacing indicated in the table above.

Pipe Size Inches	Minimum Hanger Rod Size, Inches	
	Cast Iron	Copper or Steel
Up to 6	3/8	3/8
8	1/2	1/2
10	1/2	5/8
12	1/2	3/4
14	3/4*	3/4
15	5/8	---
16	7/8*	7/8
18	7/8*	1
20	1*	1
24	1-1/4*	1-1/4

* Indicates mechanical joint, ductile iron pipe.

- G. Pipe Guides: Provide pipe alignment guides to guide expanding pipe to move freely from anchor points in expansion joints, loops or bends.

3.08 ANCHORS

- A. General: Install a suitable anchor on piping to prevent movement from expansion and contraction by welding or clamping securely to pipe at fitting or coupling. Approval of the Architect of method of anchorage must be obtained before installation of work. Properly anchor piping to remove strains on equipment which would be caused by expansion and contraction. Insulate anchors on piping to prevent moisture condensation problems.

- B. Below Grade: Where mechanical joint piping enters the building below grade, the last section of pipe shall have anchor bolts tied to the building structure.

3.09 V-BELT DRIVE

- A. Sheaves: To provide the properly sized sheave, V-belt drive fans shall be initially provided with variable pitch sheaves. Upon completion of system balancing by the T&B Agency, the adjustable pitch sheaves shall be replaced with fixed sheaves and belts of the size and type specified by the T&B Agency. Tag the adjustable sheaves, turn over to the City, and receive written receipt from the City accepting these sheaves.
- B. Vibration of Air Handling Equipment and Fan Units: Field vibration levels will not be acceptable for air handling equipment and fans driven by motors 5 hp or greater, if the maximum vibration velocity or displacement measurement exceeds the following values (when measurements are taken at the bearing supports using a vibration analyzer with the filter set at the operating fan speed):

TABLE - MAXIMUM ALLOWABLE FAN VIBRATION

Fan Speed (RPM)	Maximum Vibration Level
800 or less	5 mils (0.127 mm) max. displacement
801 and greater	0.20 in/sec. (5 mm/s) max. velocity

3.10 FIRE/SMOKE RATED FLOOR, PARTITION OR WALL PENETRATIONS

- A. Fire and Fire/Smoke Penetrations: Protect all penetrations of rated partitions with a listed assembly for each particular rating and building material partition. Comply with the manufacturer's instructions for installation of the partition penetration protection assembly.

END OF SECTION 15050

NO TEXT FOR THIS PAGE

SECTION 15060

PIPE AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, are a part of this Section.

1.02 SUMMARY

- A. General: Provide and install pipe and fittings as indicated and including all offsets, fittings, sleeves and similar items required but not necessarily indicated due to drawing scale for complete and operable systems.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15100, VALVES
3. 15120, PIPING SPECIALTIES
4. 15240, VIBRATION ISOLATION
5. 15250, THERMAL INSULATION
6. 15483, FUEL PIPING SYSTEM
7. 15484, SPECIAL WATER SYSTEM
8. 15510, HYDRONIC PIPING SYSTEM

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Provide shop drawing and/or manufacturer's data sheet for the following items:

1. Manufacturers Literature:
 - a. Complete design and construction data for dielectric unions and flanges.
 - b. Complete design and construction data for grooved mechanical fittings and couplings for steel piping systems.
 - c. Manufacturer's data on piping and fittings used, with an indication of each specific application.
2. Performance Data:
 - a. Submit a copy of the Welding Procedure Specification with the Procedure Qualification Record and certificates of the welders and welding operators required by Section IX of the ASME Boiler and Pressure Vessel Code.

3. Installation Data:

- a. Manufacturer's printed instructions for the installation of grooved mechanical fittings and couplings for steel pipe.
- b. UL approval number, installation materials, and procedures for pipe penetrations of fire-rated walls and floor.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the applicable standards and codes listed in paragraph entitled "Code Compliance" in Section 15010.
- B. Quality and Weight: The quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society of Testing and Materials, American National Standards Institute, American Society of Mechanical Engineers, and the American Welding Society.
- C. Piping System: All pressurized piping systems shall conform to ASME B31.9, Code for Pressure Piping, Building Services Piping.
- D. Welder Certification: Welders shall be tested and certified within the last 2 years by the National Certified Pipe Welding Bureau or recognized testing agency acceptable to the Engineer. Competent certified welders shall perform all welding operations. Each welder shall possess a stamp to identify his work and shall stamp each weld. A copy of the certification shall be available at the job site for each welder.
- E. Welding Installation: Welding shall be in accordance with the welding procedures and requirements set forth in "Welding of Pipe Joints" of the "Code for Pressure Piping" in the American Welding Society Welding handbook. Pipe welding shall comply with the provisions of the latest revision of the applicable code, whether ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping, or state or local requirements as may supersede these codes.
- F. Boiler Piping: Boiler external piping shall comply with the provisions of the latest revision of ANSI Code for Pressure Piping, Section I, B31.1 Power Piping; Section I of the ASME Boiler and Pressure Code; Section IV, Heating Boilers; and Section VIII, Pressure Vessels as applicable to this project.
- G. Brazing: Brazing of copper tubing shall be in accordance with the standards of the American Welding Society, the Copper Development Association Copper Tube Handbook instructions on brazing, and ASME Boiler code Section IX.
- H. Soldering: Soldering of copper tubing shall be done in accordance with the Copper Development Association, Copper Tube Handbook instructions on Joining and Forming Copper Tube, Soldered Joints.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Application: This section covers the material and installation of various pipe and fittings which may be indicated in other sections of these specifications for use in a specific piping system. Pipe and fittings specified in this section may not be substituted in piping systems for the specific pipe and fitting materials indicated in those individual sections of these specifications.
- B. Fittings: Fittings shall be at a minimum the same gauge as the connected piping, and shall be compatible with the piping material (i.e., galvanized fittings on galvanized pipe.) The use of field-fabricated fittings is prohibited.
- C. Lead Content: Pipe, fittings or any other piping device which includes any lead in the alloy shall not be used in any potable water system.
- D. Connection of Different Pipe Materials: Where different types of above ground pipe material or different weights or schedules of pipe are joined, provide a stainless steel coupling with an elastomeric gasket for the connection. The coupling shall incorporate a full-length shield of 304 stainless steel, with bolts manufactured of 304 stainless steel which tighten the shield around the gasket to provide a solid connection.
 - 1. Manufacturer and Model:
 - a. Fernco: Lowflex Series 2000 for 4 inch or smaller; Series 1000 with stainless steel shear rings for up to 10 inches.

2.02 MANUFACTURERS

- A. Copper Press Fittings: Viega or Ridge Tool Company

2.03 MATERIAL

- A. Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

2.04 STEEL PIPING

- A. Pipe: Black steel pipe shall be seamless or electric resistance weld for pipe sizes 2 inch and above, conforming to ASTM A 54 Grade A below 2 inch, continuous weld conforming to ASTM A 53-89a Type B, ASTM A 106 Grade B. Galvanized pipe shall conform to ASTM A 53-89a. Unless otherwise noted, black and galvanized steel pipe smaller than 12 inches shall be schedule 40 and pipe 12 inches and larger shall be standard schedule. The ASTM number shall be marked on each length of pipe.
- B. Fittings:

1. Threaded Fittings: Malleable iron 150 lb. or 300 lb. class conforming to ASTM A-47 and ANSI B16.3, or cast iron 125 lb. or 250 lb. class conforming to ASTM A-234 and ANSI B16.4. Threads shall conform to ANSI B1.20.1, standard pattern.
2. Pipe Nipples: Provide nipples of same material and weight as pipe used, except provide schedule 80 nipples when length of unthreaded part of nipple is less than 1-1/2 inch. Threads shall comply with ANSI B1.20.1. Nipples shall not be threaded full-length (no close nipples).
3. Welded Fittings: Forged, seamless, black steel, long radius, conforming to ANSI B16.11 for socket-type welds and ANSI B16.9 for butt-type welds. Weldolet fittings may be used in lieu of forged tees where branch connections are not larger than three-quarters the size of main pipe, except on piping 2 inch and smaller, where forged fittings shall be used exclusively. Mitred elbows, tees and reducers are prohibited.
4. Unions: Unions shall be malleable iron or steel with ground joint on piping 1-1/2 inch and smaller; flanges shall be used on sizes 2 inch and larger. Unions shall conform to ANSI B16.39 with ANSI B1.20.1 threads and shall have hexagonal ball-and-socket joints with bronze metal-to-metal seating surfaces, female ends, and a seat ring pressed into the headpiece so it cannot be forced out.
5. Couplings: All couplings shall be taper tapped. Couplings shipped with pipe are not acceptable.
6. Flanges: Forged carbon steel, welding neck type or lap joint conforming to ANSI B16.5. Flanges shall have raised face and gaskets with bolt spacing for the required pressure classification. Gasket material shall be ring-type, 1/16 inch thick compressed heat-resistant fiber or neoprene; gasket shall not contain any asbestos. Flange bolts shall conform to ASTM A307 hex bolts, with ANSI B18.2 hex nuts. Black steel flanges shall have black steel bolts and nuts; galvanized steel flanges shall have galvanized steel bolts and nuts.
7. Grooved Mechanical Fittings and Couplings: Mechanical pipe couplings for steel pipe shall be self-centering and shall engage and lock in place the grooved or shouldered pipe and pipe fitting ends in a positive watertight couple. Mechanical couplings shall have a central cavity pressure-responsive housing fabricated in two or more parts of malleable iron castings in accordance with ASTM A47, or ductile iron in accordance with ASTM A536; where pipe is galvanized, couplings shall be galvanized. Mechanical fittings shall be malleable or ductile iron conforming as specified above, or shall be manufactured for fabricated steel complying to ASTM A53 or ASTM A106. Couplings shall have two or more nuts with electroplated oval type ASTM A183 bolts, locking pins, toggles, or lugs as required to secure grooved pipe and fittings. Housing clamps shall hold in place a composition water-sealing gasket designed to allow internal water pressures serve to increase the watertightness of the seal. Gaskets shall be neoprene or EPDM and suitable for use to 230 degrees F. Rigid couplings shall be used for rigid joints, otherwise use flexible-type couplings.
 - a. Manufacturer:

- (1) Victaulic Company of America
- (2) Anvil Gruvlok
- (3) Central Sprink, Inc.

2.05 COPPER ALLOY PIPING

- A. Pressure Pipe: Copper piping shall be annealed seamless hard temper type "K", "L" as indicated and shall comply with ASTM B-88. Copper is allowed for pipe sizes up to and including 4 inch diameter. The name or trademark of the manufacturer and the type of pipe shall be permanently marked on each section of pipe at intervals not exceeding 4-1/2 feet.
- B. Drainage Pipe: Non-pressure piping shall be copper type DWV, hard temper and conform to ASTM B306.
- C. Fittings:
 1. General: Fittings used in copper alloy piping shall be streamlined pattern, wrought or cast brass conforming to ANSI B16.22 or wrought bronze conforming to ANSI B16.15.
 2. Flare Fitting: Flare fittings shall be used on soft copper tubing, and shall comply with ANSI B16.26.
 3. Union: Unions in 2 inch and smaller copper alloy piping shall be brass or bronze, ground joint for solder connection with hexagonal ball-and-socket joints, bronze metal-to-metal seating surfaces, female ends, and a brass seat ring pressed into the headpiece so it cannot be forced out.
 4. Flanges: Flanges shall be used in copper alloy piping larger than 2 inch, and shall comply with ANSI B16.24. Flanges shall have raised face and gaskets drilled for the pressure (class 150 or 300 lb.) as required. Gasket material shall be ring-type, 1/16 inch thick compressed heat-resistant fiber or neoprene; gasket shall not contain any asbestos. Flange bolts shall be brass and conform to ASTM A307 hex bolts, with ANSI B18.2 brass hex nuts.
 5. Dielectric Isolator: Dielectric couplings shall be rated for at least 150 percent of the maximum working pressure of the piping system and at least 50 degree F. higher than the maximum operating temperature of the piping system in which they are installed. Couplings shall be electroplated steel or brass with inert and non-corrosive thermoplastic lining, or bronze fittings.
 - a. Union: Provide dielectric insulating unions in piping 2 inch and smaller with threaded or solder joint connections.
 - b. Flanges: Flanged dielectric insulating sets shall be used for pipe sizes 2-1/2 inches and larger. Flanged insulation sets shall have phenolic retainer, nitrile rubber seal element, polyethylene sleeves and double washer.

c. Manufacturer:

- (1) Epco
- (2) Watts
- (3) Eclipse
- (4) Grinnell
- (5) Victaulic

- D. Drainage Fitting: Fittings for copper DWV shall be cast bronze or wrought copper solder joint DWV drainage fittings complying with ANSI B.16.23 and B.16.29.

2.06 JOINT FILLER MATERIALS

- A. Solder: Solder containing lead shall not be used in potable water piping; only 95% tin - 5% antimony (95/5) or silver brazing (no substitutions) are acceptable for solder joints in potable water piping. 95/5 and 50/50 tin-lead solder shall conform to ASTM B32.
- B. Brazing: Brazing (silver solder) material shall conform to AWS A5.8, classification BAg 1.
- C. Welding: All electrodes shall conform to AWS Standards E-6010, E-7010, E-7018 or E-8018-B2, C2, or C3 as applicable.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: Pipe and fittings shall be installed as specified in this section unless specific installation instructions are provided in the individual sections covering the piping system. Install each run with a minimum of joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes where indicated using reducing fittings. Align piping at connections within 1/16 inch misalignment tolerance.
- B. Routing and Placement: Piping shall be run without traps or pockets and pitched a minimum 1 inch in 40 feet in the direction of flow, unless indicated or required to be pitched steeper. Grade piping so that air in the mains and risers will be carried up and discharged at venting points. Coordinate installation with structural and architectural features, and with other piping, equipment and the work of other trades. All piping shall be installed as close to the structure overhead as possible.
- C. Prohibited Installation: Do not run piping through transformer vaults, elevator equipment rooms or other electrical or electronic equipment spaces and enclosures. Do not run piping over electrical panels. Where pipe joints or valves in water lines occur within two feet in horizontal directions from electrical panels or equipment, provide drip pans, if allowed by the local authority, sized to afford protection. Pans shall be 20-gauge galvanized steel with edges turned up 2-1/2 inches on all sides, reinforced with galvanized steel angles or by rolling edges over 1/4-inch diameter steel wire. Provide a drain with 3/4-inch flange and pipe to nearest floor drain, and support the pan assemblies as required to prevent sagging or swaying.

- D. Interior Piping: Interior piping shall be run parallel to the walls and ceilings; avoid diagonal runs. Provide a minimum 6 inch clearance between walls and horizontal piping.
- E. Exterior Piping: Exterior piping (above and below grade) shall essentially be routed and located as indicated on the drawings; however, actual placement shall be verified by confirming exact location of structures and other utilities in the field and by careful layout prior to execution of the work.
- F. Insulated Piping: Pipe requiring insulation shall be installed with sufficient clearances to permit proper application of insulation.
- G. PVC Pipe: PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.
- H. Drains: Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded nipple with hose end and cap.
- I. Tool Marks: Copper, brass and chromed, polished or painted piping, fittings and connections to fixtures shall not show tool marks. Replace damaged piping and fittings.
- J. Potable Water Solder Joints: Samples of solder in potable water piping may be taken from completed joints and tested for lead. If tests indicate lead, the joints will be condemned and all fittings, valves and pipe ends shall be replaced with new materials where such joints occur at no cost to the City.

3.02 EXPANSION AND CONTRACTION

- A. Provision for Expansion: Piping shall be installed with provisions for expansion both horizontally and vertically in all long runs including runouts from risers. Expansion loops and/or expansion elbows shall be provided for expansion and contraction where required and where shown on the drawings.
- B. Cold-Springing of Pipe: Cold-spring hot piping systems to reduce the amount of thermal expansion of the piping.
- C. Pipe Anchors: Provide pipe anchors as indicated or as required to eliminate excessive piping movement in thermal and pressure piping systems.

3.03 JOINTS AND CONNECTIONS

- A. General: Align all pipe before joints are made. Joints and connections shall be air, gas and watertight.
- B. Steel Pipe Joints: All pipe joints up to 1-1/4 inch shall be threaded; joints in pipe 1-1/2 inch and 2 inch may be socket-type welded or threaded; pipe 2-1/2 inch and larger shall be butt fusion welded.

- C. **Welded Joints:** All welds shall be first quality metal, thoroughly fused to the base metal at all points, free of cracks, oxidation, blow holes and nonmetallic inclusions. The welder shall leave his indelible identifying mark on the piping adjacent to each weld.
- D. **Testing of Welded Joints:** The Engineer may at his own discretion visually spot check welding work anytime. The Engineer may also employ an outside testing agency to analyze, using whatever means available, any of the welded joints for imperfections. All welded joints found by inspection or testing to have imperfections shall be repaired as directed by the Engineer.
- E. **Threaded Joints:** Use ANSI B2.1 threaded joints in piping with a minimum wall thickness of Standard Schedule pipe. Assemble the joint wrench-tight, applying force on the end of the fitting into which the pipe is being joined. If a seam fails during cutting or threading, that portion of pipe shall be discarded. Threaded joints shall have a minimum of 3 threads engaged and a maximum of 3 threads exposed.
- F. **Solder Joints:** Solder joints shall be used on pipe 2-1/2 inches and smaller. Unless otherwise noted the following solder material shall be used:
 - 1. For operating pressures up to 125 psig, 95/5 solder.
 - 2. For operating pressures above 125 psig, silver brazing alloy.
- G. **Brazed Joints for Domestic Water and Refrigerant Piping:** Piping 3 inches and larger, and as otherwise indicated, shall be brazed. Remove stems, seats and packing of valves and accessible internal parts at piping specialties before brazing. Fill the pipe and fittings during brazing with an inert gas (i.e., nitrogen or carbon dioxide) to prevent the formation of scale. Heat joints to a uniform temperature and form a liquid-tight circumferential joint seal.
 - 1. **Brazed Joints for Medical Gas:** See Specification Section 15485 for method.
- H. **Dissimilar Metals:** Dielectric unions or flanges shall be provided at all junctions of copper or brass pipe or fittings and ferrous material to prevent electrolysis and galvanic corrosion. Where copper or brass tubing or fittings are anchored, supported, or may come in contact with ferrous piping system materials, isolate the two materials with a non-conducting neoprene spacer.
- I. **Flanges:** Connect pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping; clean flange faces and install gaskets. Using a torque wrench, tighten flange to the torque specified by the manufacturer of the flange to provide uniform compression of gaskets.
- J. **Cut-Grooved Mechanical Couplings for Steel Pipe:** Pipe grooving shall be in accordance with the pipe coupling manufacturer's recommendations. Piping shall be cut-grooved, except where indicated. Pipe wall thickness shall be a minimum of Standard Schedule. Before the assembly of couplings, lightly coat the pipe ends and the outside of gaskets with cup grease or graphite paste to facilitate installation. Tighten bolts or lugs to the proper torque as directed by the manufacturer to provide a watertight joint.

- K. Rated Penetrations: Provide UL-approved method of sealing fire- and fire/smoke rated wall and floor penetrations. Submit method proposed prior to installation.

3.04 EQUIPMENT CONNECTIONS

- A. General: Make connections between equipment and piping system in this section of the specifications with unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance. Connections to equipment shall be made in accordance with details on the drawings and the equipment manufacturer's installation instructions. Final connections to equipment shall be made with unions for pipe sizes 2 inch and under and with flanges for pipe sizes over 2 inch.
- B. Locations: Provide unions or flanges where indicated, and in the following locations even if not indicated:
 - 1. In long runs of straight piping for water and other non-gaseous services at 60-foot intervals to permit convenient disassembly for alterations and repairs.
 - 2. In bypasses around equipment.
 - 3. In connections to pumps, steam traps and other in-line equipment requiring disconnection for repairs and replacement, located between the isolation valve and the equipment.
 - 4. Within 3 inches of each threaded valve and each piece of equipment not having unions or flanges attached.
- C. Pump Connections: Where the suction or discharge of any pump unit is smaller than the pipe size noted on the drawings, reducing elbows or fittings shall be provided at the pump connections only.
- D. Coil Connections: Where coil piping connections are smaller than the distribution piping size shown on the drawings, the reduction in size shall be provided as close to the coil as possible. All valves, strainers, unions, flanges, balancing valves, etc. shall be full distribution pipe size except for control valves.

3.05 PIPE SIZE REDUCTIONS AND ENLARGEMENTS

- A. Prohibited Fittings: Screwed bushings are prohibited, except where available space prevents use of reducing couplings.
- B. No-Hub Clamps: No-hub clamps with bushings shall not be used for pipe size reduction. Cast iron fittings are required.
- C. Reducing Couplings: Eccentric reducing couplings shall be installed throughout steam and water piping to prevent air or water pockets occurring due to a change in pipe size. Eccentric couplings on steam shall bring the pipes flush on the bottom; eccentric couplings on water lines shall bring the pipes flush on top except as otherwise specified

or indicated. Concentric reducing couplings in horizontal water circulating piping may be utilized if a manual air vent on the larger pipe adjacent to the reducer is installed.

D. PROTECTION

- E. Protective Wrap: Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene film or 15 lb. felt.
- F. Pipe Embedded in Concrete: Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.
- G. Thread Protection: Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

3.06 FLUSHING AND CLEANING

- A. Preparation for Testing: Before final testing, flush piping systems with clean water to remove debris. Disconnect all coils and heat exchangers from the system before flushing. Flush all coils and heat exchangers separately to assure that debris does not become lodged in them. Provide temporary valves and drains as required to accomplish flushing.
- B. Final Flushing: After flushing, thoroughly clean each piping system with appropriate cleanser to remove oil, grease, lacquer, etc. Thoroughly flush each liquid system with clean water after cleaning.
- C. Chemical cleaning: After the piping is installed, add an aqueous solution of trisodium phosphate in a proportion of one pound per fifty gallons of water in the system. After filling with this solution, the system shall be allowed to circulate for two hours. The system shall then be drained completely. All strainers shall be removed, cleaned and replaced, and the system shall be refilled with fresh water. The Engineer shall be given notice of this cleaning operation. If, in the opinion of the Engineer, the cleaning operation has not been properly performed, the above procedure shall be repeated. After cleaning system, it shall be tested by litmus paper and shall be left on the slightly alkaline side (pH > 7.5). If the system is still acidic, the trisodium phosphate cleaning shall be repeated.

3.07 PRESSURE TESTING

- A. Pressure Test: Prior to insulating and concealing the piping system, apply a water pressure test to all parts of each system before equipment is connected. Use a hydrostatic pressure of not less than 100 psig or 150 percent of system operating pressure whichever is greater. Test system for a period not less than four hours. There shall be no leaks at any point in the system at this pressure.
- B. Concealed Work: Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and found free of leaks. Make repairs to defects that are discovered as a result of inspections or tests with new materials;

caulking of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.

- C. Field Testing: Complete all field testing prior to insulating, wrapping or backfilling.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 15100

VALVES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide those valves, cocks and specialties which are required for piping systems specified in other sections of these specifications.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15120, PIPING SPECIALTIES
4. 15250, THERMAL INSULATION
5. 15483, FUEL PIPING SYSTEM
6. 15510, HYDRONIC PIPING SYSTEM

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Dimensional outline drawing of each valve listed in this section including sizes available and pressure limitations.
 - b. Outline drawing of each calibrated balancing and flow-measuring valve including flow and pressure limitations.
2. Installation Instructions:
 - a. Manufacturer's printed installation instructions for all valves including copies shipped with the valves.

1.05 VALVES AND COCKS

- A. Basic Requirements: Valves and cocks may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary for the proper operation of the system shall be furnished and installed. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equivalent material and pressure class will be accepted. Valves shall have the manufacturer's name or trademark, recommended service pressure, and size indicated by raised letters cast on the valve body.

1.06 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Pressure and Temperature Rating: Valves shall have a pressure and temperature rating equal to or exceeding the piping in which they are installed, except that valves shall be designed for a minimum steam working pressure (SWP) of 125 psi; water-oil-gas (WOG) pressure of 200 psi.
- C. Safety and Relief Valves: Safety and relief valves on un-fired pressure vessels shall be tested, labeled and installed in accordance with the ASME Boiler Code Section VIII, Un-fired Pressure Vessels, Section UG-126 Safety and Relief Valves.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General: Refer to paragraph entitled "MANUFACTURERS" in Section 15010. Model numbers or product type listed for one or more manufacturers are given to provide an example of the item required.
- B. Continuity: Valves of a similar type provided shall be of the same manufacturer.

2.02 BUTTERFLY VALVES

- A. General: Valves shall be capable of bubble tight shut-off at pressure differentials of 150 psi. Valves in insulated piping shall have a minimum of 2 inch extended necks for insulation clearance.
- B. Operators: Valves 4 inch and smaller shall have steel lever latch-type actuator capable of infinite position (or minimum of 10 locking positions) and shall have adjustable memory stop. Valves 5 inch and larger shall have enclosed gear type actuator with chain wheel, hand wheel or crank type operating mechanisms, adjustable opening and closing memory stops, and position indicator. All valves 4 inch and larger located more than 7 feet above the floor or landing shall be provided with chain wheel and chain extending to within 12 inches above the floor or landing. Provide stem extensions (in addition to insulation clearance extension) as required to place operators in an easily accessible location free of interference with adjacent piping, equipment structure, etc.
- C. 2 inch and smaller: Cast bronze body, viton seals, full port, stainless steel trim.

1. Manufacturer and Model Number:

	Threaded	Solder Joint
Milwaukee	BB2-100	BB2-350

D. 2 inch and larger: Threaded and tapped lug, cast iron ASTM A126-B or ductile iron ASTM A-395 Class 60-40-18 body, bronze ASTM B-62, aluminum bronze or nylon coated disc, 416 stainless steel or phosphate coated steel shaft, and EPDM seat designed to seal against the companion flanges. Stem seals shall consist of a primary seal between the spherical disc hub and the spherical seat hub. Wafer-type are not permitted.

1. Manufacturer and Model Number:

Crane	44-BXZ
Bray	Series 34
Centerline	Series LT
De Zurik	660LR-S823
Nibco	LD 2000
Milwaukee	ML223-E

2.03 BALL VALVES

A. 2 inch and smaller: 150 psi SWP, 400 psi WOG. Standard port ball, bronze trim, cast bronze body, chromium-plated brass ball, bronze non-blowout stem, Teflon seat, double o-ring stem seals, zinc-coated steel handle with plastic coated hand grip, 90 degree operation from full open to tight shut-off.

1. Manufacturer and Model Number:

	Threaded	Solder Joint
Crane	9301	9321
Milwaukee	BA-200	BA-250
Nibco	T-585-70	S-585-70
Jamesbury	300	---
Stockham	S214-BR-T-T	S216-BR-T-S

2.04 FLOW BALANCING VALVES

- A. Circuit Setter Valve: Provide a ball type circuit setter valve for flow balancing and flow measurement, with positive shutoff, and drain connection. Valve shall have bronze body and brass trim with meter port connections having EPT inserts, positive shut-off check valves, and threaded caps. Valves shall be provided with externally calibrated adjustment with a memory stop.

1. Manufacturer and Model:

Bell & Gossett	CB Series
Taco	CS Series
Flowset	AS Series

- B. Calibration Meter: Provide one portable differential pressure gauge calibration meter kit of same manufacturer as valves. Kit shall be housed in a hand-carrying case and shall contain all devices required, including pressure gauges, 5 foot meter hoses with disconnect ends, positive shutoff valves, operating instructions, and flow versus pressure drop curves, to enable testing and balancing of each size and type of balancing valve installed.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: Install valves in horizontal piping with the valve stem in the vertical upright position.

- B. Access: Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.
- C. Solder or Brazed Connections: Disassemble prior to installation in piping to prevent heat damage to the seat and seals.

3.02 VALVES

- A. Access: Install valves, balancing cocks and similar items in easily accessible locations. Provide access panels for all concealed valves. Where gate valves in sizes 2 to 4 inches are indicated on the drawings, butterfly valves which comply with these specifications may be furnished. Install butterfly valves between properly spaced flanges; fully open before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion. Valve bolt-up method shall hold valve in place and bubble-tight when piping or equipment is disconnected from either side of the valve.

3.03 DRAIN VALVES

- A. Location: Install drain valves at the base of all water piping risers (both supply and return) and at all low points in the piping system. Drain valves shall be fitted with hose connection end with cap unless otherwise indicated.

3.04 BALL VALVES

- A. Installation: Ball valves may be installed in lieu of gate valves or butterfly valves.

3.05 FLOW BALANCING VALVES

- A. Location: Provide flow balancing valves where indicated. The exact location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's recommendations.
- B. Manufacturer' Recommendation: Install in accordance with manufacturer's recommendations including valve orientation and increases or decreases in pipe size at points of installation, together with minimum recommended lengths of straight pipe before and after points of installation.
- C. Calibration Meter: At the conclusion of the system test and balance and prior to final completion the meter shall be turned over to, and shall become the property of, the City.

3.06 ISOLATION VALVES

- A. Piping: Install isolation/shut-off valves at all main risers and main branch takeoffs, to permit isolation of piping sections for drainage.
- B. Equipment: Install isolation/shut-off valves on each inlet and outlet of each piece of equipment to which water, air or steam is piped, to allow isolation, venting and drainage.

Provide a flange or union between the valve and the equipment to permit disconnection, removal and service.

3.07 CHECK VALVES

- A. Coordination: Unless otherwise indicated, Y-pattern horizontal swing check valves shall be used in vertical lines; horizontal swing check valves shall be used with gate valves; horizontal lift check valves shall be used with globe, angle and ball valves; wafer check valves shall be used with butterfly valves and OS&Y valves.

END OF SECTION

SECTION 15120
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide those piping specialties which are required for the piping systems specified in other sections of these specifications.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15100, VALVES
4. 15250, THERMAL INSULATION
5. 15483, FUEL PIPING SYSTEM
6. 15510, HYDRONIC PIPING SYSTEM
7. 15990, PERFORMANCE VERIFICATION

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Catalog cut with picture of each of the following items:
 - (1) Thermometers and thermometer wells.
 - (2) Temperature/pressure test plugs.
 - (3) Pressure gauges and gauge cocks including snubbers.
 - (4) Air Separators.

1.05 AIR VENT

- A. Automatic: Brass or stainless steel float type, brass body, check valve to prevent air re-entry, 300 degrees F. operating temperature, 150 psi working pressure.

1. Manufacturer and Model:

Metraflex	MV-15
Crane	976
Amtrol	706
Spirax/Sarco	13W
Armstrong Machine Co.	1AV
Bell & Gossett	107

- B. Manual: Bronze body with non-ferrous internal parts, 150 psig working pressure, 225 degrees F. operating temperature, 1/2 inch inlet, 1/8 inch discharge, brass manual thumbscrew or screwdriver cock.

1. Manufacturer:

Crane	700 or 702
Armstrong Machine Co.	505A
Bell & Gossett	4V

PART 2 - EXECUTION

2.01 GENERAL

- A. Installation: Install all piping specialties according to the manufacturer's shop drawings and instructions. Provide dielectric isolating connectors when connecting copper or brass pipe or piping specialties to steel pipe or weldolets.
- B. Access: Install piping specialties with adequate clearance to permit easy operation and servicing.
- C. Strainer Blow Down: Provide blow down gate or ball valve on 1-1/2 inch and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.
- D. Strainer Location: Provide strainers at the inlet to each control valve, steam trap, pump and where otherwise indicated.

2.02 THERMOMETERS

- A. General: Install test wells, separable sockets, and thermometers in accordance with manufacturer's instructions. In horizontal piping the installation shall be on the top of the pipe not greater than 45 degrees from horizontal. Locate and adjust mounting angle as required to permit easy reading of all thermometers associated with a single device from a single accessible point.
- B. Piping Systems: Install to permit accurate reading of actual conditions. Make allowance for unrestricted flow by installing sockets in oversized fitting for line sizes 2 inch and under. Sockets, wells and thermometer stems shall extend at least halfway into the pipe but shall not impinge on the opposite pipe wall.
- C. Duct Systems: Install the thermometer sensing element into the fully blended and developed profile of the airstream to give an accurate reading of actual conditions.
- D. Protection: Protect equipment from damage from time of receipt until final acceptance. Thoroughly clean thermometers, wells and sockets of all dirt and construction debris prior to final inspection.
- E. Condenser Water: Thermometer sockets and wells in condenser water piping system shall be stainless steel.

2.03 TEMPERATURE/PRESSURE TEST PORTS

- A. Location: Provide a temperature/pressure test port at the following locations:
 - 1. Inlets and outlets of each water coil for:
 - a. Each air handling unit
 - b. Every fan coil unit
 - c. And where otherwise indicated
- B. Test Kit: Provide City with one companion test kit suitable for taking temperature and pressure readings with test ports. Provide to Engineer written certification of delivery of test kit to City; certification shall be signed by Cities authorized representative.

2.04 PRESSURE GAUGES

- A. General: Install pressure gauges, gauge valves, test plugs and snubbers in accordance with manufacturer's instructions. Locate and adjust to permit easy reading of all gauges associated with a single device from a single accessible point. Provide compound gauges where operating conditions will produce pressures below atmospheric (i.e. open-loop system pump suction).
- B. Installation: Install to permit accurate reading and to permit easy access to gauge and gauge valve. Where mounting location does not permit rotation of the gauge for removal, install using a union type gauge valve.
- C. Gauge Valve: Install using brass nipples of sufficient length to raise gauge valve clear of insulation and finish.

- D. Snubber or Glycerin Filled Gauge: Provide on all gauges at suction and discharge of all pumps and elsewhere as required to prevent pulsation and damage to gauge.
- E. Locations Required: Provide permanent gauges, with gauge valves, at the following locations:
 - 1. Fluid inlet and outlet of:
 - a. Each water coil in each air handling unit
 - b. Each chiller
 - c. Each boiler
 - 2. Where otherwise indicated or required.
- F. Valve Only Locations: Provide gauge valves to permit temporary or permanent installation of gauges for pressure indication at the following locations:

2.05 AUTOMATIC AIR VENTS

- A. Location: Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hydronic piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building. Manual air vents shall not be used in concealed locations. Provide air chamber where venting is required but inaccessible, extend discharge tubing to an accessible location with 1/4 inch copper type L tubing and terminate with a brass needle valve with pipe discharge to drain. Air chamber shall be an 8 inch long pipe, vertical rise from top of piping, one pipe size larger than piping to a maximum of 3 inches.

END OF SECTION

SECTION 15240

VIBRATION ISOLATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide vibration hangers and isolation supports for equipment and piping as required to prevent transmission of vibration and structure-borne noise to building structure.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

- 1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
- 2. 15510, HYDRONIC PIPING SYSTEM
- 3. 15680, WATER CHILLER
- 4. 15800, AIR HANDLING UNIT

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. In addition to those requirements, submit for review the following data:

- 1. Manufacturers Literature:
 - a. Dimensional outline drawing for each vibration isolator.
 - b. Spring diameter, free spring height, solid spring height, deflection, spring constant and efficiency for each spring isolator.
 - c. Maximum design rated load for each spring isolator.
- 2. Performance Data:
 - a. Maximum deflection at rated load.
 - b. Load-versus-deflection curve.
- 3. Installation Instructions:

- a. Manufacturer's printed installation instructions including copies shipped with the isolators.
- b. Pre-adjustment procedure, intended to control direction of pipe movement and final operating deflection of the springs.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Acceptance: All vibration isolation equipment shall be both recommended by the manufacturer and acceptable to the Engineer for each particular application on this project.
- C. Elastomeric Isolators: Elastomeric isolators shall comply with ASTM D2240.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manufacturers: Refer to paragraph entitled "MANUFACTURERS" in Section 15010. Vibration isolation equipment shall be provided by a single manufacturer.

2.02 BASIC REQUIREMENTS

- A. Location: Unless otherwise noted, spring type vibration isolators shall be used for all motor driven equipment. The vibration isolation manufacturer shall determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria indicated.
- B. Selection: Unit designations are indicated in the section describing the equipment to be isolated. Each of the following basic isolators may not be applicable to a specific installation application.
- C. Operating Range: Isolators shall be selected to operate within the linear portion of their load-versus-deflection curve.
- D. Indication: Vibration isolators shall have known undeflected heights or calibration markings so the amount of deflection can be determined when carrying load.

2.03 HANGERS

- A. Piping:
 1. Type PVH-1: Neoprene and spring hangers; vertical deflection; position type; steel housing for undamped support of the spring; provisions for attachment of hanger rods; reinforced neoprene washer and grommet to break up metal to metal contact;

free standing spring; 1 inch minimum static deflection (unless otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; be capable of holding the supported item at fixed elevation during installation with secondary adjustment to transfer the load to the spring while maintaining a fixed position; scale and pointer to indicate the deflection.

- a. Manufacturer and Model Number:

Mason Industries	Type PCDNHS
Amber-Booth	Type PBS

2. Type PVH-2: Neoprene and spring hangers; vertical and angular deflection; position type; laterally stable steel spring and 0.3 inch deflection neoprene or fiberglass element in series; neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact; spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring; springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection; capable of holding the supported item at the fixed elevation during installation with secondary adjustment to transfer the load to the spring while maintaining a fixed position; scale and pointer to indicate the deflection.

- a. Manufacturer and Model Number:

Mason Industries	Type PC30N
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3. Type PVH-3: Neoprene-in-shear hangers; steel housing for undamped support of the neoprene; provisions for attachment of hanger rods.

- a. Manufacturer and Model Number:

Mason Industries	Type HD
Amber-Booth	Type HRD

2.04 SUPPORTS

A. Equipment:

1. Type EVS-1: Spring mounts; open type; unrestrained; free standing springs; laterally stable; minimum horizontal-to-vertical spring rate (K_x/K_y) of 1.0; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless

otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; 1 inch minimum static deflection (unless otherwise specified).

a. Manufacturer and Model Number:

Mason Industries	Type SLF
Korfund	Series L
Amber-Booth	Type SW

2. Type EVS-2: Neoprene pads; waffle or ribbed pattern neoprene pads shall be fabricated from 40 or 50 Durometer neoprene. 40 Durometer pad loading shall not exceed 60 pounds per square inch or 90 pounds per square inch for a 50 Durometer pad.

a. Manufacturer and Model Number:

Mason Industries	Type W
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3. Type EVS-3: Housed; unrestrained; springs free standing within their housing; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the supporting surface (unless otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; 1 inch minimum static deflection (unless otherwise specified); welded steel housing; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and the piping saddle (leveling bolts shall be adjusted to maintain this clearance).

a. Manufacturer and Model Number:

Mason Industries	Type C
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4. Type EVS-4: Neoprene-in-shear mounts; double deflection neoprene-in-shear mountings shall have a minimum static deflection of 0.35 inch; all metal surfaces shall be neoprene-covered; top and bottom surfaces shall be neoprene ribbed and bolt holes shall be provided in the base. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang; steel rails shall be by same manufacturer as vibration isolators and equivalent to Mason Industries, Type DNR.

a. Manufacturer and Model Number:

Mason Industries	Type ND
Consolidated Kinetics	Type RD

Vibration Mounts and Controls	Series RD
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5. Type EVS-5: Standard neoprene pads; 2 inch by 2 inch by 3/4 inch thick single or multiple molded modules; 50 durometer; 15 percent deflection at optimum rating of 45 pounds per square inch.

a. Manufacturer and Model Number:

Mason Industries	Type Super W
Mason Industries	Type Super W

6. Type EVS-6: Open type; restrained; free standing springs; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the supporting surface; spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of rated deflection; 1 inch minimum static deflection (unless otherwise indicated); restraint consisting of welded steel channel ends for outdoor installation; vertical rise of isolated equipment when load is reduced; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and piping saddle (leveling bolts shall be adjusted to maintain this clearance).

a. Manufacturer and Model Number:

Mason Industries	Type SLR
Amber-Booth	Type CT

B. Piping:

1. Type PVS-1: Spring mounts; open type; unrestrained; free standing springs; laterally stable; minimum horizontal-to-vertical spring rate (Kx/Ky) of 1.0; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the supporting surface (unless otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; 1 inch minimum static deflection (unless otherwise specified).

a. Manufacturer and Model Number:

Mason Industries	Type SLF
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Korfund	Series L
Amber-Booth	Type SW

2. Type PVS-2: Open type; restrained; free standing springs; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the supporting surface (unless otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; 1 inch minimum static deflection (unless otherwise specified); restraint consisting of welded steel channel ends for outdoor installation and welded steel studs for indoor installation; restraint shall have restraining bolts connecting top plate and lower housing to limit vertical rise of isolated piping when load is reduced; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and the piping saddle (leveling bolts shall be adjusted to maintain this clearance).

- a. Manufacturer and Model Number:

Mason Industries	Type SLR
Amber-Booth	Type CT

3. Type PVS-3: Housed; unrestrained; springs free standing within their housing; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the supporting surface (unless otherwise specified); spring diameters not less than 80 percent of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50 percent of the rated deflection; 1 inch minimum static deflection (unless otherwise specified); welded steel housing; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and the piping saddle (leveling bolts shall be adjusted to maintain this clearance).

- a. Manufacturer and Model Number:

Mason Industries	Type C
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2.05 PIPE CONNECTORS

- A. General: Flexible connectors shall be provided for all piping connections to rotating equipment.
- B. Internal Diameter: Connectors shall have the same internal diameter as the pipe in which it is installed (not necessarily internal diameters of inlets or outlets of equipment).

- C. Recommended Application: Flexible connectors shall both be recommended by the manufacturer and acceptable to the Engineer for handling the conveyed fluid at all conditions (maximums and minimums of temperatures, pressures, velocities, etc.) encountered for each particular application.
- D. Design Requirements: Connectors shall be designed to absorb the combination of vibratory and expansion or contraction motions (lateral and axial and angular) encountered at each installation point (for example, do not use hose type where axial motion is encountered at the installation point unless so recommended by the manufacturer and acceptable to the Engineer).
- E. Allowable Displacement: The allowable displacement of the flexible connector in all directions shall be greater than the maximum deflection in the same relative direction. The stiffness of the flexible connector shall be less than the stiffness of the isolators.
- F. Expansion:
 - 1. Type PVE-2: Non-ferrous single arch expansion joint connector fabricated of multiple plies of nylon cord, fabric and neoprene; furnished with metallic flanges which are independent of the casing and retained by beaded ends which fit into machined groves, forming a liquid tight seal without gasketing. Provide bolted stabilizing/control rods to maintain anchoring where required, due to size or operating pressure.

- a. Manufacturer and Model Number:

Mason Industries	Type MFNC
Keflex	Ke-max
Metroflex	
Proco Products, Inc.	Style 240
Amber-Booth	Style 2800

- 2. Type PVE-3: Non-ferrous twin arch expansion joint connector fabricated of multiple plies of nylon cord, fabric and neoprene; furnished with metallic flanges which are independent of the casing and retained by beaded ends which fit into machined groves, forming a liquid tight seal without gasketing. Provide bolted stabilizing/control rods to maintain anchoring where required, due to size or operating pressure.

- a. Manufacturer and Model Number:

Mason Industries	Type MFTNC
Keflex	Ke-joint
Metroflex	

Proco Products, Inc.	Style 242
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3. Type PVE-4: Non-ferrous elbow expansion joint connector fabricated of multiple plies of nylon cord, fabric and neoprene; furnished with metallic flanges which are independent of the casing and retained by beaded ends which fit into machined grooves, forming a liquid tight seal without gasketing.

- a. Manufacturer and Model Number:

Mason Industries	Type MFNEC
Proco Products, Inc.	Series 428

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: Isolators shall be installed in strict accordance with the manufacturer's instructions and shall be adjusted prior to requesting final inspection or the performance of any vibration testing specified. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted, necessary changes or additions shall be performed to eliminate the noise and vibration without additional cost to the City.
- B. Corrosion Protection: Steel components shall be phosphated and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
- C. Weather Protection: All isolators exposed to weather shall have steel parts PVC coated, neoprene coated or hot-dip galvanized. Aluminum components shall be etched and painted. Nuts, bolts and washers shall be zinc-electroplated.
- D. Positioning: Each item of equipment (machinery, piping, etc.) which is required to have vibration isolation equipment shall rest in its intended, operating position (i.e.; exactly level, etc.) after installation of vibration isolation equipment. Acceptance of such vibration isolation equipment by the Engineer shall not constitute a waiver of this responsibility.
- E. Pads: Rotating or vibrating equipment which is specified to rest on concrete housekeeping pads shall have minimum 5/16 inch thick Type EVS-2 isolation pads unless otherwise indicated. Loading shall not exceed manufacturer's recommended rating.
- F. Cleaning: Prior to start-up, clean out all foreign matter between isolators or bases and equipment and verify there are no isolation short-circuits in the installation.

3.02 PIPING IN MECHANICAL EQUIPMENT AND AIR HANDLING UNIT ROOMS

A. General:

1. Isolators for equipment and piping are described elsewhere in this division. The vibration isolation manufacturer shall coordinate the selection of piping supports with equipment supports to provide a carefully engineered system designed to accommodate expansion and contraction without excessive stress or misalignment at equipment connections or in the piping.
2. Temporary anchors, where required, shall be installed to permit pre-adjustment of springs in risers.
3. Permanent limit stops shall be installed to prevent excessive vertical motion of risers in the event water is drained from system. Locations and other details of these limit stops shall be submitted to the Engineer for acceptance.
4. Piping connected to vibration isolated equipment shall not strain or force out of alignment the vibration isolators supporting the basic equipment, nor shall pipes restrict such equipment from "floating" freely on its respective vibration isolation system.
5. Piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.
6. The weight of the pipe shall not be carried by walls through which the pipe passes.

B. Isolator Locations:

1. Hanger Boxes: Isolators shall be installed with the hanger box attached to or hung as close as possible to the structure. Hanger rods shall be aligned to clear the hanger box.

C. EQUIPMENT ISOLATION

- D. Vibration Measurement: No vibration amplitude measurement at driving (motor) or driven (pump, fan, etc.) speeds shall exceed manufacturers recommended values. No axial vibration shall exceed maximum radial (perpendicular to shaft) vibration at any bearing or measuring location. In no event shall any rotating equipment exceed 0.05 inches/second rms vibration amplitude under normal operating conditions. Whenever rotational speed is measured as the disturbing frequency, the lowest speed in the system shall be used.

END OF SECTION

SECTION 15250

THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide thermal insulation as indicated. Materials such as fasteners and retainers not specifically described but required for a complete and proper installation shall be provided.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15100, VALVES
3. 15510, HYDRONIC PIPING SYSTEM
4. 15550, HOT WATER BOILER AND ACCESSORIES
5. 15680, WATER CHILLERS
6. 15800, AIR HANDLING UNITS
7. 15885, AIR FILTERS
8. 15890, DUCTWORK

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Provide data on all types of insulation, jacketing, sealer and adhesive required by this section of these specifications, with indication of each material and its intended application.
2. Performance Data:
 - a. Provide thermal performance, density and vapor permeance for each type of insulation, finish, cover, facing or jacket specified in this section.

- b. Unless otherwise stated, insulation types and thicknesses specified are based on insulating materials having a "K" value (BTU per hour per square foot per degree temperature difference) per inch of thickness as indicated.
 - c. Vapor permeance is based on vapor retardant materials having water vapor transmission rates in perms (grains of vapor per hour per square foot per inch of mercury vapor pressure differential).
 - d. Alternate materials shall be approved on the basis of thicknesses providing equivalent heat transfer or vapor transmission rates.
3. Installation Instructions:
- a. Provide copy of manufacturer's printed installation instructions for all insulation materials including copies shipped with the material.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall comply with the paragraph entitled "Code Compliance" in Section 15010.
- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- C.
- D. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A, 2002 Revision, as to flame spread and smoke developed ratings throughout their operating temperature range. All insulation, jackets, facings and adhesives used to adhere the jacket or facing to the insulation, including fittings and butt strips, shall have a non-combustible fire and smoke hazard rating and label as tested by ASTM E-84, NFPA 255, 2000 Revision and UL-723 not exceeding flame spread value of 25 and smoke developed/fuel contributed value of 50. Accessories such as mastics, cements, tapes and cloth for fittings shall have the same ratings.
- E. ASHRAE: Insulation thermal conductance values and insulation thicknesses shall comply with the requirements of the American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc. (ASHRAE) Standard 90.1-1989.
- F. Florida Energy Code: Insulation thermal conductance values and insulation thickness shall comply with the Florida Energy Efficiency Code for Building Construction, 2001 edition.
- G. Industry Standards: Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be included in the submittal.

- H. Packaging Information: All products or their shipping cartons shall bear the Underwriter's Label indicating that flame and smoke ratings do not exceed the above criteria. Every package or container of insulation, jacketing, facing, cement, adhesive, or coating delivered to the project site must have a manufacturer's stamp or label attached, giving the brand and a description of the material. All vapor retardants shall be labeled, indicating the thickness, product nomenclature and manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials: The insulation materials and installation procedures shall be as indicated in this section and must be approved by the insulation product manufacturer for each particular application. The actual products to be used must comply with the insulation material for the specific application as indicated in other sections of these specifications.
- B. Applicability: Products and manufacturers listed may not all be applicable. Use only those products and manufacturers which are indicated as being applicable to a specific insulation condition. Insulating materials shall be resilient and moisture-resistant so that the insulating properties will not be affected by rough handling, water damage and similar construction hazards. All adhesives, sealers and vapor retardant coatings shall be compatible with the materials to which they are applied, and shall not corrode, soften or attack such materials when wet or dry.
- C. Acceptable Manufacturers: Manufacturers which are listed are those manufacturers who may make one or more of the insulation products required. Listing of a manufacturer does not mean the manufacturer is approved for all applicable insulation conditions. Manufacturers must comply with the requirements of each insulation condition to be acceptable for the application.

2.02 MANUFACTURER

- A. Refer to paragraph entitled "MANUFACTURERS" in Section 15010.

2.03 CELLULAR GLASS INSULATION

- A. General: Preformed or block type as applicable. Fire, water and vermin retardant; closed cell glass composition; density of 8.0 pcf. Material shall comply with ASTM C 552, "Specification for Cellular Glass Thermal Insulation" and Military Specification MIL-I-24244B. Flame spread rating of 5 and a smoke developed rating of zero per ASTM E 84; maximum "k" value of 0.34 at 75 deg F. Temperature applications from -450 degrees F. to 1200 degrees F. when installed in accordance with manufacturer's recommendations.

- 1. Pipe insulation: Preformed cellular glass.

- a. Manufacturer and Product:



Pittsburgh-Corning	Foamglas
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- B. Joint Sealant: Non-hardening vapor retardant sealant specifically designed for use with cellular glass insulation.

1. Manufacturer and Product:

Pittsburgh-Corning	Pittseal 440N
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- C. Finish Mastic: For cellular glass insulation. Waterproof, weather, acid and alkali resistant asphalt mastic coating for use in the range of -40 degrees F. to 200 degrees F.

1. Manufacturer and Product:

Pittsburgh-Corning	Pittcote 440 Vapor and Weather Barrier Finish
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- D. Finish Fabric: ASJ jacket, suitable for painting.

2.04 POLYMER CLOSED-CELL FOAM

- A. General: Flexible foam-type expanded closed-cell preformed (tube) or sheet as applicable. Maximum K value of 0.255 at 75 degrees F., and zero water absorption and water-vapor transmission. Allowable temperature applications from -110 degrees F. to 210 degrees F. when installed in accordance with manufacturer's recommendations. Do not install in return air plenums.

- a. Manufacturer:

- (1) IMCOA
- (2) MOMACO

2.05 ELASTOMERIC CLOSED-CELL FOAM

- A. General: Flexible foam-type expanded closed-cell preformed (tube), roll or sheet as applicable. Nitrile, rubber based, closed cell structure. Maximum K value of 0.27 at 75 degrees F., and maximum water vapor transmission of 0.02 perm. Allowable temperature applications from -40 degrees F. to 220 degrees F. when installed in accordance with manufacturer's recommendations. Do not install in return air plenums.

- a. Manufacturer:

- (1) Armstrong AP Armaflex

(2) Rubatex

B. Adhesive: For joints and seams in foam insulation.

a. Manufacturer and Product:

Rubatex	R-373 Insulation Adhesive
Armstrong	520 Adhesive

C. Finishing Coating: For weather protection of foam insulations.

a. Manufacturer and Product:

Rubatex	374 coating
Armstrong	WB Armaflex Finish

2.06 FIBERGLASS INSULATION

A. General: Inorganic fibrous glass.

B. Blanket: Flexible form; faced, unfaced or coated as indicated.

1. High-temperature insulation: Unfinished, non-combustible, wool-like; composed of long glass fibers bonded with a thermosetting resin to an all-service jacket. Thermal conductivity (K) of 0.23 at 100 degrees F. and maximum moisture transmission of 0.02 perm, or as acceptable to the Engineer, according to the density, thickness and operating temperature. Applicable for boilers, vessels, breechings and stacks operating up to 1000 degrees F. Finished or held in place by wire ties, metal lath, lagging or as indicated. Insulation shall have negligible thermal expansion, cracking and warping throughout its anticipated operating temperature range.

a. Manufacturer and Product:

Pittsburgh-Corning	StrataFab
Certain-Teed	High-Temperature Fiberglass Mineral Fiber Insulation

2. Duct insulation, external: Composed of flexible blanket of glass fiber factory laminated to a reinforced foil kraft (FRK) vapor retardant with a minimum 2 inch taping and stapling flange on one edge. Suitable for operation at temperatures from 40 degrees F. to 250 degrees F. thermal conductivity of 0.31 at 75 degrees F. Minimum density of 0.75 pcf. Provide 2 inch thickness unless otherwise indicated in Section 15890.

3. Finish Fabric, General Purpose: Nylon membrane. For use generally with fiberglass duct insulations at joints or seams or as indicated. Apply using Foster GPM 35-00 or equivalent.

- a. Manufacturer:
 - (1) Armstrong
 - (2) CertainTeed
 - (3) Childers Products Co.
 - (4) Knauf
 - (5) Schuller
 - (6) Owens-Corning
 - (7) Pittsburgh Corning

C. Preformed: Jacketed or unjacketed as indicated, one-piece or half-sectional.

1. Pipe insulation, preformed jacketed fiberglass: Jacketed with factory-applied kraft reinforced foil all-service vapor retardant jacket suitable for use in systems with temperatures from -60 to 350 degrees F. The jacketing shall have a white finish suitable for painting without sizing. Jacket closure system of factory-applied double pressure-sensitive adhesive on longitudinal joints; self-sealing butt strips at circumferential joints which provide closure and positive vapor retardant seal without hard rubbing or the application of heat. Thermal conductivity (K) of 0.24 at 100 degrees F. and vapor transmission of 0.02 perms.

- a. Manufacturer and Product:

Owens-Corning	Fiberglas ASJ/SSL-II
Schuller	Micro-Lok with AP-T Plus jacket
CertainTeed	500 Snap-On

2. Pipe insulation, preformed unjacketed fiberglass: Suitable for field-jacketing. Thermal conductivity (K) of 0.23 at 100 degrees F.

- a. Manufacturer and Product:

Owens-Corning	Fiberglas No-Wrap
Schuller	Micro-Lok

2.07 INSULATION MASTICS AND ADHESIVE

- A. Mastic: Low-odor, fire and vapor retardant mastic with permeance not exceeding 0.08 perms in accordance with ASTM E96. For use where indicated or otherwise applicable. Coating shall be non-flammable in both dry and wet states.

1. Manufacturer and Product:

Foster	GPM 35-00
Childers	Chil-Perm CP-30 Low-Odor

2. Adhesive: For adhering fiberglass blanket and board insulations to metal substrate such as ductwork.

- a. Manufacturer and Product:

Insulcoustic	I-C 201
Foster	85-20

2.08 INSULATION JACKETS AND COVERS

- A. Pipe Fitting Covers, PVC: Insulated polyvinyl-chloride fitting covers of minimum 0.015 inch thickness and in shapes as required; with fiberglass insulation insert. Suitable for temperature range of 0 to 450 degrees F. Acid, alkali and chemical resistant. Suitable for painting if required. NFPA-255 rated not to exceed 25/50 flame spread/smoke developed.

1. Manufacturer and Product:

Schuller	Zeston 25/50 PVC Insulated Fitting Covers
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2.09 RELATED PRODUCTS

- A. Wire: Dead soft, 16-gauge, stainless steel.
- B. Straps: Stainless steel T-304 (18-8) soft annealed with deburred edge with stainless steel wing seals.

1. Manufacturer and Product:

Childers Products	Febstraps
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- C. Screws: Aluminum pan head type "A" slotted #8 by 1/2 inch.

PART 3 - EXECUTION

3.01 GENERAL

- A. Field Forming, Fitting and Finishing: Where preformed insulation products are available they shall be used. Provide field formed, fitted and finished insulation systems only if such application is more practical and acceptable to the Engineer.
- B. Terms: For an explanation of the terms used to describe the installation of the various types of insulation products refer to paragraph entitled "DEFINITIONS" in Section 15010.
- C. Pre-installation:
 - 1. Prior to work of this section, carefully inspect the installed work of all trades and verify that all work is complete to the point where this installation may properly commence.
 - 2. Insulation on pipe fittings, valves and pipe joints shall not be installed before the piping is tested and approved. Do not apply insulation adhesives, materials or finishes until the building is adequately closed in and the item to be insulated has been completely installed, tested and proved tight and suitable for insulation.
 - 3. Remove all foreign material, clean and surfaces before applying insulation.
- D. Penetrations: All insulation shall be continuous through walls, floors and ceiling openings, except at fire dampers. Pipe insulation through fire rated partitions shall be cellular foamglass type only, with the ends sealed; fiberglass and foam insulation through rated partitions is prohibited. Where piping and ducts pass through partitions (walls or floors), the openings in the construction around the piping and ducts shall be packed with fire-stop material to provide an effective retardant against the spread of fire, smoke and gases as shown in the detail drawings or as shown in a current Underwriter's Laboratory "Building Materials Directory". Submit a copy of the intended system to the authority having jurisdiction for their review and acceptance.
- E. Vapor Retardant Continuity: A continuous, unbroken moisture and vapor seal shall be provided over insulation on cold surfaces where vapor retardant jackets, facings, or coatings are required. Anchors, hangers and other projections shall be insulated and vapor-sealed to prevent condensation. All openings and punctures shall be sealed with a vapor retardant compound. The edges of vapor retardant insulation at valve stems, instrument wells, gauge connections, unions and other raw edges shall be sealed to prevent moisture from penetrating the insulation by sealing on all open ends.

- F. **Workmanship:** Insulation materials shall be installed in a workmanlike manner with smooth and even surfaces, with jackets drawn tight and smoothly cemented down at all longitudinal and end laps. Jacket and facing laps, joint strips and insulation ends, and straight runs of piping at not more than 21 foot intervals shall be secured and sealed with fire-retardant vapor retardant adhesive. Scrap pieces of insulation shall not be used where a full-length section will fit. All surface finishes shall be extended to protect all interfacing surfaces, ends and raw edges of insulation. Insulation on strainers shall be installed to facilitate cleaning of the strainer. Do not insulate unions, but terminate insulation at both ends neatly with a 45 degree bevel.
- G. **Hot Equipment Hanger Insulation:** On all hot piping and equipment, hangers and supports may be attached to piping or equipment before insulation is applied, except where roller hangers are required.
- H. **Cold Equipment Insulation:**
1. **Hangers and Supports:** Insulation and jackets shall be neatly finished at pipe and duct hangers, clamps, anchors, and other supports which are in contact with the pipe or duct. Insulation shall consist of rigid pipe or duct insulation of equal thickness to the adjoining insulation, and shall be provided with a vapor retardant seal. The length of insulation shall be sufficient to prevent condensation but not be less than 9 inches.
 2. **Pipe Shields:** For cold piping, hangers and supports shall be installed on the outside of the insulation and the insulation shall be protected by a galvanized metal shield. Shield shall extend halfway up both sides of the pipe insulation cover and shall provide support over the bottom 120 degree arc of the insulation. If the hanger is too large to provide this support a metal liner shall be provided. The shield shall be fastened with pipe straps at each end. The insulation shields shall comply with the following table:

TABLE - PIPE INSULATION SHIELDS

Pipe Size, Inches	Metal Gauge	Length, Inches
1/2 to 1-1/2	18	12
2 to 4	16	12
6	16	18
8 to 12	14	24
14 & above	12	24

Note: This table is based on an insulation with a minimum of 4 psi compressive strength and a maximum of a 10 foot span between hangers. Any modifications must be submitted for acceptance.

3. Trapeze Hangers for Glass Fiber Insulation: Piping insulated with glass fiber insulation and supported on trapeze hangers shall have a 6 inch long paraffin coated hard maple curved block between the saddle and the piping. The block shall be encased in the insulation exterior jacket or vapor barrier.
 - I. Valves, Cocks and Specialties: Insulate as for the related piping system in which they are located unless otherwise indicated.
 - J. Piping: Insulation thicknesses for piping are given for insulation installed at the locations indicated. Thicknesses are based on the various conditions of temperature, usage and environment which are typically encountered.
 - K. Insulation Over Nameplates: Cleanouts, nameplates, ASME labels and manholes shall not be insulated, and the insulation on surrounding surfaces shall be neatly beveled off at such openings.
 - L. Factory Pre-insulated Components: Where equipment and other system components are specified in other sections to have factory installed insulation, no additional insulation is required unless additional non-factory-installed insulation is specifically described.
 - M. Minimum Thicknesses: Insulation thicknesses which are indicated are minimum thicknesses. The same insulation material may be provided in greater thickness as an aid to installation and handling procedures or due to material availability and procurement considerations, as long as the additional thickness does not reduce critical clearances from other piping, walls, etc. and does not increase the thermal conductance.
 - N. Bands and Fasteners: Metal bands used on pipe insulation shall be 3/4" wide made from brass or aluminum. Bands shall be spaced to hold the ends and center of each section at a maximum spacing of 18 inches on centers. Bands shall not be visible on exposed work. Mechanical fasteners shall be installed in accordance with the manufacturers recommendations. Projecting points and sharp edges of fasteners shall not extend outside the insulation facing; clip off projecting points and provide plastic caps or cement cover finish.
- 3.02 CELLULAR GLASS PIPING INSULATION
- A. Interior, Concealed: Insulate with prefabricated, cellular glass pipe insulation. Coat joints with joint sealant and secure each section with not less than two wires. Finish with a layer of fabric applied between two glove coats of mastic. Mastic and fabric shall be applied in strict accordance with the manufacturer's recommendations and in ambient conditions of 50 to 120 degrees F.

- B. Interior, Exposed: Insulate with prefabricated, cellular glass pipe insulation. Coat joints with joint sealant and secure each section with not less than two wires. Finish with jacket secured with straps. Finish elbows and fittings with mastic, reinforced with fabric or finish with fitting covers. Finish materials shall be applied in strict accordance with the manufacturer's recommendations.
- C. Exterior, Protected: Provide same insulation system as for "Interior, Exposed" except thickness as required.
- D. Exterior, Unprotected: Provide same insulation system as for "Exterior, Protected" except thickness as required.

3.03 GLASS FIBER PIPING INSULATION

- A. Interior, Concealed: Insulate with glass fiber insulation with all-purpose jacket. Elbows, joints, valves, and all like items shall be insulated using closely mitered insulation and wrapped with glass fabric secured with 20-gauge noncorrosive wire finished with a smoothing coat of insulating cement and mastic or insulated and jacketed using factory-made pre-molded pipe fitting covers. Install all items in strict accordance with the manufacturer's recommendations.
- B. Interior, Exposed: Provide as specified for "Interior, Concealed", except where field-fabricated fitting covers are used. Additionally finish with open weave 20x10 mesh glass fabric adhered between two flood coats of white lagging adhesive, overlapping the adjacent pipe insulation 2" and smoothed to a neat uniform finish without noticeable ridges or exposed fabric. Finish materials shall be applied in strict accordance with the manufacturer's recommendations.
- C. Interior, Exposed, Special Locations: Provide same as "Interior, Exposed" with the additional requirement that the final coat of mastic for the insulation finish shall be gloved and finished to accept painting.
- D. Exterior, Protected: Provide the same insulation system as "Interior, Concealed" except thicknesses as specified. Cover finish with aluminum jacketing and fitting covers. Secure fitting covers with screws and secure jacketing with straps containing a high-temperature sealant.
- E. Exterior, Unprotected: Provide the same as for "Exterior, Protected".
- F. Underground: Not acceptable.

3.04 DUCT SYSTEMS

- A. General: Air handling unit casings downstream of cooling coils shall be insulated. Insulate supply and return air ducts for heating and air conditioning systems from supply fan discharge to room outlets on all systems. Outside air ducts shall be externally insulated.

- B. Interior, Concealed, External Insulation: Insulate with fiberglass blanket wrap applied over clean, dry sheet metal ductwork installed to allow maximum fullness at corners (avoid excessive compression). Adhere duct insulation to metal and provide continuity of vapor retardant in accordance with the manufacturer's recommendations. Finish joints and seams with finish fabric and mastic, applied by trowel, to provide a smooth, seamless and vapor-retardant finish. Where duct width exceeds 24 inches, the insulation shall be additionally secured to the bottom of the duct using mechanical fasteners spaced 1 foot on center to prevent sagging of the insulation. Fasteners shall be solid base and attached to ductwork by spot welding or perforated base and secured to ductwork with adhesive. Self-adhesive or double-sided tape is not allowed.
- C. Interior, Exposed, Round: Insulate with same insulation system as for "Interior, Concealed". An acceptable alternate is preformed jacketed fiberglass pipe insulation of the same internal size as the round ductwork, with performance criteria and installation as specified herein.
- D. Interior, Exposed, Rectangular: Insulate with semi-rigid fiberglass board. Adhere to ductwork with adhesive. Finish joints and seams with finish fabric and mastic, applied by trowel, to provide a smooth, seamless and vapor-retardant finish.
- E. Exterior, Protected: Similar to "Interior, Exposed, Round or Rectangular".
- F. Exterior, Unprotected: Similar to "Exterior, Protected", but in addition finish with two 1/4 inch thick coats of heavy-duty weatherproof mastic, to be applied by spray or trowel, with a layer of glass cloth embedded between the coats installed in accordance with the mastic manufacturers written recommendations.

3.05 DUCT SYSTEMS EQUIPMENT

- A. General: Insulate as follows unless detailed to a greater extent elsewhere.
- B. Duct Accessories: Where ducts will be insulated, make provisions for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be attached and finished shall be mounted on the duct.

3.06 COLD EQUIPMENT AND RELATED COMPONENTS

- A. Condensate Drain Piping From Cooling Equipment:
 - 1. Interior; and Exterior, Protected: Insulate with preformed elastomeric pipe insulation secured with adhesive and finished with a white finish coating.
 - 2. Exterior, Unprotected: None required.
- B. Flexible Pipe Connectors for Vibration Isolation: Insulate with elastomeric insulation. Secure the insulation with adhesive applied to a clean surface and finish with white finish coating.

3.07 MISCELLANEOUS ITEMS

- A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115 degrees F. Insulation materials and method shall be as directed by the Engineer.
- B. Final Inspection: At final inspection the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without an additional change to the City.

END OF SECTION 15250

NO TEXT FOR THIS PAGE

SECTION 15483

FUEL PIPING SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide fuel piping and related equipment as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:
 - 1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
 - 2. 15060, PIPE AND FITTINGS
 - 3. 15100, VALVES
 - 4. 15120, PIPING SPECIALTIES
 - 5. 15550, HOT WATER BOILER AND ACCESSORIES
- B. Related Divisions: Other Divisions or Sections of these specifications which relate to the requirements of this Section may include but are not limited to the following:
 - 1. Division 1, ALTERNATES
 - 2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Provide shop drawing and/or manufacturer's data sheet for all items.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Authority having Jurisdiction.
- C. NFPA-30, Flammable and Combustible Liquids Code.
- D. NFPA-31, Standard for the Installation of Oil Burning Equipment.

- E. NFPA-54, National Fuel Gas Code.
- F. NFPA-58, Standard for Storage and Handling of Liquefied Petroleum Gases.
- G. DEP: The installation of fuel storage tanks shall comply with the Florida Department of Environmental Protection, Chapter 62-761.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Application: The fuel piping systems shall only be of the materials indicated in this section. See Section 15060, PIPE AND FITTINGS for material specifications.
- B. Manufacturer: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.
- C. Wiring: All wiring to warning lights, alarms and controls shall comply with the requirements of Division 16.

2.02 NATURAL GAS/PROPANE PIPING

- A. General: The following schedule covers materials unless specifically noted otherwise.
 - 1. Piping
 - a. 1-1/2 inch and larger shall be schedule 40 black steel with welded fittings.
 - b. 1-1/4 inch and smaller shall be schedule 40 black steel with malleable iron fittings.
- B. Valves: All valves shall be 150 psi SWP, 300 psi WOG, AGA approved as specified in Section 15100, VALVES.
- C. Gas Regulator: At each point where a gas line enters a building, the line shall be equipped with a pressure reducing regulator to reduce gas pressure to seven inches water column before the building entry. Such regulators shall be equipped with a high outlet pressure shut off device requiring manual reset sized to interrupt gas flow if the outlet pressure exceeds set pressure by fourteen (14) inches water column. Regulators should be capable of delivering the required gas volume with 5 psig inlet pressure and seven inch water column outlet pressure and shall be rated for a minimum sixty (60) psig inlet working pressure. or accepted substitution regulator shall be used.
 - 1. Equipment Locations: Provide auxiliary gas pressure regulators at each equipment location for gas distribution system pressures greater than 2 psig. Regulators shall be capable of delivering the required gas volume with a seven inch water column outlet pressure.
 - 2. Manufacturer:

- a. Rockwell
- b. Fisher

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation: The design drawings are generally diagrammatic. Every bend, off-set, elbow or other fitting which is required, may not be shown for the piping installation. Careful coordination of the work is necessary to avoid conflicts.
- B. Piping: Run all piping parallel or perpendicular to building lines unless otherwise indicated.
- C. Dielectric Connections: Provide dielectric unions between dissimilar metals and at connections to the tank and all equipment. Do not use steel and copper piping in the same system without isolation.
- D. Prohibited Fittings: Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal piping shall be made with eccentric reducers. Top of piping shall be flat for venting. The bottom of vent and return lines shall be flat for drainage.

3.02 NATURAL GAS/PROPANE PIPING

- A. Concealed piping: Lines run in concealed but accessible construction need not be installed in a protective conduit but shall be labeled in accordance with Section 15050, BASIC MECHANICAL MATERIALS AND METHODS.
- B. Dirt Pockets: Run distribution system with a pitch down to dirt pockets. Full line size, a 12 inch minimum nipple with a screw cap at the bottom.
- C. Equipment Connections: Make connections to equipment furnished by others or under other sections of these specifications. Where an emergency shut-off valve is indicated or required it shall be mounted in a visible location after all equipment is installed.
- D. Make connections between any piece of equipment and piping system by means unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance. Provide dirt pocket at each piece of equipment.
- E. Valves: Install valves in supply lines to each piece of equipment on supply side of union connection.

3.03 TESTS

- A. Natural Gas/Propane Piping: Piping shall be disconnected from tank and equipment prior to testing. Piping shall be tested at 50 psig air pressure for a period of four hours.

END OF SECTION 15483

SECTION 15484

SPECIAL PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide related items necessary to complete the installation of the special piping systems as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

- 1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
- 2. 15060, PIPE AND FITTINGS
- 3. 15100, VALVES
- 4. 15120, PIPING SPECIALTIES

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

- 1. Division 1, ALTERNATES
- 2. Division 16, ELECTRICAL

1.04 SUBMITTALS

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Provide shop drawing and/or manufacturer's data sheet for the following items:

- 1. Manufacturers Literature:
 - a. Complete list of all piping materials to be used in this section including valves, pipe schedules, pipe sizes and method of connection for each piping system

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Material: Refer to the requirements of Section 15060, PIPE AND FITTINGS, and Section 15100, VALVES, for complete description of materials specifications and installation, as well as, requirements of this section.
- B. Manufacturer: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.

2.02 PIPING

- A. Laboratory Compressed Air Piping: Piping shall be type "L" hard drawn copper with brazed joints.
- B. Laboratory Vacuum Piping: Piping shall be type "L" hard drawn copper with brazed joints.

PART 3 - EXECUTION

3.01 GENERAL

- A. Pressure Testing: Pressure testing shall be performed as described in section 15060, PIPE AND FITTINGS.

END OF SECTION 15484

SECTION 15510

HYDRONIC PIPING SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide hydronic piping system as indicated on the drawings and specified herein.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15100, VALVES
4. 15120, PIPING SPECIALTIES
5. 15160, PUMPS
6. 15250, THERMAL INSULATION
7. 15550, HOT WATER BOILER AND ACCESSORIES
8. 15680, WATER CHILLER
9. 15800, AIR HANDLING UNIT
10. 15950, BUILDING CONTROL SYSTEM
11. 15990, PERFORMANCE VERIFICATION

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Complete list of all piping materials to be used in this section including valves, thermometers, pressure gauges, pipe schedules, pipe material, pipe sizes and method of connection for each piping system.
 - b. Complete list of thermometer temperature ranges and pressure gauge ranges for each piping system.

- c. Provide a schematic diagram of the make-up assembly for each closed-loop hydronic water system including the pipe size and the schematic location of all equipment and setting of the pressure regulator.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Application: The hydronic piping systems shall only be of the materials indicated in this section. See Section 15060, PIPE AND FITTINGS for material specifications.
- B. Valves: All valves used in the hydronic piping shall be 150 psi SWP, 300 psi WOG as specified in Section 15100, VALVES.
- C. Valves: All valves used in the hydronic piping shall be 125 psi SWP, 200 psi WOG as specified in Section 15100, VALVES.

2.02 CHILLED WATER

- A. General: Only the following materials shall be used for chilled water piping unless specifically indicated otherwise.
- B. Pipe:
 - 1. Piping shall be black steel; Type L or K hard drawn copper is allowed for pipe sizes 4 inches or less.
- C. Fittings:
 - 1. Welded or brazed fittings shall be used on piping 3 inches and larger. Screwed fittings are allowed on piping 2-1/2 inch and smaller.
 - 2. Rigid grooved mechanical joint piping connections will be allowed for all above ground piping of black steel or copper.
- D. Thermometers: Range shall be 0 to 120 degrees F.
- E. Gauges:
 - 1. Pressure: Range shall be 0 to 60 psig.
- F. Insulation:
 - 1. Pipe insulation shall be cellular glass

2. The insulation thickness in inches, unless otherwise specifically indicated, shall be in accordance with the following table:

TABLE - CELLULAR GLASS PIPING INSULATION THICKNESS

Pipe Size, Inches	Up to 1	1-1/4 to 2	2-1/2 to 4	5 to 6	8 & Up
Chilled Water	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
Glycol or Brine	1-1/2	1-1/2	2	2	2

3. For piping exposed to the outdoor air, increase insulation thickness by 1/2 inch. Provide insulation in 2 layers for 1-1/2 inch thickness or greater.

2.03 HEATING WATER

- A. General: Only the following materials shall be used for heating water piping unless specifically indicated otherwise.
- B. Pipe:
1. Piping shall be black steel; Type L or K hard drawn copper is allowed for pipe sizes 4 inches or less.
- C. Fittings:
1. Welded or brazed fittings shall be used on piping 3 inches and larger. Screwed fittings are allowed on piping 2-1/2 inch and smaller.
 2. Rigid grooved mechanical joint piping connections will be allowed for all above ground piping of black steel or copper.
- D. Thermometers: Range shall be 30 to 240 degrees F.
- E. Gauges:
1. Pressure: Range shall be 0 to 60 psig.
- F. Insulation:
1. Pipe insulation shall be cellular glass.
 2. Pipe insulation exposed to the outdoor air, or in equipment or air handling rooms shall be cellular glass. Concealed piping, piping located in a return air plenum, and piping above an accessible ceiling may be fiberglass.

- a.
3. Unless otherwise specifically noted the insulation thickness in inches shall be in accordance with the following table:

TABLE - HEATING PIPING INSULATION THICKNESS

Pipe Size, Inches	Up to 1	1-1/4 to 2	2-1/2 to 4	5 to 6	8 & Up
Up to 250 Deg. F.	1-1/2	1-1/2	2	2	2
250 - 305 Deg. F.	2	2-1/2	2-1/2	3	3

4. For piping exposed to the outdoor air increase insulation thickness by 1/2 inch.

2.04 TOWER WATER

- A. General: Only the following materials shall be used for tower water piping unless specifically indicated otherwise.
- B. Pipe:
1. Piping shall be black steel; Type L or K hard drawn copper allowed for pipe size 4 inches or less.
- C. Fittings: Rigid grooved mechanical joint piping connections will be allowed for all above ground piping.
- D. Thermometers: Range shall be 0 to 120 degrees F. Thermometer wells in cooling tower water piping shall be stainless steel.
- E. Gauges:
- 1.
 2. Pressure: Range shall be 0 to 60 psig.

2.05 CONDENSATE AND EQUIPMENT DRAIN

- A. Pipe and Fittings: Type L hard-drawn copper.
- B. Pipe and Fittings: DWV copper.
- C. Pipe and Fittings: Schedule 40 PVC.

2.06 FITTING COVERS AND PIPE JACKETS

- A. Jacket and Cover Location: Provide aluminum pipe jackets and fitting covers as specified in Section 15250 on all insulated hydronic piping systems in the following locations:
- B. Jacket and Cover Location: Provide plastic pipe jackets and fitting covers as specified in Section 15250 on all insulated hydronic piping systems in the following locations:
 - 1. Central Energy Plant.
 - 2. All Air Handling Equipment Rooms.
 - 3. On all piping exposed to the weather.
- C. Fitting Covers: Provide plastic fitting covers as specified in Section 15250 on all insulated hydronic piping systems in the following locations:
 - 1. Central Energy Plant.
 - 2. All Air Handling Equipment Rooms.
 - 3. On all piping exposed to the weather.

PART 3 - EXECUTION

3.01 GROOVED MECHANICAL JOINT PIPING

- A. Valves and specialties: Where grooved mechanical piping is used and valves and specialties are specified in Section 15100, VALVES and Section 15120, PIPING SPECIALTIES, the piping system shall be consistent. A mixture of flanged valves and specialties and grooved-end valves and specialties is not allowed except at flanged equipment connections.

3.02 INSULATION

- A. Installation: Piping and equipment insulation installation shall comply with the requirements of Section 15250, THERMAL INSULATION.

3.03 DRAINS

- A. General: Provide piping from cooling coil drain pans, and other gravity equipment drain indirect waste to open site drains, or other trapped and vented receptors, as indicated or required. Terminate lines with unthreaded pipe, providing a minimum three pipe diameter air gap between the drain line and the flooded drain rim.

3.04 FITTING COVERS AND PIPE JACKETS

- A. General: Fitting covers and pipe jackets shall be installed in compliance with the manufacturers written instructions.

3.05 CLEANING AND PRESSURE TESTS

- A. Hydronic Piping: Pipe cleaning, flushing and pressure testing shall be performed as described in Section 15060, PIPE AND FITTINGS.

END OF SECTION 15510

SECTION 15550

HOT WATER BOILER AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide complete factory packaged hot water boiler with all accessories. Size, capacity and performance shall be as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15100, VALVES
4. 15120, PIPING SPECIALTIES
5. 15160, PUMPS
6. 15250, THERMAL INSULATION
7. 15483, FUEL PIPING SYSTEM
8. 15510, HYDRONIC PIPING SYSTEM
9. 15950, BUILDING CONTROL SYSTEM
10. 15990, PERFORMANCE VERIFICATION

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

1. Division 1, ALTERNATES
2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Dimensional outline drawing of the boiler showing the location of all equipment connections.
 - b. Operating weight and support locations.
 - c. Maximum design operating pressure.
 - d. Dimensional outline drawings of all boiler accessories.
 - e. Horsepower, voltage and phase for all electrical driven equipment.
2. Performance Data:
 - a. Maximum fuel input and output capacity and efficiency at design and part-load conditions, from 20 to 100 percent of full-load.
 - b. Energy input requirements of auxiliaries such as controls, blowers, fuel pumps, etc.
3. Installation Instructions:
 - a. Manufacturer's printed installation instructions including copies shipped with the boiler and accessories.
 - b. For all non-factory installed safety equipment.
 - c. Burner and fuel connections.
 - d. Waterside chemical boil-out procedures.
4. Operating Instructions:
 - a. Manufacturer's printed operating instructions for each item of equipment covered in this Section.
 - b. Boiler start-up and checkout procedures.
5. Maintenance Instructions:
 - a. Manufacturer's printed maintenance instructions for each item of equipment covered in this Section.
 - b. Exploded parts list.
6. Manufacturer's Start-up and Checkout:
 - a. Start-up and checkout of the operation of the boiler and all of the boiler auxiliaries.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Code Requirements: Boiler shall be constructed in accordance with Section IV of the ASME Boiler and Pressure Vessel Code and shall bear the ASME stamp, and shall be registered with the National Board of Pressure Vessel Inspectors.
- C. UL Listing: Breeching and stack and all fittings shall be UL listed as complying with UL Standard 103 which requires that it be capable of continuous operation at 1000 degrees F. flue gas temperature at 4 inch clearance.
- D. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- E. ASHRAE: The heat loss or standby loss through the exterior jacket shall not exceed ASHRAE Standard 90.1-1989 requirements.
- F. NFPA 54, National Fuel Gas Code, 2002 Revision.
- G. NFPA 211, Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, 2003 Revision.
- H. AGA: Natural gas-fired equipment shall be tested and approved according to standards of the American Gas Association (AGA).

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.

2.02 ATMOSPHERIC BOILER

- A. Basic Features: Constructed of welded steel boiler plate; atmospheric type up-shot low pressure gas burner; all necessary and required controls, fuel train and trim.
- B. Construction Features: The boiler shall have the following features, characteristics and components:
 - 1. Heating surface shall not be less than 5 square feet per boiler horsepower.
 - 2. Furnished with manhole and handhole opening for internal inspection and cleaning.
 - 3. Staggered tube flexibly designed for free expansion.

4. Welded on structural steel base with provisions for anchoring to a housekeeping pad.
 5. Clean out openings in front section of boiler for access to flueways.
 6. Drain and blowdown connections.
 7. Sectional 16 gauge metal jacket; galvanized and finished in heat resistant baked enamel; insulated internally with minimum 1 inch fiberglass insulation; removable for service and maintenance.
 8. Factory installed lifting lugs or bolts.
 9. Factory provided draft diverter.
- C. Trim and Accessories: The following factory pre-wired controls and accessories shall be included:
1. Manual reset low water cutoff.
 2. Adjustable high temperature limit safety, with manual reset.
 3. ASME safety relief valve.
 4. Pressure-temperature gauge.
 5. Adjustable immersion type operating aquastat with external graduations for cut-in/cut-out settings.
- D. Finish: The entire boiler, base frame and other components shall be cleaned, primed, and factory painted with a hard-finish enamel.
- E. Atmospheric Natural Gas Burner Assembly: Natural gas burner shall have the following features, characteristics and components:
1. Tubular steel up-shot atmospheric type with multiple replaceable non-premix burner jets, requiring no motor, blower or other moving parts.
 2. Gas pilots shall be spark ignited with electronic ultraviolet flame safeguard.
 3. Electronic pilot safety control.
 4. Electric motor solenoid gas valve operator with proof-of-closure.
 5. Underwriters' Laboratory listed Gas Fired Boiler Assembly.
 6. Two stage, high-low gas burner with low fire start.

- F. Gas Pressure Regulators: Provide additional gas pressure regulating valves if necessary to reduce line pressure to within manufacturer's requirements.
- G. Manufacturer:
 - 1. Bryan Steam Corporation
 - 2. Cleaver-Brooks
 - 3. Parker Boiler Company

PART 3 - EXECUTION

3.01 GENERAL

- A. Controls: Interface with all other related controls to provide system operation.
- B. Connections: Provide all piping and electrical connections to boiler. Support piping so that pipe weight is not borne by the boiler.
- C. Boiler Support: The boiler shall be installed on a 4 inch housekeeping pad located under the supporting members. Refer to paragraph entitled "HOUSEKEEPING PADS AND EQUIPMENT SUPPORTS" in Section 15050.
- D. Relief Valves: Provide an ASME rated pressure relief valve, sized for the burner-input capacity, for each boiler. Pipe pressure relief valve discharge to the nearest floor drain using uninsulated schedule 40 black steel pipe.
- E. Gauges: Provide thermometers and pressure gauges with gauge valves at each boiler inlet and outlet.
- F. Factory Testing: Each boiler shall be factory assembled and factory test fired. Submit six copies of manufacturer's test results for each unit prior to final completion.

3.02 BREECHING AND STACK

- A. General: Provide breeching and stack system in accordance with manufacturers installation instructions. Maintain UL listing and minimum clearances from combustibles. Assemble flue system and accessories as indicated for complete installation.
- B. Installation: Install with minimum of joints. Align breeching and flue at connections, within 1/8 inch misalignment tolerance to keep internal surfaces smooth. Support breechings and stack with suitable ties, braces, hangers, and anchors which will hold work true-to-shape and prevent buckling and movement. Manual and automatic dampers shall not be installed in breeching or stack.
- C. Weather Protection: All parts exposed to the outside atmosphere or other hostile environments that are not protected by stainless steel outer jacket shall be protected by a minimum of one base coat and one finish coat of Series 4200 or 4300 heat resistant paint as manufactured by Rustoleum Corporation.

- D. Field Fabricated Breeching: Breeching shall be continuously welded of minimum 16 gauge black steel, or heavier where required for structural support. Unless otherwise indicated, insulate with 1-1/2 inch thick calcium silicate block as specified in Section 15250.
- E. Support: Support breechings from building structure in manner indicated and, where not otherwise indicated, anchor with bolts, concrete inserts, steel expansion anchors (not lead-shield type), welded studs, C-clamps or special beam clamps. Support vertical stacks, at 12 foot spacing, by attaching to adjacent vertical structures or by direct bearing at each floor or roof penetration. Guy and support entire assembly to be structurally stable.
- F. Routing: Locate runs as indicated or, if otherwise approved, in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Horizontal breeching shall slope upward a minimum of 1/4 inch per lineal foot.
- G. Other Requirements:
 - 1. Provide UL listed barometric damper or draft hood in accordance with damper manufacturer's recommendations to reduce excessive draft by admitting ambient air into the breeching or stack. Damper shall be welded or banded into the side of the breeching or stack.
 - 2. Provide insulated thimble(s) or otherwise maintain UL and NFPA required clearances where necessary.
 - 3. Clean breechings internally during installation, removing dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal.
 - 4. At ends of breeching which are not connected to equipment or stacks at the time of installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until connections are completed.
 - 5. Provide expansion joints to compensate for thermal expansion of the breeching and stack.
 - 6. Provide bolted and gasketed clean-outs at each change of direction, ends of breeching runs, with a 1/2 inch schedule 40 black steel drain pipe threaded and capped at the base of each vertical rise.

3.03 CHEMICAL BOIL-OUT

- A. Procedure: Follow the manufacturer's instructions to chemically clean the waterside of the boiler. If instructions are not given, then clean out the boiler waterside by adding trisodium phosphate in an aqueous solution at a ratio of one pound per fifty pounds of water, or use another boil-out chemical as approved by the boiler manufacturer. After filling the boiler with this mixture, fire the boiler and hold the temperature for 2 hours, then drain the boiler and refill with fresh water. Test the boiler water for alkalinity; if the

boiler is acidic (pH below 7.0), repeat the chemical boil-out procedure as detailed above, including draining and refilling, as necessary until the boiler is alkaline, but at least 3 refillings and draining sequences to eliminate residual chemicals.

3.04 MANUFACTURER'S FIELD SUPERVISION AND START-UP

- A. General: An authorized representative of the boiler manufacturer shall checkout complete boiler installation, assist in the start-up and testing, and calibrate all unit controls, adjust air/fuel ratios and perform such adjustments as may be required to insure optimum performance and efficiency. Submit six copies of the signed start-up data to the Engineer prior to final completion.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 15680

WATER CHILLER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide water cooled, water chiller of type, size, capacities, and operating characteristics as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15100, VALVES
4. 15120, PIPING SPECIALTIES
5. 15160, PUMPS
6. 15240, VIBRATION ISOLATION
7. 15510, HYDRONIC PIPING SYSTEM
8. 15770, THERMAL STORAGE SYSTEM
9. 15950, BUILDING CONTROL SYSTEM
10. 15990, PERFORMANCE VERIFICATION

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

1. Division 1, ALTERNATES
2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Dimensional outline drawing of each water chiller showing the location of all equipment connections.

- b. Operating weight and support locations including vibration isolation equipment.
 - c. Complete wiring diagram of the motor starter and all components.
2. Performance Data:
- a. Provide the following information for each water chiller.
 - (1) Maximum and minimum water flow allowed through the evaporator and the pressure drop in feet of water at each condition (maximum, minimum and design).
 - (2) Pressure drop through the condenser in feet of water at the design water flow.
 - (3) Speed/torque curve under the most severe starting conditions.
 - (4) Maximum allowable voltage drop during starting.
 - (5) Locked rotor current.
 - (6) Waterside number of passes, arrangements and connections for the evaporator.
 - (7) Waterside number of passes, arrangements and connections for the condenser.
 - (8) Heat rejection capacity and flow-rate of oil cooler, and water system used (chilled, tower or potable).
 - (9) Ozone depletion potential (ODP) and global warming potential (GWP) of the refrigerant used.
 - (10) Maximum sound pressure level (dBA) at operating conditions.
3. Installation Instructions:
- a. Manufacturer's printed installation instructions including copies shipped with the equipment.
4. Operating Instructions:
- a. Manufacturer's printed operating instructions for the water chiller, motor starter and associated equipment.
5. Maintenance Instructions:
- a. Manufacturer's printed maintenance instructions for the water chiller, motor starter and associated equipment.

- b. Exploded parts lists for the chiller and all of the chiller auxiliaries.
6. Manufacturer's Start-up and Checkout:
- a. Start-up and checkout of the operation of water chillers and all of the chiller auxiliaries.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. ARI:
 - 1. Chiller shall be certified in accordance with ARI Standard 550/590-2004.
 - 2. Chiller sound pressure level ratings shall be tested in accordance with ARI Standard 575-94, Method of Measuring Machinery Sound Within An Equipment Space, and shall not exceed 89 dBA sound pressure level (Lw) at a distance of 1 meter.
- C. ANSI/ASHRAE: Equipment and installation shall be in compliance with Safety Code for Mechanical Refrigeration, ANSI/ASHRAE Standard 15-1994.
- D. ANSI/ASME: Comply with ANSI/ASME SEC VIII Boiler and Pressure Vessels, Code for Unfired Pressure Vessels.
- E. NIOSH: National Institute for Occupational Safety and Health.
- F. MSHA: Mine Safety and Health Administration (Subpart H, 30 CFR, Part II for 30 minute-rated service life) and OSHA approved re-entry device.

1.06 FACTORY PERFORMANCE VERIFICATION

- A. General: Each chiller shall undergo a factory performance test in an ARI-certified test facility. The chiller manufacturer shall supply the certified original test report confirming specified performance. The factory tests shall be conducted in accordance with ARI Standard 550/590-2004 procedures and tolerances, and the calibration of all instrumentation shall be traceable to a National Institute of Standards and Technology reference.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.

2.02 EQUIPMENT

- A. General: Unit shall be factory assembled and tested, single piece, liquid chiller consisting of compressor, motor, evaporator, condenser, vibration isolation, and microprocessor control system. Motor starter shall be factory furnished.
- B. Sole-source Responsibility: Chiller accessories, starter and controls not produced by the chiller manufacturer shall be in accordance with the manufacturer's standard practices and specific recommendations, and shall be covered under the chiller manufacturer's warranty for sole-source responsibility.
- C. Lifting Lugs: Parts weighing over 50 pounds which must be removed for inspection, service or repair, such as motors, gear boxes, casing tops, evaporator/condenser heads, etc. shall be furnished with lifting eyes or lugs.

2.03 ROTARY SCREW COMPRESSOR

- A. Compressor: Provide hermetic or semi-hermetic double-helical rotary screw compressors.
- B. Impeller: The impeller shall be single-stage type manufactured from high-strength forged steel with compressor shaft and gear assembly statically and dynamically balanced and having no critical speed within the operating range. Gears shall be balanced and over-speed tested at 1.25 times design speed. Compressor housing shall be manufactured from cast iron. Provide means to prevent backspin during shutdown.
- C. Lubrication System: Compressor shall be provided with a factory installed lubrication system to deliver oil under constant pressure to bearings and transmission gears during startup, operation, and coastdown. Included in the system shall be:
 - 1. Low oil flow shutdown protection.
 - 2. Thermostatically controlled oil heater in the oil sump.
- D. Crankcase Heater: Provide crankcase heater to evaporate refrigerant returning to crankcase during shut down. Energize heater when compressor is not operating.
- E. Capacity Control: Provide compressor with automatic capacity reduction equipment performed by a capacity control slide valve. Use lifting mechanism operated by oil pressure. Compressor must start unloaded for soft start on motors. Chiller shall have stable control of machine capacity down to 15 percent of full load continuously without surge, cavitation, and without the use of hot-gas bypass.
- F. Motor: Provide constant speed 3600 rpm compressor motor, suction gas cooled with solid state sensor and electronic winding overheating protection, designed for star delta starting. Provide factory-mounted and wired starter and disconnect.

- G. Refrigerant Piping: Refrigerant circuit shall have backseating suction and discharge valves with gauge ports, liquid line shutoff valves, refrigerant filter/dryer with isolation valves and a liquid line sight glass.
- H. Refrigerant Piping: All units shall have independent refrigeration circuits, each with a separate compressor. Each refrigerant circuit shall have backseating suction and discharge valves with gauge ports, liquid line shutoff valves, refrigerant filter/dryer with isolation valves and a liquid line sight glass.
- I. Manufacturer:
 - 1. Carrier – Basis of Design
 - 2. Trane
 - 3. York
 - 4. Dunham Bush

2.04 EVAPORATOR AND CONDENSER

- A. General: The evaporator and condenser shall be shell-and-tube type design. Tube water flow velocity shall not be less than 3 nor exceed 10 feet per second.
- B. Tubes: Tubing shall be seamless finned copper or 85 percent red brass, nominal 3/4 inch ID with wall thickness of 0.028 inches. Individual removal of tubes from either end shall be possible without affecting strength or durability of tube sheets or causing leakage at adjacent tubes. Tubes shall be rolled or silver-brazed into tubesheets without reduction in tube wall thickness. Tubes shall fit tightly into tubesheets and intermediate tube supports on maximum four-foot centers to prevent crevice corrosion or chafing due to vibration.
- C. Refrigerant Connections: Evaporator shall be equipped with refrigerant charging, transfer and relief connections and refrigerant temperature thermowell. Relief connection shall be complete with an automatically resetting relief valve, Type K or L copper piping to the exterior of the building, and drip leg with drain valve; refrigerant rupture disks are not acceptable. Provide a 2 inch capped tee in the relief vent piping and valved refrigerant connections on the top and bottom of the evaporator for connections to a pump-out unit.
- D. Refrigerant Chambers: Provide refrigerant chambers with baffles or other devices to ensure distribution of entering liquid and complete separation of liquid and gas refrigerant.
- E. Gauge Glass: Provide gauge glasses to monitor refrigerant level.

F. INSULATION

2.05 CONTROLS AND SAFETIES

- A. General: The chiller shall be controlled by a stand-alone microprocessor based control system. A dedicated factory mounted and tested control panel shall be supplied with

each chiller by the chiller manufacturer. Panel shall operate on 115 volt, single phase, 60 Hertz power through a factory furnished, fused and wired step-down transformer. Capacity controls shall be electronic.

- B. Control Components: Factory-mounted and factory-wired panel control components shall include, but are not limited, to the following:
1. HAND-OFF-AUTO switch for the control panel. In "AUTO", the start-up and shutdown shall be automatic and controlled through the Building Control System (BCS). In "HAND", the local control panel shall control the chiller, and "OFF" shall turn the machine off and not allow restart by the BCS.
 2. The BCS shall be capable of unloading any operating chiller as required by the control sequence of operation when energizing another chiller.
 3. The BCS shall have input indication whether or not the chillers are operating, or off due to safety trip. The microprocessor system shall assure a smooth pull down of loop temperature to prevent power demand spikes. After shutdown, the system shall indicate time remaining until restart.
 4. Provide differential pressure switches across the inlet and outlet to the evaporator and to the condenser to prevent the compressor from starting or operating unless water flow is established.
- C. Safety Components: Safety control components shall include, but are not limited to, the following:
1. Unit shall automatically shutdown upon tripping of any of the following safety devices. Each of these devices shall require manual reset and cause an alarm indication.
 - a. Motor over-current
 - b. Over voltage, under voltage or single phasing condition
 - c. High condenser pressure
 - d. High motor temperature
 - e. High compressor discharge temperature
 2. The chiller microprocessor shall prevent machine re-start until a preset time period has elapsed.
- D. Diagnostics:
1. A diagnostic module shall indicate a safety lockout condition through a number display code with a legend provided in the control panel. The following devices shall be covered by the diagnostic display:
 - a. Motor over-current
 - b. Over voltage
 - c. Under voltage
 - d. Low refrigerant temperature
 - e. High condenser pressure

- f. High motor temperature
- g. Low oil pressure

E. Capacity Control: Capacity shall incorporate the following:

- 1. Entering and leaving water sensors and adjustable chilled water discharge temperature set-point controller to maintain a constant leaving water temperature.
- 2. Compatibility with remote (electronic) adjustment for both chilled water temperature and load limit set points. Remote set-point compatibility shall enable remote adjustment by BCS.

F. Relays: Control panel shall be complete with all control and time delays necessary to: insure proper interlock and starting sequence, lock out compressor in event of actuation of a safety device, and to provide individual remote annunciation of control operation.

G. Recycle Timer: A recycle timer shall provide protection against short cycling of compressor.

H. Start Counter: Provide a non-re-settable totalizing mechanical meter to count the number of starts on the motor.

I. Elapsed Time Meter: Provide a non-resettable totalizing mechanical meter to monitor chiller run time, measured in tenths of hours.

2.06 BUILDING CONTROL SYSTEM INTERFACE

A. General: The chiller manufacturer shall provide a net interface to the building control system (BCS) specified in Section 15950, BUILDING CONTROL SYSTEM. The BCS shall be able to monitor, display and control the data available from the microprocessor controls on the chiller.

B. Alarm Limits: The chiller manufacturer shall provide all of the recommended high and low alarm limits to be set in the BCS.

C. Monitoring, Alarm and Control Points: The monitoring, alarm and control points that are available for the chiller used as the basis of design shall be provided. The monitoring, alarm and control points typically shall include as a minimum the following:

- 1. Chiller on/off status
- 2. Chilled water temperature set-point
- 3. Evaporator and condenser water flow pressure differential
- 4. Compressor status including current limiting set-point
- 5. Evaporator entering and leaving water temperature
- 6. Condenser entering and leaving water temperature
- 7. Evaporator and condenser refrigerant temperatures
- 8. Condenser refrigerant pressure
- 9. Each bearing temperature
- 10. Phase current for each phase
- 11. Motor winding temperatures

12. Diagnostic status

- D. Diagnostic Status: The diagnostic status shall include a report from the chiller's microprocessor which shows the above operating conditions one minute prior to any latching alarm which shuts down the chiller.

PART 3 - EXECUTION

3.01 UNIT PLACEMENT

- A. Field Verification: Water chiller locations shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to equipment used for actual installation.
- B. Field Supplied Equipment: All field supplied wires, bus bars and fittings shall be copper only.

3.02 EQUIPMENT SUPPORT

- A. General: Chillers, and freestanding starter enclosures where provided, shall be mounted on housekeeping pads. Refer to paragraph entitled "HOUSEKEEPING PADS" in Section 15050.

3.03 PIPING

- A. Piping Connections: Piping connections to the nozzles of the evaporator and condenser shall have provisions for removal to provide unobstructed access for cleaning and replacing tubes.
- B. Piping Auxiliaries: Install in the piping for each chiller:
1. Thermometers with separable sockets in entering and leaving water to the evaporator and condenser.
 2. Pressure gauge with gauge valves in the entering and leaving water to the evaporator and condenser.
 3. Valved 1/2 inch connections in the entering and leaving water to the evaporator and condenser for differential pressure switch connection.
- C. Relief Connections: Pipe relief valve discharge full size of connections to the exterior. Connect the discharge from the relief valves to the relief line using Type PVT-1 flexible pipe connectors as specified in Section 15240.

3.04 REFRIGERANT AND OIL

- A. General: Provide initial charge of refrigerant and oil, and any additional oil or refrigerant and charging devices required to replace losses during checkout, startup, and system

testing prior to final acceptance. Log all quantities of refrigerant or oil entered into the machines.

- B. Moisture Indicators: Provide bulls-eye moisture indicators on each refrigerant liquid line to the filter/dryers.

3.05 SPARE PARTS

- A. Maintenance Items: Provide to the City prior to final completion and in original packaging the following:

1. One set of replacement oil filters and gaskets.
2. Replacement evaporator and condenser water barrel head gaskets, one for each removable head.
3. One jointed tube rodding brush with handle and sufficient sections to rod the full length of the chiller tubes.
4. Six each evaporator and condenser tube brushes, compatible with the joined rod above.

3.06 MANUFACTURER'S FIELD SUPERVISION AND START-UP

- A. General: An authorized representative of the chiller manufacturer shall personally checkout complete chiller installation, observe the start-up and test, and calibrate all unit controls and perform adjustments to insure optimum performance and efficiency.
- B. Vibration: Vibration shall not exceed 1.0 mil at the bearings when the chiller is operating at 100 percent full-load.

3.07 MANUFACTURER'S CHECKOUT

- A. Certified Representatives: Provide a minimum of 2 factory trained representatives of chiller and controller manufacturers for checkout and startup service. The service representatives shall inspect the switchgear installation and all wiring, and shall verify all control adjustments prior to startup. After certifying correctness of the electrical installation, the service representatives shall jointly perform initial startup and checkout and log all pertinent data for each individual machine, and shall supervise leak testing, evacuation and dehydration, and charging the unit with refrigerant and oil.

3.08 FIELD OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Requirement: Provide on-site instruction by an authorized representative of the chiller manufacturer. A minimum of 8 hours of classroom and on-site instruction shall be given to Cities designated operating and service personnel, and receipt of same shall be acknowledged in writing prior to final acceptance.

3.09 WARRANTY

- A. General: In addition to the warranties required in Division 1, provide a 5-year parts and labor warranty on the compressor and compressor motor, which shall start at the date of substantial completion.

END OF SECTION 15680

SECTION 15800

AIR HANDLING UNIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide air handling units as indicated, including appurtenances, accessories and service connections.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15060, PIPE AND FITTINGS
3. 15250, THERMAL INSULATION
4. 15240, VIBRATION ISOLATION
5. 15510, HYDRONIC PIPING SYSTEM
6. 15885, AIR FILTER
7. 15890, DUCTWORK
8. 15950, BUILDING CONTROL SYSTEM
9. 15990, PERFORMANCE VERIFICATION

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

1. Division 1, ALTERNATES
2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Dimensional outline drawing for each air handling unit indicating the location of all connections including the drain pan connection.
 - b. Operating weight and vibration isolators for each unit.
2. Performance Data:

- a. Provide the following information for each air handling unit:
 - (1) Coil capacity at design conditions including air entering and leaving temperatures.
 - (2) Coil descriptions, rows and fins per inch, and face velocity.
 - (3) Air flow and airside pressure loss at design conditions.
 - (4) Water flow and waterside pressure drop at design conditions.
 - (5) Fan curve indicating design flow and brake-horsepower at scheduled static pressure, including drive losses.
 - (6) Motor horsepower, voltage and phase.
 - (7) Filter pressure drop and face velocity when furnished by the air handling unit manufacturer.

3. Installation Instructions:

- a. Manufacturer's printed instructions for the assembly and installation of each air handling unit including copies shipped with the equipment.

4. Maintenance Instructions:

- a. Manufacturer's printed instructions for the maintenance of each air handling unit.
- b. Exploded parts list for air handling unit fan drive and assembly.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the paragraph entitled "Code Compliance" in Section 15010.
- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- C. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A, 2002 Revision, and NFPA 255, 2000 Revision, with flame spread not exceeding 25 and smoke developed ratings not exceeding 50.
- D. Performance: Supply fan performance shall be certified as complying with ARI Standard 430-89. Coil capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410-91.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Single Source: All air handling units shall be of the same manufacturer. All components in factory-furnished air handling units shall be factory-assembled and factory-tested prior to shipping.
- B. Condensate Drain Pan: Each unit shall have an insulated, 20 gauge stainless steel double wall drain pan for condensate drainage. Drain pan shall extend a minimum of 12 inches downstream of the coil face for inspection and access. The insulation shall be a minimum of 2 inch thick foam. Threaded pipe drain connections shall be provided on one side only and the pan shall slope toward the connection, allowing no standing water. The drain connection shall be on the side of the unit that has the condensate drain plumbing connection. If the selected air handling units have more than one drain connection, each connection shall be provided with a trap and an individual drain line piped to discharge at the nearest condensate floor drain. The discharge of the individual condensate traps shall not be connected together.
- C. Sound Power Levels: Sound power levels in each band shall not exceed those indicated.
- D. Fan Motor: Fan motors shall be an open drip proof ball bearing specifically designed for fan applications, unless otherwise indicated. Refer to paragraph entitled "ELECTRIC MOTOR" in Section 15030 for motor efficiency requirements. Unless specifically indicated otherwise air handling unit fan motors shall be selected as follows:
 1. Less than 5 HP; 135 percent of bHP
 2. 5 Hp through 25 HP; 125 percent of bHP
 3. Greater than 25 HP; 115 percent of bHP

2.02 CENTRAL STATION AIR HANDLING UNIT

- A. Manufacturer: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.
 1. Temtrol
 2. Buffalo
 3. Trane Custom
 4. York Custom

B. General:

Unit Casing: Unit frame shall be from 14-gauge carbon tubular steel, mig welded to form a unitized assembly for support of all internal components. Base and unit frame shall be painted with a lacquer resisting gray phenolic corrosion inhibitive primer. The air handling unit casing shall be of the "no-through-metal" design. The casing structure shall incorporate insulating thermal breaks as required so that, when fully assembled, there exists no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to 1/200 of the narrowest panel dimension. If panels cannot meet this deflection, add additional internal reinforcing. Panels shall be gasketed and secured to the tubular steel frame with 1/4" hex head, zinc plated fasteners and neoprene washers. Outer panels must be removable without affecting the structural integrity of the unit. Exterior casings

shall have a polyester resin paint system that is designed for long term corrosion resistance meeting or exceeding (ASTM B-117) Salt Spray Resistance at 95 degrees F. 1,000 hrs. and (ASTM D-2247) Humidity Resistance at 95 degrees F. 1,000 hrs. The color shall be sterling gray.

1. . Provide a full perimeter welded base frame manufactured with structural steel tubing and C-Channel cross support members on close centers.
2. Access Doors: Hinged insulated access doors shall provide access to the mixing air section, the inlet and outlet of each coil, the drain pan, and both sides of the internal fan drive and filter section. Latches for doors shall be industrial cam-lock type. Removing bolted sections of the air handling unit casing is not acceptable.
3. Fans: Fans shall be single width single inlet airfoil plug type constructed in accordance with the American Fan Manufacturers' Association Standards. Fan blades shall be hollow airfoil in shape, welded to the center and wheel side plates. Fan shafts shall not pass through their first critical speed at any cataloged rpm.
4. Sound Power Levels: Sound power levels in each band shall not exceed those indicated.

Bearings: Bearings shall be selected for a minimum L-50 life (200,000) hours at maximum horsepower and operating speed for the classification.

C. Single Zone Draw-Through:

1. General: All air handling units shall be single zone draw-through type unless otherwise indicated.
2. Solid Double Wall Construction: Units shall be double wall construction with 2 inch thickness, 3.0 pound density fiberglass insulation. Insulation shall be continuous throughout the entire unit, including all panels, sections, spacers, seams and connections. The insulation shall be sandwiched between a minimum 20 gauge galvanized solid interior wall and the exterior wall.

D. Fan Drive:

1. General: Refer to paragraph entitled "V-BELT DRIVE" in Section 15050.
 - a. Internal: Fans shall be dynamically balanced from 20% to 100% of fan speed at the factory as a complete fan assembly (fan wheel, motor, drive and belts). Bearings shall be re-greaseable and supplied with copper grease lines and fittings extending to the interior of the access door to allow for lubrication without entering the interior of the unit.

E. Fan Capacity Control:

1. Variable Frequency Drive: Air handling unit fan motors controlled through a variable frequency drive shall comply with the requirement of paragraph entitled "VARIABLE FREQUENCY DRIVE" in Section 15030.

2.03 COILS

- A. Water Coils: Coils shall be leak tested to 200 psig air pressure underwater and designed for 300 psig working pressure. The coils shall be 1/2" diameter 0.017" thick continuous seamless copper tube with aluminum plate fins bonded by mechanical expansion of the tubes, unless otherwise indicated. Fin spacing shall not exceed 12 per inch. Frames shall be constructed of minimum 16 gauge Type 304 stainless steel casing with copper headers brazed to tubes and threaded connections. Both supply and return headers shall be provided with 1/8 inch NPT vent connection at top and bottom for venting and draining coil. The coils shall be arranged for the water to counterflow in the direction of the air flow. Tube sheets shall be minimum 16 gauge Type 304 stainless steel, located on each end and at a maximum of 80 inch intermediate spans with drain collars to support tubes. Return bends shall be die-formed, brazed to tubes and header and shall be seamless hard-drawn copper tubing. Casing channels shall be free-draining, without depressions to collect moisture and contaminants or to block fin area, and with an air bypass/water carryover arrester between the casing bottom channel and the fins.

2.04 FILTERS

- A. General: Filters and filter frames shall be supplied by the air handling unit manufacturer and shall comply with the requirements of Section 15885, AIR FILTER.
- B. Type: Filters shall be 4" thick 30% MERV 8 pleated media unless otherwise indicated.
- C. Standard Size: All filter frames shall be constructed to industry-accepted filters sized from filter manufacturers standard catalogs.
- D. Filter Section: Filter section shall be the full height and width of the casing, unless blanked off, to prevent air bypass around the filter, with hinged and fully gasketed access doors on both sides.
- E. Air Pressure Gauge: Provide a Dwyer magnahelic type differential air pressure gauge across each filter bank delivering more than 1000 cfm of air. Refer to Section 15885, AIR FILTER, for complete requirements.

PART 3 - EXECUTION

3.01 GENERAL

- A. Clearance: Layout and carefully install units with sufficient clearances to permit proper maintenance. The space required shall be as recommended by the manufacturer including the space required for removal of the coil and for filter maintenance.
- B. Control Interlock: Interlock the air handling units with their associated exhaust fans such that when the air handling unit is de-energized for any reason the exhaust fans are also de-energized; when the air handling unit starts, the associated exhaust fans shall also start.
- C. Piping: Isolation valves and flanges or unions shall be so arranged that the removal of the coil piping shall provide unobstructed access for the removal of the coil.

- D. Fins: Straighten fins for each coil, using a fin comb, prior to final acceptance. Coils having tubes with broken fins shall be replaced at no additional cost to the Owner.
- E. Dampers: All air handling units with a direct unconditioned outside air connection shall be provided with a damper in the outside air duct that closes whenever the unit fan is not energized.

3.02 VIBRATION ISOLATION

A. Equipment Mounting:

- 1. Installed units shall be free of vibration and shall not produce excessive noise. Refer to Section 15240, VIBRATION ISOLATION. Isolators shall be sized for a maximum static deflection of 2 inches.
- ~~2.~~ Internal fan drive units shall include 2" spring isolators with vertical thrust restraint.

B. Duct Connections:

- 1. Internal fan drive units shall be provided with flexible duct connection inside the unit and in the supply and return duct connections as required to prevent transmission of vibration into the duct system. Refer to paragraph entitled "FLEXIBLE DUCT EQUIPMENT CONNECTIONS" in Section 15910.

C. Piping Connections:

- 1. Provide a P-trap in the condensate pan drain connection. The distance of the outlet of the P-trap below the bottom of the condensate drain pan shall be at least 1-1/2 times the suction static pressure at the inlet of the coil to insure complete drainage of the pan.

D. Electrical and Control Connections:

- 1. Internal fan drive units may have the rigid portion of the raceway attached to the unit. The internal fan motor shall be factory wired to an external j-box to facilitate VFD wiring. Wiring connection shall be made with seal-tight flexible conduit.

3.03 CORROSION PROTECTION COATING

- A. Corrosion Protection Coating: Provide corrosion protection coating for the chilled water coil. Coating shall be flexible polymer. The coil shall be completely immersed in the coating bath including headers, casing and heat exchange surfaces. The coating shall be electrodeposited. The coating shall then be cured by baking. Sprayed-on coil coatings are not acceptable.

- 1. AST Electro Fin

3.04 EQUIPMENT SUPPORT

- A. Installation: Install each unit on a housekeeping pad. Refer to paragraph entitled "HOUSEKEEPING PAD AND EQUIPMENT SUPPORT" in Section 15050.
- B. Pad Height: The height of the housekeeping pad under the air handling unit with a cooling coil drain pan shall be high enough, 4" minimum, to provide a condensate trap with required trap seal.

END OF SECTION

NO TEXT FOR THIS PAGE

SECTION 15885

AIR FILTER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.02 SUMMARY

- A. General: Provide complete air filter assemblies of the types, sizes, efficiencies and capacities as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

- 1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
- 2. 15250, THERMAL INSULATION
- 3. 15800, AIR HANDLING UNIT
- 4. 15950, BUILDING CONTROL SYSTEM
- 5. 15990, PERFORMANCE VERIFICATION

- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:

- 1.
- 2. Division 16, ELECTRICAL

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

- 1. Manufacturers Literature:
 - a. Dimensional outline drawing of each filter box assembly showing all connections, access doors and support locations.
 - b. Details of the air filter gauge.
- 2. Performance Data:
 - a. Initial and recommended final pressure drop across each filter assembly at the air flows indicated.

- b. Clean filter efficiency for each type of filter.
- 3. Installation Instructions:
 - a. Manufacturer's printed instructions for the installation of the filter holding assembly including copies shipped with the equipment.
 - b. Manufacturer's printed instructions for the installation of the air filter gauge.
- 4. Maintenance Instructions:
 - a. Manufacturer's printed instructions for the maintenance of the air filter gauge.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General: Refer to paragraph entitled "MANUFACTURERS" in Section 15010.
- B. Filter Manufacturer: The same manufacturer shall be used for all filters provided, for sole-source responsibility and compatibility.
- C. Filter Housing Apparatus Manufacturers: Same manufacturer as the applicable filters or same manufacturer as the air handling unit in which the filters are installed.
- D. Air Handling Unit Filter Sections: Sections shall be sized to accept specified filters. Air handling unit filter sections shall be factory made by air handling unit manufacturer or by filter manufacturer to be specifically compatible with the air handling unit.
- E. Fan Coil Unit and Fan Powered Terminal Unit Filter Box: Filter shall be an integral part of the fan coil unit or terminal unit assembly.
- F. Access: Filter sections shall be designed for side service access unless otherwise indicated.

2.02 PLEATED FILTER MEDIA

- A. General: Unless otherwise indicated all pleated media filters shall have a face size of 24 inches by 24 inches or 24 inches by 12 inches. The filter shall be listed by Underwriters' Laboratories as Class 2.
- B. 30 Percent Efficient Filters: Filter media shall be reinforced non-woven cotton with polyester trace fibers, treated with adhesive and continuously laminated to a supported steel welded wire grid. The disposable filter media enclosing frame shall be rigid wet-strength beverage board with diagonal support members. The inside periphery of the frame shall be bonded to the filter media to eliminate air bypass. Each filter shall contain a minimum 3 square feet of media per square foot of face area, and a minimum 11

pleats per linear foot. Unless otherwise indicated, media thickness shall be 2 inches; clean resistance shall not exceed 0.30 inches of water at 500 fpm face velocity.

1. Manufacturer and Model:
 - a. American Air Filter, AM-Air 300X
 - b. Farr Company, 30/30

2.03 AIR FILTER GAUGES

A. General:

1. Range: The air filter gauge pressure range shall be applicable for each type filter bank.
2. Tubing and Connections: Each air filter gauge shall be complete with 1/4 inch tubing and fittings, 2 static pressure tips, and mounting hardware.

B. Curved Inclined-Vertical Tube Manometer: Gauge shall be inclined-vertical tube differential pressure type, constructed of solid acrylic plastic with built-in level and over-pressure safety trap. The gauge shall have an adjustable zero setting.

1. Manufacturer and Model:
 - a. Dwyer, Mark II 25

PART 3 - EXECUTION

3.01 GENERAL

- A. Arrangement and Access: Arrange, install and make provisions for easy access to and removal and replacement of filters. Provide gasketed access doors or panels as necessary.
- B. Coordination and Matching: Coordinate assembly components and match sizes and quantities of filters with related air moving systems (e.g., air handling units, fan coil units, filter banks) so that filter and assemblies operate in accordance with manufacturer's recommendations.
- C. Insulation: The filter housing and access doors shall be insulated externally where pre-cooled outside air is introduced into the return air upstream from the filter housing location, or where the filter housing is located downstream from the cooling coil. The insulation shall be the same as specified for the ductwork. All insulation shall comply with the requirements of Section 15250, THERMAL INSULATION.
- D. Pre-Filters: Provide minimum 30% efficient filters upstream of each filter bank using cartridge filters.

3.02 AIR FILTER GAUGES

- A. General: Provide air filter gauge for each separate filter bank of each air handling unit filter assembly and any system with a flow-rate above 1000 cfm. Air filter gauges shall be installed complete with pressure fittings, tubing, vent valves, lags, and fluid, for a complete installation.
- B. Installation: Air filter gauges shall be installed in strict accordance with the manufacturer's instructions and in a manner which will not compromise filter access. Install mounting brackets as required. Filter gauges shall be mounted approximately 5 feet above the floor or service platform.

3.03 MISCELLANEOUS SUPPORT STEEL AND HARDWARE

- A. General: Provide as required for adequate support and structural integrity of each filter bank. In no case shall supplementary supports be less than those indicated or recommended by the filter manufacturer.
- B. Air Handling Unit: Filter racks as an integral part of the air handling unit shall be supported on the units housekeeping pads.
- C. Duct Mounted Filters: Filters mounted in the discharge ductwork from an air handling unit shall be supported independent of the ductwork. The structural support and cross-bracing shall allow the removal and replacement of the filters without movement of the filter rack.

3.04 ORIGINAL AND SPARE FILTER SETS

- A. Requirement: Provide construction filter set and 2 spare filter sets for each air moving unit. Prior to final testing and balancing, replace each filter with a new filter set; date and initial each filter prior to installation for tracking purposes. The spare filter set shall be turned over to the City in original shipping cartons prior to final completion.

END OF SECTION

SECTION 15890

DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide complete duct systems as indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15240, VIBRATION ISOLATION
3. 15250, THERMAL INSULATION
4. 15800, AIR HANDLING UNIT
5. 15880, AIR DISTRIBUTION
6. 15885, AIR FILTERS
7. 15910, DUCTWORK SPECIALTIES
8. 15990, PERFORMANCE VERIFICATION

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Complete set of published data on factory prefabricated duct construction material including sheet metal gauges, with indication of each material, method of construction, support method, and its intended application and design pressure limitation.
 - b. Material to be used for internal acoustical duct liner including surface film, mastic and installation.
 - c. Complete set of published data on duct sealant, mastic, and gasket material to be used, including its intended application.
2. Performance Data:

- a. Operating pressure for each duct system.
 - b. Velocity limitations for internal acoustical liner.
3. Installation Instructions:
- a. Manufacturer's printed instructions for the installation of prefabricated ductwork including copies shipped with the material.
 - b. Manufacturer's printed instructions for the installation of the internal acoustical liner.

1.05 TERMINOLOGY

- A. Dimensions: All ductwork dimensions are nominal free clearance internal dimensions which do not include insulation thickness, unless otherwise indicated.
- B. Finish: Where ductwork is exposed to view in occupied spaces, provide materials free from visual imperfections including pitting, seam marks, stains and discolorations, and other defects including those which would impair painting. Sheet metal in exposed locations shall be mill-phosphatized unless otherwise indicated.

1.06 APPLICABLE STANDARDS

- A. SMACNA: Use material, weight, thickness, gauge, reinforcing, seams and joints, suspension, workmanship and construction and installation methods as outlined in the Sheet Metal and Air Conditioning Contractors National Association, Inc., HVAC Duct Construction Standards, Metal & Flexible Second Edition with Addendum, 1997. Manufactured round or oval ductwork shall comply with the manufacturer's published recommendations and installation instructions. Where duct gauge and reinforcement is specified for rectangular ducts, the following nominal metal thicknesses shall be used:

TABLE - METAL THICKNESS - DECIMAL INCHES

Metal Gauge	26	24	22	20	18	16	14	12
Galvanized	.0217	.0276	.0336	.0396	.0516	.0635	.0785	.1084
Aluminum	.0320	.0400	.0500	.0630	.0800	.0900	.1000	.1250
Stainless	.0178	.0235	.0293	.0355	.0480	.0595	.0751	.1054

- B. Comply: With the National Fire Protection Association (NFPA) Standards and other Codes and Standards as adopted by the Local Authority having Jurisdiction.
- C. HVAC Duct Leakage Standard: Duct leakage test methods, apparatus, and reporting shall comply with the requirements of the SMACNA HVAC Air Duct Leakage Test Manual, First Edition, (1985), and as otherwise indicated.

- D. NFPA: The duct system, fittings, sealants and accessories shall comply to NFPA 90A requiring a flame spread rating of not over 25 and a smoke developed/fuel contributed rating no higher than 50.
- E. Underwriters' Laboratories Rating: All flexible fiberglass duct shall be listed Class 1 by the UL-181 standards rating.
- F. AWS: All welded ductwork shall be installed in conformance to American Welding Society AWS D9-84.
- G. ASTM: Unless otherwise specified, American Society for Testing and Materials specifications applicable are:

Material	Type	ASTM Number
Galvanized Steel	----	A525
Stainless Steel	302, 304	A480
Cold Rolled Steel	----	A366
Aluminum	3003 H-14	B209

PART 2 - PRODUCTS

2.01 Manufacturer:

- A. General: Refer to paragraph entitled "Manufacturer" in Section 15010.

2.02 GENERAL

- A. Special Gauges and Construction:

- 1. Gauges: Gauges indicated in this section are for galvanized steel. Where gauges are indicated for a material other than galvanized steel, provide the indicated gauge.

2.03 SHEET METAL DUCTWORK

- A. Material: Prime quality 48 inch wide resquare tight coat cold-rolled hot-dipped galvanized steel capable of double seaming without fracture. Conform to the requirements of ASTM A-525 and ASTM-G90 for a minimum galvanizing coat of 1.25 ounces per square foot total for both sides.
- B. Square and Rectangular Duct Connections: Manufactured air duct connections with gasket tape, integral mastic sealer and bolted connections maybe used for transverse joints.
 - 1. Manufacturer:

- a. Ductmate Industries, Inc.
- b. Engel Industries
- c. Nexus
- d. Ward
- e. Lockformer

2.04 MISCELLANEOUS

A. Support materials: Angles and other structural shapes used in connection with galvanized steel sheets shall be zinc-coated steel. Hanger rods shall be minimum 3/8 inch diameter, hot-rolled mild steel. Rivets, screws, and other accessories shall be made of the same materials as the duct or casing. Minimum screw size shall be No. 8 and minimum rivet diameter shall be 5/32 inch.

B. Sealant/Mastic: Low-odor, oil-resistant, non-hardening migrating mastic or liquid neoprene-based cement, applicable for fabrication or installation, shall be used as compounded specifically for sealing fitting components or longitudinal seams in ductwork. Oil- or asphalt-based caulking compounds are not acceptable.

1. Manufacturer:

- a. Childers
- b. B. Fuller/Foster
- c. United McGill
- d. 3M

C. Gaskets: Gasket material shall be soft elastomer butyl or neoprene rubber formed for the specific application.

PART 3 - EXECUTION

3.01 GENERAL

A. Criteria: All duct systems shall be furnished and installed free of noise, chatter, vibration, breathing and pulsation under all conditions of operation. Remove, replace or reinforce to correct adverse conditions. Fiberglass duct is not allowed on the project unless specifically indicated as acceptable.

B. Field Conditions: If field conditions are determined to exist which would limit the guarantee of air delivery or system performance, submit notice in writing to the Engineer. Prior to ductwork fabrication, verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Take precautions to avoid space interferences with beams, columns, joists, pipes, lights, conduit, other ducts, equipment, etc. Make necessary revisions to routing where any spatial or coordination conflicts appear, at no additional cost to the City or change in the contract price.

C. Preparation for Installation: Ductwork shall be shop-fabricated in lengths sufficient to minimize the number of joints, and shall be preassembled in the shop to the greatest extent possible to minimize field-assembly of the system. Space duct joints to avoid

cutting when installing branch takeoffs, outlet collars, etc. Disassemble ductwork only to the extent necessary for shipping and handling; match-mark sections for reassembly and coordinated installation. Install concrete inserts for support of the ductwork in coordination with the formwork to avoid delays.

- D. Installation: Properly support and align ductwork accurately at connections within 1/8 inch misalignment tolerance. Ducts shall be free of sags and bulges. Hang ductwork below concrete floors or roof deck with hangers set prior to pouring concrete, or from self drilling screw anchors. Gun powder set anchors are not permitted. Locate duct runs, except as otherwise indicated, vertically and horizontally, avoiding diagonal runs wherever possible. Parallel runs of horizontal ducts shall be grouped together on trapeze or strap hangers. Hold ducts as close to the structure above as possible. Maintain a minimum 6 inch clearance between walls and duct or duct exterior insulation for inspection.
- E. Duct Cleaning: All recirculating air systems shall be installed to comply with Duct Cleanliness Level C of the SMACNA Duct Cleanliness for New Construction Guidelines 2000. Continuously cap open ends of ductwork to prevent entry of dust, debris and foreign material throughout the installation. Where the interior of ductwork has been exposed to dust or debris, clean the interior of the entire ductwork system from the point of debris entry to the duct termination.
- F. Duct Penetrations: Where it is necessary that ducts be divided due to pipes or other obstructions which must pass through these ducts, provide air-stream deflectors in the duct and increase the duct size to maintain equivalent area around the deflectors. Such changes shall be in accordance with standard SMACNA details and shall be shown on As-Built Drawings.
- G. Interior Duct Painting: Interior of ductwork visible through registers, grilles, or diffusers shall be painted flat black.
- H. Prohibited Duct Locations: Do not route ductwork through transformer vaults, or into electrical rooms or elevator equipment spaces unless the ductwork is dedicated to serving that space. Do not install ductwork over elevator equipment, electrical distribution panels or motor control stations.
- I. Balancing Devices: Due to clarity of the drawings, not all duct balancing dampers may be indicated. However, provide each duct branch and each duct takeoff with a balancing damper to assure correct balance and quiet distribution of indicated air quantities.
- J. Equipment Connections: Provide and install all duct connections to air handling units and fans and provide flexible connections, elbows and bends which minimize noise and pressure drop. Provide and install all necessary blank-off safing plates or transitions required to facilitate installation. Provide flexible connections between ductwork and all rotating or vibrating equipment.
- K. Coordination: Coordinate dimensions at interfaces of dissimilar type of ductwork and at interfaces of ductwork with equipment so that proper overlaps, interfaces, etc., of insulation and continuity of vapor barriers are maintained. Where ducts of two dissimilar metals meet, the joints shall be installed such that the metals do not contact each other.

- L. Terminal Unit Connection: Connect low pressure ductwork to terminal units (fan terminal units, variable volume boxes, etc.) with flexible duct unless otherwise indicated. Comply with the requirements of paragraph entitled "FLEXIBLE DUCT EQUIPMENT CONNECTIONS" in Section 15910.
- M. Exterior Insulated Duct: Provide a seamless insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices with a metal collar equivalent in depth to insulation thickness and suitably sized to which insulation may be finished.

3.02 SHEET METAL DUCTS

- A. Construction: Provide corner closures. Longitudinal seams and transverse joints shall be flat and smooth inside. Make slip joints in direction of air flow. Longitudinal joints shall be Pittsburgh lock or double corner seam. Button punch snaplock construction is not acceptable. All welds shall be continuous and corrosion-resistant. Sealant shall be applied over the continuous length of every seam.
- B. Fittings: Fabricate offsets, turns and elbows with centerline radius equal to 1-1/2 times diameter when possible. No mitered offsets will be allowed.
- C. Round/Oval: Use manufactured ductwork where round or flat oval is indicated. Where round or oval low pressure ductwork is designated to have internal acoustical/thermal liner, provide factory-fabricated double-wall ductwork.
- D. Acoustical Liner: Unless otherwise indicated, duct dimensions are clear interior dimensions, not including thicknesses of internal acoustical liner. Internal duct liner shall be cut to assure overlapped and compressed longitudinal corner joints. The liner shall be secured in accordance with the manufacturers' recommendations. Where interior liner is installed downstream from final filters, provide double-wall duct construction or a minimum 8 mil thickness mylar scrim covering to prevent filtered air contact with the fibrous material.
- E. Vapor Retardant: Where exterior-insulated ductwork connects to ductwork without exterior insulation, the exterior insulation shall overlap the connecting duct a minimum of 4 inches. The vapor retardant on the exterior insulation shall be sealed to the exposed metal duct.

3.03 SUPPLY, RETURN, INTAKE, EXHAUST AND RELIEF DUCTWORK

- A. General Air Moving Systems: Ductwork shall be constructed of galvanized sheet metal unless otherwise indicated and shall comply with SMACNA Pressure Classification.
- B. Minimum Requirements: Unless otherwise indicated all ductwork shall comply with the following minimum pressure requirements:
 - 1. 3 inch w.g. Pressure:

- a. From the supply fan discharge to a terminal unit inlet.
2. 2 inch w.g. Pressure:
 - a. From the supply fan discharge to a room supply air device.
 - b. From the return air inlet device to the inlet of the return fan or air handling fan return connection.
3. 1 inch w.g. Pressure:
 - a. From the discharge side of a terminal unit to the room supply air device.
 - b. From the room exhaust device to the inlet of the roof exhaust fan.
4. All supply, return and outside air ducts shall be externally insulated unless specifically indicated to be internally insulated, extending from fan, throughout system, to all outlets. Unless otherwise indicated, external insulation shall be minimum 2 inch thick fiberglass duct wrap where concealed and 1-1/2 inch thick duct board where exposed; finish as specified.

3.04 CHANGES IN SHAPE OR DIMENSION

- A. Criteria: Where duct size or shape is altered to effect a change in area, the following shall apply:
 1. Do not exceed a slope of 1 inch in 7 inches for transitions with increasing area.
 2. Do not exceed a slope of 1 inch in 4 inches for transitions with decreasing area; 1 inch in 7 inches is preferable and should be used wherever possible.
 3. Transition angles shall not exceed 30 degrees at inlet connections to coils or other equipment, nor 15 degrees at outlet connections.

3.05 MATERIALS AND APPLICATIONS FOR SEALING DUCTS

- A. Liquid Sealant: Use only for slip type joints where sealant is to fill space between overlapping pieces of metal. Do not use where metal clearances exceed 1/16 inch.
- B. Mastics: Use in lieu of liquid sealant as a filler, in grooves and between flanges.
- C. Tape: Tape is not allowed to seal sheet metal ducts.
- D. Combination of mastic and embedded fabric: Use mastic/mesh/mastic layers as a sealant where pressure equals or exceeds 3 inch w.g. and where any space between metal surfaces at transverse joints, longitudinal seams or duct wall penetrations exceeds 1/16 inch.

- E. Surface preparation: Surfaces to receive sealant should be free from oil, dust, dirt, rust, moisture, ice crystals and other substances that inhibit or prevent bonding. Use solvent and apply a face primer if necessary to obtain a clean surface for adhesion.
- F. System Preparation: Remove all dirt and foreign material from the entire duct system and clean diffusers, registers and grilles before operating fans.

3.06 DUCT ACCESS DOORS

- A. General: All supply and return ductwork including outdoor air intakes shall be provided with access doors to permit periodic cleaning of the inside surfaces. Refer to paragraph entitled "DUCT ACCESS DOORS" in Section 15910.
- B. Location: Duct access doors shall be located such that they may be accessed by a person standing on a ladder. Access doors located above a ceiling shall not be more than 42 inches above the ceiling unless a work platform is provided. The access doors may be located on the sides or bottom of the ductwork and shall be available in each straight run and not more than 30 feet on centers. All elements of the duct system shall be available for cleaning without passing the cleaning equipment through duct turning vanes.
- C. Size: The width of the access door shall be a minimum of 1 inch less than the width of the duct. The length of the access door shall be a minimum of 12 inches up to a width of 12 inches, a minimum of 18 inches up to a width of 18 inches, and a minimum of 24 inches up to a width of 24 inches. Duct access door for duct cleaning purposed need not be larger than 24 inches by 24 inches.

END OF SECTION

SECTION 15910

DUCTWORK SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS are a part of this Section.

1.02 SUMMARY

- A. General: Provide necessary duct system accessories to assure balanced, quiet and draftless distribution and conveyance, with minimum of turbulence, noise and pressure drop for supply, return, exhaust and ventilation systems indicated.

1.03 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:

1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
2. 15240, VIBRATION ISOLATION
3. 15250, THERMAL INSULATION
4. 15880, AIR DISTRIBUTION
5. 15890, DUCTWORK
6. 15950, BUILDING CONTROL SYSTEM
7. 15990, PERFORMANCE VERIFICATION

1.04 SUBMITTAL

- A. General: Refer to paragraph entitled "SUBMITTAL" in Section 15010. Include the following data:

1. Manufacturers Literature:
 - a. Dimensional outline drawing of the following products:
 - (1) Flexible duct connection.
 - (2) Splitter damper.
 - (3) Turning vanes.
 - (4) Air extractors.
 - (5) Manual volume dampers.
 - (6) Backdraft dampers.

- (7) Fire dampers.
- (8) Sound attenuators (Silencers).

2. Installation Instructions:

- a. Manufacturer's printed installation instructions for each of the products listed including copies shipped with the equipment.

1.05 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall be in compliance with the applicable standards and codes listed in paragraph entitled "Code Compliance" in Section 15010.
- B. SMACNA: Use material, weight, thickness, gauge, reinforcement, seams and joints, suspension, workmanship, construction and installation methods as outlined in the Sheet Metal and Air Conditioning Contractors National Association, Inc. HVAC Duct Construction Standards, Metal & Flexible, Second Edition, 1995, or in accordance with the manufacturer's recommendations.
- C. NFPA: The duct fittings, accessories and sealants shall comply to the requirements with NFPA 90A, 2002 Revisions, requiring a flame spread rating of not over 25 and a smoke developed/fuel contributed rating no higher than 50.
- D. AWS: All welding of fittings and accessories to ductwork shall conform to American Welding Society AWS D9-84.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. General: Refer to paragraph entitled "MANUFACTURERS" in Section 15010. Model numbers or product type listed for manufacturers are given to provide an example of the item required.

2.02 GENERAL

- A. Clear Dimensions: Ductwork dimensions indicated which may affect items of this section are nominal free clearance internal dimensions, not including interior insulation thickness, if any.
- B. Gauges: Gauges indicated in this section are for galvanized steel. Where gauges are specifically indicated for a sheet metal material other than galvanized steel, provide the indicated gauge.

2.03 FLEXIBLE DUCT EQUIPMENT CONNECTION

- A. Flexible Duct Connections: Duct Connector shall be a waterproof neoprene-coated polymer fabric specifically manufactured to provide an airtight flexible connection between ductwork and rotating or vibrating equipment. Minimum tear and tensile strength shall be 125 and 300 pounds respectively.

1. Manufacturer:
 - a. Ductmate Proflex Vinyl
 - b. Durodyne
 - c. Ventfabrics

2.04 SPLITTERS

- A. General: Provide splitters for adjustment of air volume to the respective branches where indicated, constructed of the same material and at least the same gauge as the duct, but not less than twenty-two gauge. Use in duct systems to 2 inches w.g. only. Splitters shall be rigidly attached to pivot rod and operating linkage; install on raised insulated base when used in internally insulated ductwork. Splitter blades shall be formed in two thicknesses of metal with a rounded edge to air flow.

- B. Manufacturers:

1. Ventlock
2. Ruskin
3. Metalaire

2.05 TURNING VANES

- A. General: Turning vanes shall be completely flutter-proof; permanently fixed type aluminum, steel with acid/solvent chemical corrosion resistant coating, or galvanized steel. Turning vanes shall be minimum 24 gauge for single thickness and 26 gauge for double thickness and airfoil vanes. Turning vanes shall be securely fastened to a runner; vane edges shall project airflow parallel to duct sides. Airfoil-type turning vanes shall be constructed of galvanized steel or aluminum with a sound-attenuating fiberglass inner liner and open protective metal facing.

- B. Manufacturer and Type:

1. Barber-Coleman, Airturns
2. Dura-Dyne, VR
3. Hart & Cooley

2.06 EXTRACTORS

- A. General: Extractors shall deflect, proportion and direct the indicated air quantities to the branch duct and/or to the registers, grilles or other outlets without causing objectionable noise or pressure drop.

- B. Adjustable Multivaned: Multivaned with vanes on 1 inch centers where required to have shutoff capability or unless otherwise indicated; adjustable gang-operated and synchronized to remain parallel to flow regardless of extractor angle.
 - 1. Minimum .040 thick aluminum, steel with acid/solvent chemical corrosion resistant coating, or galvanized steel.
- C. Actuator: Provided with manual actuator devices for adjusting and securing the position of these deflectors; these devices shall allow adjustment of the deflectors from outside the ductwork without puncturing or penetrating ductwork or its vapor barrier. Provide remote actuator assembly where required.
- D. Manufacturer and Type:
 - 1. Titus, Model AG-45 or AG-225 Volume Extractor
 - 2. Waterloo, Type DTM or DT2M Extractor
 - 3. Anemostat, DTB or DTA
 - 4. Young Regulator, 890 or 890A

2.07 MANUAL VOLUME DAMPERS

- A. General: These dampers are other than those specified as being integral with a register, diffuser or other air outlet or inlet.
- B. Criteria: Volume dampers shall meet the following criteria:
 - 1. For ducts up to 10 inches in duct depth or 100 square inches in area, use single blade dampers of minimum 20 gauge.
 - 2. Opposed blade type multi-blade dampers shall be a minimum 4 inch deep and fabricated of minimum 16 gauge galvanized steel blades with a welded 16 gauge galvanized steel channel frame; sheet metal screws shall not be used in the construction of any damper. Blades shall ride in bronze bushings on 3/8 inch steel shafts suitable for motor operation. Damper blades shall be operated by a common linkage, with a 6 inch maximum blade width, and shall be formed with double 90 degree bends to ensure positive air lock and maximum strength. Blades shall be felt-tipped to ensure tight closure and noiseless operation, and shall be capable of opening to a full 90 degrees; damper linkage shall incorporate a positive 90 degree opening stop.
 - 3. Dampers shall be made of galvanized steel, stainless steel, steel with acid/solvent chemical resistant coating, or steel sprayed or dipped aluminum rust resistant finish as required to match the attached duct material; stiffened and fabricated to prevent vibration and flutter.
 - 4. Provide a hand quadrant stand-off bracket so that the damper can be adjusted from outside the completed ductwork without puncturing or otherwise penetrating the duct insulation or its vapor retardant barrier.

5. Dampers shall be fully adjustable and with locking device and damper position indicator. The damper and damper frame may be fabricated in one section to 48 inch in width and 90 inch in height; larger sizes shall be made in sections with mullions.
6. Pressure drop through the damper shall not exceed 0.03 inches w.g. at 1000 fpm velocity based on the damper face area. The damper shall have full shutoff capability, with leakage rates less than 10 cfm/square ft of damper face area at 4 inches w.g. Airfoil opposed blade dampers shall be provided if the velocity through a fully opened damper exceeds the manufacturer's printed maximum velocity limit.
7. Manufacturer:
 - a. Air Balance, Inc.
 - b. Greenheck
 - c. Nailor
 - d. Penn
 - e. Ruskin
 - f. Young Regulator Co.

2.08 BACKDRAFT DAMPERS

- A. General: Backdraft dampers shall be the multi-blade, weighted type with counter-balanced blades. Damper frame shall be aluminum or galvanized steel suitable for flange and gasket connection to ductwork. Blade edges shall have vinyl or polyurethane foam gasketing with ball bearings.
- B. Manufacturer:
 1. Air Balance
 2. Louvers & Dampers
 3. Ruskin

2.09 DUCT ACCESS DOORS

- A. General:
 1. Doors shall be factory prefabricated double wall, 24 gauge galvanized steel. Access doors shall be able to withstand the same test pressures without deformation, vibration or leakage as the ductwork and casings in which they are installed.
 2. Access door minimum size shall be as large as is compatible with the duct size but in no case less than the following (provide larger sizes if necessary to permit proper access operation):

Maximum Duct Dimensions	Access Door Size
11" and less	10" x 12"

12" through 16"	12" x 16"
17" and over	16" x 24"

3. Personnel walk-in access doors in air handling unit casings shall be a maximum 54 inch high by 20 inch wide.
- B. Latches: Doors shall be provided with adjustable tension catches and shall be gasketed around their perimeters with felt or soft rubber gasketing attached to the doors with cement and countersunk rivets for an airtight seal. Access doors less than 24 inch in height shall have a continuous piano hinge (or two 1 inch by 1 inch butt hinges where concealed) and one panel latch; access doors in casings and ducts 24 inch in height and over shall have two heavy butt hinges and two pairs of lever-type latches operable from both sides of the door, installed to open against air pressure. Access doors shall be fastened with spring clips which release in the event of sudden negative pressure, such as created when a damper closes, to prevent duct implosion.
- C. Indicators: Where access doors are concealed in hung ceiling, provide indicator buttons in the ceiling immediately below the access door.
- D. Vision Panels: Where indicated, provide plexiglass vision panels of minimum 0.125 inch thickness for access doors to 10 inch high, or 0.25 inch thick plexiglass for larger access doors. Where required, provide and install vision panels in casing access doors made of transparent wired glass.
- E. Combination Access/Relief Doors: Panels shall have pressure-sensitive release latches, set to the pressure rating of the duct unless otherwise indicated, with a chain securing the relief door to the mounting frame.
- F. Insulated: Insulated access doors shall have a minimum 1 inch rigid 3-pound density fiberglass board between the inner and outer panels.
- G. Manufacturer:
1. Ventfabrics, Inc., Ventlok
 2. Ruskin
 3. United Sheet Metal

2.10 AIRFLOW STRAIGHTENERS

- A. General: Airflow straighteners shall be constructed of 3/4 inch honeycomb parallel cell orientation in 1 inch depths, with a slip-in frame to permit removal for cleaning. For air velocities to 2500 fpm, the airflow straightener cells shall be manufactured from aluminum; for air velocities in excess of 2500 fpm the cells shall be galvanized steel or stainless steel.
- B. Manufacturer:
1. Titus

2. Barber-Colman

PART 3 - EXECUTION

3.01 GENERAL

- A. Transitions: Provide and install transitions where required for final connection to any duct fitting, accessory, device or duct-mounted equipment.
- B. Special System: All accessories installed in poly-vinyl-steel ductwork shall have acid/solvent chemical corrosion resistant coating.
- C. Location and Use of Dampers: Install a volume damper at each duct branch, as far as possible upstream from air inlets or outlets, to attenuate noise transmission caused by damper throttling. Where the necessary pressure drop across a single volume damper becomes excessive and cannot be reduced through the use of splitter dampers or extractors and creates objectionable noise in the opinion of the Engineer, an orifice plate shall be installed. The orifice plate shall be sized to provide sufficient pressure drop to allow the volume damper to control the air flow without any objectionable noise transmission. Use splitter dampers, extractors or orifice plates only where manual volume dampers will not accomplish the intended balancing, or where indicated. The use of splitter dampers, extractors or orifice plates shall not eliminate the need for specified or required manual dampers.
- D. Duct Mounted Smoke Detectors: Install duct mounted smoke detectors where indicated in strict accordance with manufacturer's recommendations.

3.02 TURNING VANES

- A. General: Install turning vanes for all short-radius elbows where the centerline radius is less than 1-1/2 times the duct width, and all square corner bends with a transition angle greater than 30 degrees. Install vanes in sections or use tie rods to limit the unbraced vane length. Turning vanes shall be single-wall type for ducts with a vane runner length less than 18 inch and air velocity less than 2500 fpm; duct systems with longer runner lengths or higher air velocities shall use double-wall vanes. Airfoil-type vanes shall be used wherever the duct static pressure exceeds 2 inches w.g. If the duct size changes in a mitred elbow, the vanes shall be fitted with a trailing edge extension.

3.03 DUCT ACCESS DOORS

- A. General: Provide and install an access door in the ductwork for each fire, smoke, fire/smoke and motorized damper; in-line duct heater and coil; permanent test ports; and where access for observation or maintenance is necessary.

3.04 FLEXIBLE DUCT EQUIPMENT CONNECTIONS

- A. General: Provided flexible duct connections where air handlers, fans and blowers connect to their ductwork. Flexible duct connections shall be installed as follows:
 - 1. Connections shall be at least 4 inches long and shall not be stretched tight or have any metal touching. The flexible material shall not be skewed.

2. Connections shall be attached on each side to metal (either metal ductwork, air handling apparatus, or heavy gauge steel sleeves).

3.05 TEST OPENINGS

- A. General: Furnish and install capped test openings for test equipment (pitot tubes, etc.) on the entering and leaving sides of air handling units, duct-mounted coils and other airside equipment. Locate these test openings in each main supply duct at the downstream end of the straightest run of the main before the first take-off. Form test ports by drilling as many evenly-spaced 7/16 inch holes in the duct as will fit on maximum 8 inch centers, lined up perpendicular to the airflow. Holes shall be sealed with replaceable plastic plugs, and shall be made accessible through exterior insulation for future balancing.

3.06 FITTINGS AND TRANSITIONS

- A. Divided Flow Fittings: All divided flow fittings shall be furnished as separate fittings; tap covers welded into spiral duct sections are not acceptable. All tees, crosses and laterals up to and including 12 inch diameter shall have a minimum 3/8 inch radius rounded entrance into the tap, produced by machining, press forming or hand-grinding smooth and free of projections, weld build-up, burrs or irregularities. All round duct tees and crosses shall be the spun conical converging type for branch entrances, with a raised bead on the throat of the fitting to assure a tight positive connection. Lateral and Y-type fittings shall be constructed so that airstream converge or diverge at angles of 45 degrees or less.
- B. Construction: All welded fittings shall have continuous welds along all seams.
- C. Flexible Duct Connectors: Provide spin-in type connector fitting with balancing damper at all connections between rigid sheet metal duct and flexible duct at the upstream end of the flexible duct.
- D. Branch Takeoffs: Unless indicated otherwise, branch takeoff connections shall be made with 45 degree laterals or 45 degree elbows. Where 90 degree branches are shown, provide conical tees or "shoe" fittings at a 45 degree entry, with a lockable quadrant damper.
- E. Elbows: Elbows shall be die-stamped or multiple-gore construction with seam circumferential joints unless shown as mitred square elbows with turning vanes, except elbows 8 inch in diameter or less shall be die-stamped. All offsets in excess of 30 degrees shall have radius fittings with a minimum 1.5 ratio; provide turning vanes in all elbows and bends as specified herein.

END OF SECTION

SECTION 15990 - PERFORMANCE VERIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Basic Requirements: Provisions of Section 15010, BASIC MECHANICAL REQUIREMENTS, and Section 15030, ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT, are a part of this Section.

1.2 SUMMARY

- A. Scope: Verify the performance of the systems of Division 15 by testing and balancing procedures described in this section.
- B. General: The Contractor will select a test and balance agency (herein referred to as the T&B Agency) and pay for the services of the T&B Agency for system and equipment performance verification.
- C. Definition of Terms:
 - 1. "Contractor" shall refer to the General Contractor.
 - 2. "City" shall refer to or their designated representative.

1.3 ADDITIONAL REQUIREMENTS

- A. Related Sections: Other Sections of Division 15 which relate to the requirements of this Section may include but are not limited to the following:
 - 1. 15050, BASIC MECHANICAL MATERIALS AND METHODS
 - 2. 15120, PIPING SPECIALTIES
 - 3. 15450, PLUMBING EQUIPMENT
 - 4. 15510, HYDRONIC PIPING SYSTEM
 - 5. 15680, WATER CHILLER
 - 6. 15800, AIR HANDLING UNIT
 - 7. 15880, AIR DISTRIBUTION
 - 8. 15885, AIR FILTER
 - 9. 15910, DUCTWORK SPECIALTIES
- B. Related Divisions: Other Divisions of these specifications which relate to the requirements of this Section may include but are not limited to the following:
 - 1. Division 1, ALTERNATE
 - 2. Division 16, ELECTRICAL

1.4 APPLICABLE STANDARDS

- A. General: All equipment, material, accessories, methods of construction and reinforcement, finish quality, workmanship and installation shall comply with the paragraph entitled "Code Compliance" in Section 15010.

1.5 TEST AND BALANCE AGENCY

- A. General: Performance verification shall be performed by an independent T&B Agency.
- B. Certification: The T&B Agency shall be a certified member of the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).
- C. References: The T&B Agency shall have been in business continuously for the previous 3 years and shall specialize in and be limited to testing and balancing HVAC systems. The T&B Agency shall submit references of five previously successfully completed projects of similar size, type, scope, and complexity.
- D. Supervision: Field work shall be performed under the direct supervision of a full-time employee of the T&B Agency. The final test reports shall be certified and sealed by the supervisor and signed by the employees performing the work.
- E. Approval: The T&B Agency shall not be affiliated with the construction contractors, equipment manufacturers, sales vendors, or design engineering firms. All test and balancing work shall be scheduled by the Contractor in corporation with the T&B Agency and at the direction of the City. The T&B Agency shall report to the Engineer in writing anytime the scheduled services cannot be preformed as schedule or as required. The Contractor shall be responsible for the operation of all equipment during the test and balance process.
- F. Reporting: The T&B Agency shall function as an authorized inspection agency responsible to the City, and shall list all items which are installed incorrectly, require correction or completion, or which have not been installed in accordance with the contract documents. Prior to beginning system balancing, submit to the Engineer for the Cities review, written procedures to be followed for the testing and balancing work.

1.6 AGENCY APPROVAL

- A. Name and Qualifications: Submit the name and qualifications of the proposed T&B Agency to the Engineer for acceptance within thirty (30) days of Notice to Proceed. If the proposed agency is not submitted within the stated time the Engineer shall select the T&B Agency and deduct the cost of their services from the Contract Amount.

1.7 INSTRUMENTATION

- A. General: All test and balance equipment and instruments shall be furnished by the T&B Agency and shall have been calibrated to the tolerances required in balancing standards within six (6) months of use on this work. A list of equipment and instruments shall be submitted to the Engineer for the Cities review prior to commencing test and balancing operations and shall include manufacturer, serial number and certification of last calibration date and method of calibration including test references. Instruments without calibration adjustment capability shall be accompanied with manufacturer's certification of accuracy. Instruments shall have maximum field measuring accuracy, shall be applied as recommended by the manufacturer, and shall have minimum scale and maximum subdivisions with ranges for the values being measured.

1.8 WORK INCLUDED

- A. General: The T&B Agency shall provide all labor, supervision, professional services, tools, test equipment and instruments (except as otherwise indicated) to perform work of this section; including but not limited to:
1. Review the automatic temperature control and air terminal unit as-built conditions for their effects on the testing and balancing procedures for the air and hydronic systems.
 2. Where conditions may exist in the system design or construction which may adversely affect system performance, identify the conditions and submit recommended corrections in writing for consideration by the Engineer.
 3. During construction, review shop drawings relevant to performance verification to confirm that the required piping, ductwork and equipment, and their respective specialties and accessories such as gauges, valves, dampers, access doors, etc., are properly selected, sized and located to permit proper and complete testing and balancing.
 4. Perform a minimum of 24 hours of site inspections at a maximum of 8 hours per visit during construction and prior to the scheduled start of the test and balance work to become familiar with the project, equipment locations, and to verify compliance with documents. After each inspection submit a written report to the Engineer indicating the area covered and the results of the inspection.
 5. Submit the Equipment Test and Systems Balance Report for review and acceptance.
 6. Furnish specifications for properly-sized fixed sheaves and belts on fan systems after proper RPM has been established.
 7. Test for sound and vibration levels.
 8. Test and report pressure differentials between the sampling and return ports of all duct smoke detectors.
 9. Expected systems to be Tested:
 - a. New Boiler
 - b. New AHU's
 - c. New Chiller

1.9 GUARANTY

- A. General: The T&B Agency shall include a warranty period of ninety (90) days after acceptance of test and balance work. During the warranty period, the City may request a re-check or re-setting of any system component requiring testing and balancing. The T&B Agency shall provide technicians, instruments, and tools to assist the City in conducting any test required. A guarantee, such as the AABC National Project Certification Performance Guarantee, shall also be provided.

PART 2 - PRODUCTS

2.1 REPORT

- A. Records: Recorded test data shall be at the final balanced condition for each system, and shall be arranged by system using the appropriate designation as established on the Contract Documents. 6 copies of the typewritten, signed, bound and indexed final report shall be submitted to the Engineer for the City review prior to request for substantial completion inspection. The substantial completion inspection shall not be scheduled until the final report has been received and is acceptable to the City. Report format shall be similar to forms approved for use by SMACNA or AABC.
- B. Measurements: Where actual measurements recorded for the final balance show deviations of more than 10 percent from the design, the T&B Agency shall note same in the report and submit recommendations for corrective action to the Engineer.
- C. Deficiency: Where recorded data can be reasonably interpreted to be inaccurate, inconsistent or erroneous, the City may request additional testing and balancing. The T&B Agency shall perform retesting and re-balancing at no additional cost.
- D. Vibration: Where, in the opinion of the T&B Agency, there is excessive vibration, movement or noise from any piece of equipment, ductwork, pipes, etc., the T&B Agency shall note same in the report and submit recommendations for corrective action to the Engineer.
- E. Records: Recorded test data shall be at the final balanced condition for each system, and shall be arranged by system using the appropriate designation as established on the Contract Documents. 6 copies of the typewritten, signed, bound and indexed final report shall be submitted to the City review prior to request for substantial completion inspection. The substantial completion inspection shall not be scheduled until the final report has been received and is acceptable to the City. Report format shall be similar to forms approved for use by SMACNA or AABC.
- F. Measurements: Where actual measurements recorded for the final balance show deviations of more than 10 percent from the design, the T&B Agency shall note same in the report and submit recommendations for corrective action to the City.
- G. Deficiency: Where recorded data can be reasonably interpreted to be inaccurate, inconsistent or erroneous, the City may request additional testing and balancing. The T&B Agency shall perform retesting and re-balancing at no additional cost.

- H. Vibration: Where, in the opinion of the T&B Agency, there is excessive vibration, movement or noise from any piece of equipment, ductwork, pipes, etc., the T&B Agency shall note same in the report and submit recommendations for corrective action to the City.
- I. Controls: The T&B Agency shall verify that each controller and the devices it controls, such as control valves, motorized dampers, VAV boxes, etc., operates in the exact sequence required.
- J. Test Data: Include the following data in the Systems Test and Balance Report for all items included in the project:
 - 1. Motors:
 - a. Manufacturer
 - b. Model and serial number
 - c. Rated amperage and voltage
 - d. Rated horsepower
 - e. Rated RPM
 - f. Measured amperage and voltage
 - g. Calculated brake-horsepower
 - h. Measured RPM
 - i. Sheave size, type and manufacturer
 - j. Bearing model numbers
 - 2. Fans:
 - a. Manufacturer
 - b. Model or Serial number, type of fan, number of blades, wheel diameter
 - c. Rated CFM, measured CFM
 - d. Rated RPM, measured RPM
 - e. Design inlet and outlet total and external static pressures
 - f. Actual inlet and outlet total and external static pressures
 - g. Pulley sizes, types and manufacturers
 - h. Belt size and quantity (V-belt drive only)
 - i. Bearing model numbers
 - j. Inlet vane position
 - k. Shaft diameter
 - 3. Pumps:
 - a. Manufacturer
 - b. Model or Serial number, impeller size
 - c. Rated RPM, measured RPM
 - d. Rated head, measured head
 - e. Measured discharge pressure
 - f. Measured suction pressure

- g. Rated and measured GPM
- h. Bearing serial number

4. Air Systems (including inlets and outlets):

- a. Grille or diffuser reference number, manufacturer and type
- b. Grille or diffuser location
- c. Design and measured velocity
- d. Design and measured CFM
- e. Effective area factor and size, and diffuser flow coefficients
- f. Terminal Unit CFM
- g. Tabulation of design and measured cfm for each inlet or outlet
- h. A summarization by system to compare design data to actual

5. Air Handling Units and Fan Coil Units:

- a. Design and measured air flow and water flow rates
- b. Design and measured airside static pressure drops across each coil and across the entire unit
- c. Design and measured water inlet and outlet temperatures for each coil, and waterside pressure drops
- d. Design and measured steam inlet pressure and consumption
- e. Design and measured airside cooling coil entering and leaving dry and wet bulb temperatures
- f. Design and measured airside heating coil entering and leaving dry bulb temperatures

K. Other Report Requirements: Where systems have equipment or components which are not covered by the above, the Final Test and Balance Report shall include the following design and measured data as applicable:

- 1. All duct inlet and outlet areas.
- 2. All applicable duct, pipe and coil sizes.
- 3. Outside, return, mixed and supply air conditions.
- 4. All fluid velocities, flow rates, temperatures and pressure differentials at appropriate locations.
- 5. All speeds.
- 6. All voltage and ampere ranges.

2.2 DIAGRAMS

A. General: Provide a schematic diagram (i.e., one-line) of duct systems tested. Indicate on the diagram the relative location of all air distribution devices, VAV boxes, heating/cooling coils, points of data measurements (i.e., pitot traverse, temperature, static pressure) fans, air handling units, and similar equipment included in the system which cause a pressure drop, such as filter banks, air flow monitors, sound attenuators, etc. Diagrams shall identify

each component tested utilizing the conventions shown on the drawings (i.e., AHU-1 or SF-6) and correlate with the data sheets provided in the Test and Balance Report.

PART 3 - EXECUTION

3.1 GENERAL

- A. Load Conditions: All testing and balancing of systems shall be performed with maximum attainable load. Testing and balancing of all air handling systems shall be accomplished with ceiling tiles in place and enclosing partitions, windows and doors erected.
- B. Observation: Observe all equipment and exposed piping for noise, movement or vibrations under normal operating conditions and report unacceptable operation to the Engineer and the City.
- C. Observation: Observe all equipment and exposed piping for noise, movement or vibrations under normal operating conditions and report unacceptable operation to the City.
- D. Measuring Stations: Where measuring stations are installed, each is to be read and recorded in hydronic systems, permanent devices such as flow tubes with manometers, annular ring systems, venturi tubes with portable meters, etc. must be used for final measurements after they are completed and calibrated.
- E. Balancing/Test Results: Where flow, pressure or balancing meters are provided by the manufacturer of a specific device, (i.e. flow control valves), the T&B Agency shall verify meter operation and calibrate the device with the manufacturer's meter prior to turnover to the City.
- F. Adjusting: Testing and balancing is an iterative process and the T&B Agency may have to perform preliminary adjustments, readjustments and final adjustments as necessary to properly tune the systems. This is an integral part of the balancing procedure and must be anticipated; all adjustments, spot-checking required by the City and other re-verification shall be performed at no additional cost to the City.
- G. Adjusting: Testing and balancing is an iterative process and the T&B Agency may have to perform preliminary adjustments, readjustments and final adjustments as necessary to properly tune the systems. This is an integral part of the balancing procedure and must be anticipated; all adjustments, spot-checking required by the City and other re-verification shall be performed at no additional cost to the City.

3.2 AIR SYSTEMS

- A. General: The testing and balancing shall include, but is not limited to, the following requirements:

1. Adjust fan speeds to deliver the required cfm and static pressure, and record rpm and full load amperes. Replace drives as required; increasing static pressure by dampering at the fan is not permitted.
2. Traverse main supply ducts with pitot tube to verify design cfm. Artificially load air filters by partially blanking to produce the equipment or air pressure drops through dirty filters. Mark position of balancing devices.
3. Verify the quantity of outside air and return air when the system is operating in the maximum cooling and full heating modes. Check all controls which regulate flow or pressure for calibration, verify damper positioning and modulation, and flowrate with minimum and maximum outside air.
4. Test and adjust each diffuser, grille and register to within 10 percent of design requirements, and adjust to minimize drafts and noise in all areas.
5. Observe all equipment and exposed ductwork for noise, movement or vibration under normal operating conditions and report to the Engineer.
6. Verify the operation of the following exhaust systems, adjusting the fan speed as required to deliver the specified cfm and static pressure, and record the RPM and full load amperes:
 - B. Diagrams: On the single-line diagram, indicate the measured flow rates and pressure drops across each component, such as coils, filters, air flow monitoring stations, sound attenuators, louvers, fans, etc. in order of physical arrangement.
 - C. Air Distribution: Adjust air distribution devices to distribute design air quantities. Should the temperature in any area vary more than 2 degrees from the zone thermostat setpoint, notify Engineer and obtain approval to re-balance devices to air quantities other than those indicated so that air temperature in the entire zone will be as even as possible regardless of design air quantities. After obtaining approval, perform necessary re-balancing.

3.3 EXHAUST SYSTEM AIRFLOWS

- A. Air Flow: Verify the exhaust system provides design quantities of air flow rates while operating.
- B. Kitchen Ventilator Hood: Verify total hood airflow.

3.4 HYDRONIC PIPING SYSTEM

- A. General: Test and balance shall include, but is not limited to, the following requirements:
 1. Prior to testing and balancing of each system check all control valves, inlet valves, and flow meters for proper installation, calibration and accuracy.
 2. Measure and adjust pump flow capacity to proper quantity.
 3. Adjust flow through equipment such as chillers, boilers, heat exchangers, and coils.

4. Balance system flows. After adjustments to coils are made, recheck pump setting and readjust if required. Set pressure drop through bypass to match pressure drop through coil or equipment.
5. Coordinate equipment operation and output performance with the manufacturer's representative. Record inlet and outlet temperatures.
6. Mark settings of adjustable balancing devices which provide the design flow requirement. Mark equipment settings, control damper positions, valve indicators, fan speed controls, control levers, and other balancing devices. Permanent markings shall be with an arrow indicator stamped or cut into the surface; a waterproof marker may be used on non-wear surfaces.
7. Test and balance each hydronic system and record flow rate, pump inlet and outlet pressures and motor amperage for each pump for each increment of system flow rate provided by the pumping/piping configuration. Variable speed pumps shall operate as constant volume pumps at maximum speed for purposes of this record.

3.5 SYSTEM MEASUREMENT

- A. General: Measurements shall be taken to obtain accurate and consistent readings; i.e. sufficiently downstream from changes in direction, regions of turbulence, or flow convergence.
- B. Repeatability: Take sufficient readings which when averaged will result in a repeatability error not to exceed 5 percent. When measuring a single point, repeat readings until two consecutive identical values are obtained. Readings shall be taken with the eye at the level of the indicated value to prevent parallax. Insert pulsation dampeners to eliminate error involved in estimating the median of fluctuating readings.
- C. Report Availability: One copy of the final Test and Balance Report shall be made available at the project site for the substantial completion survey. This final report shall be typewritten and submitted to the Architect prior to the substantial completion survey with sufficient time for review, comment, correction of report, additional testing as necessary, follow-up review, and acceptance signature by the Engineer. The Test and Balance Report shall include differential pressure testing of each duct smoke detector, verifying that each reading falls within the manufacturer's acceptable tolerance.

3.6 FINAL COMPLETION

- A. Educational Facilities: Final completion certification and payment shall be withheld pending receipt of a letter from the City's satisfaction and acceptance of the testing and balancing results.

END OF SECTION 15990

NO TEXT FOR THIS PAGE

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART1 - GENERAL

1.01 GENERAL

- A. Basic Requirements: The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. General Provisions: Provide all labor, materials, equipment, and incidentals required to make ready for use complete electrical systems as specified herein and shown on the drawings.
- C. Provide and Install: The word "provide" where used on the Drawings or in the Specifications shall mean "furnish, install, mount, connect, test, complete, and make ready for operation". The word "install" where used on the Drawings or in the Specifications shall mean "mount, connect, test, complete, and make ready for operation". Perform work required by, and in accordance with, the Contract Documents.
- D. Installation: Provide and place in satisfactory condition, ready for proper operation, raceways, wires, cables, and other material needed for all complete electrical systems required by the Contract Documents. Additional raceways and wiring shall be provided to complete the installation of the specific equipment provided. Include auxiliaries and accessories for complete and properly operating systems. Provide electrical systems and accessories to comply with the NEC, state and local codes and ordinances. It is the intent of these Specifications that the electrical systems be suitable in every way for the use intended. Material and work which is incidental to the work of this Contract shall be provided at no additional cost to the Contract.
- E. Field Connections: Provide field connections to remote equipment and control panels provided under other Divisions of these Specifications. Provide raceway, wire, and interconnections between equipment, transmitters, local indicators, and receivers. Install field connections to "packaged" equipment provided under other Divisions of these Specifications.

1.02 SCOPE OF WORK

- A. General: Provide labor, materials, permits, inspections and re-inspection fees, tools, equipment, transportation, insurance, temporary protection, temporary power and lighting, supervision and incidental items essential for proper installation and operation of the Electrical systems indicated in the Contract Documents. Provide materials not specifically mentioned or indicated but which are usually provided or are essential for proper installation and operation of the Electrical systems indicated in the contract documents.

- B. Notices: Give notices, file Plans, pay fees, and obtain permits and approvals from authorities having jurisdiction. Include all fees in the Bid Price.

1.03 INTERPRETATION OF DRAWINGS

- A. General: The Drawings are diagrammatic and are not intended to show exact locations of Raceway runs, outlet boxes, junction boxes, pull boxes, etc. The locations of equipment, appliances, fixtures, Raceways, outlets, boxes and similar devices shown on the Drawings are approximate only. Exact locations shall be determined and coordinated in the field. The right is reserved to change, without additional cost, the location of any outlet within the same room or general area before it is permanently installed. Obtain all information relevant to the placing of electrical work and in case of interference with other work, proceed as directed by the Engineer.
- B. Discrepancies: Notify the Engineer of any discrepancies found during construction of the project. The Engineer will provide written instructions as to how to proceed with that portion of work. If a conflict exists between the Contract Documents and an applicable code or standard, the most stringent requirement shall apply.
- C. Wiring: Each three-phase circuit shall be run in a separate Raceway unless otherwise shown on the Drawings. Unless otherwise accepted by the Engineer, Raceway shall not be installed exposed. Where circuits are shown as "home-runs" all necessary fittings, supports, and boxes shall be provided for a complete raceway installation.
- D. Layout: Circuit layouts are not intended to show the number of fittings, or other installation details. Connections to equipment shall be made as required, and in accordance with the accepted shop and manufacturer's setting drawings.
- E. Coordination: Coordinate final equipment locations with drawings or other disciplines. Layout before installation so that all trades may install equipment in available space. Provide coordination as required for installation in a neat and workmanlike manner.

1.04 EQUIPMENT SIZE AND HANDLING

- A. Coordination: Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, ship the equipment in sections of specific sizes to permit the passing through the necessary areas within the structure.
- B. Handling: Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.05 RECORD DRAWINGS

- A. Production: The Contractor shall provide two (2) sets of black or blue line on white drawings to maintain and submit record "As-Built Documents". Label each sheet of the Record Document set with "Project Record Documents" with company name of the installing contractor in stamped or printed letters. One set shall be maintained at the site and at all times be accurate, clear, and complete. These drawings shall be available at all times to the Engineer's field representatives.
- B. Recording: Record information concurrent with construction progress. Make entries within 24 hours upon receipt of information. The "As-Built" drawings shall accurately reflect installed electrical work specified or shown on the Contract Documents.
- C. Completion: At the completion of the Work, transfer changes with a colored pencil onto the second set and submit to the Engineer. The "As-Built" drawings shall be made available to the Engineer to make the substantial completion punch list.
- D. Final: Upon Contractor's completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings and CAD files. Submit drawings and CAD disks for review and acceptance. The Contractor shall provide updated disks which include final As-Built conditions.

1.06 ABBREVIATIONS

- A. Abbreviations: The following abbreviations or initials may be used:

A/C	Air Conditioning
AC	Alternating Current
ABV CLG	Above Ceiling
ADA	Americans with Disabilities Act
AF	Ampere Frame
AFF	Above Finished Floor
AFG	Above Finished Grade
AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
AMP	Ampere
ANSI	American National Standards Institute
ASA	American Standards Association
AT	Ampere Trip
ATS	Automatic Transfer Switch
AUX	Auxiliary
AWG	American Wire Gauge
BC	Bare Copper
BIL	Basic Impulse Level
BMS	Building Management System
BRKR or BKR	Breaker
CAB	Cabinet
C	Conduit or Raceway

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CB	Circuit Breaker
CBM	Certified Ballast Manufacturers
CCTV	Closed Circuit Television
CKT	Circuit
CLEC	Clock Equipment Cabinet
CLG	Ceiling
CO	Conduit or Raceway Only
COAX	Coaxial Cable
COND	Conductor
CONN	Connection
CPU	Central Processing Unit
CRT	Cathode Ray Terminal (Video display terminal)
CT	Current Transformer
CU	Copper
CW	Cold Water
DC	Direct Current
DDC	Direct Digital Control
DEG	Degree
DISC	Disconnect
DO	Draw Out
DN	Down
DPST	Double Pole Single Throw
EMT	Electrical Metallic Tubing
EO	Electrically Operated
EOL	End of Line Resistor
EWC	Electric Water Cooler
FAAP	Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FCU	Fan Coil Unit
FLA	Full Load Amperes
FM	Factory Mutual
GF	Ground Fault
GFCI	Ground Fault Circuits Interrupter
GND	Ground
HOA	Hand-Off-Automatic
HORIZ	Horizontal
HP	Horsepower
IC	Intercom
ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMC	Intermediate Metallic Raceway
IN	Inches
IT	Instantaneous Trip
IPCEA	Insulated Power Cable Engineers Association
JB	Junction Box
KCMIL	Thousand Circular Mills
KV	Kilovolt
KVA	Kilo-Volt-Amps
KW	Kilowatts
LBS	Pounds

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HFC AWTP Administration Building HVAC Improvements

LED	Light Emitting Diode
LT	Light
LTD	Long Time Delay
LTT	Long Time Trip
LTG	Lighting
MAX	Maximum
MCB	Main Circuit Breaker
MCC	Motor Control Center
MCP	Motor Circuit Protector
MIC	Microphone
MIN	Minimum
MLO	Main Lugs Only
MTD	Mounted
MTG	Mounting
MUX	Multiplex (Transponder) Panel
MVA	Mega Volt Amps
N	Neutral
NC	Normally Closed
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIC	Not in Contract
NF	Non Fused
NL	Non Linear
NO	Number or Normally Open
#	Number
Ø	Phase
OL	Overload
OSHA	Occupational Safety and Health Administration
P	Pole
PB	Pullbox
PIV	Post Indicator Valve
PNL	Panel
PR	Pair
PWR	Power
PF	Power Factor
PRI	Primary
PT	Potential Transformer
PVC	Polyvinylchloride
REF	Refrigerator
RGC or GRC	Rigid Galvanized Raceway
RMS	Root-Mean-Square
RPM	Revolutions Per Minute
RECPT	Receptacle
SCA	Short Circuit Amps
SD	Smoke Detector
SEC	Secondary
S/N	Solid Neutral
SPKR	Speaker
SPST	Single Pole Single Throw

SST	Solid State Trip
ST	Short Time Trip
STD	Short Time Delay
SW	Switch
SWGR	Switchgear
SWBD	Switchboard
TEL	Telephone
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TVEC	Television Equipment Cabinet
TYP	Typical
UL	Underwriters Laboratories
UON	Unless Otherwise Noted
V	Volt
VFD	Variable Frequency Drive
VSD	Variable Speed Drive
W	Wire
WP	Weatherproof
XFMR	Transformer

1.07 CODES, FEES, AND STANDARDS

- A. Application: The codes, standards and practices listed herein generally apply to the entire project and specification sections. Other codes, standards or practices that are more specific will be referenced within a particular specification.
- B. Requirements: All materials and types of construction covered in the specifications will be required to meet or exceed applicable standards of manufacturer, testing, performance, and installation according to the requirements of UL, ANSI, NEMA, IEEE, and NEC referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents that exceed but are not contrary to governing codes shall be followed.
- C. Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances. The completed electrical installation shall be inspected and certified by applicable agencies that it is in compliance with codes.
- D. Applicability: The codes and standards and practices listed herein, and their respective dates are furnished as the minimum latest requirements.
 - 1. State of Florida
 - 2. Hillsborough County
 - 3. City of Tampa
- E. Utility Company: Comply with latest utility company regulations.
- F. State Statutes: Florida Statutes
 - 1. 4A3, The State Fire Prevention Code

- G. Building Code: Standard Building Code.
- H. Standards: American Society of Mechanical Engineers
- I. Florida Americans with Disabilities Accessibility Implementation Act as described in Florida Accessibility Code for Building Construction, Department of Community Affairs.
- J. Manuals: Accessibility Requirements Manual Florida Department of Community Affairs.
- K. Labels: Materials and equipment shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available or desired for certain types of equipment, test data shall be submitted to validate that equipment meets or exceeds available standards.
- L. NFPA: Latest edition of the following National Fire Protection Association (NFPA) Standards:

1.08 INVESTIGATION OF SITE

- A. Site Renovation: Verify and coordinate existing site raceways and pipes at any excavation on site. Provide hand-digging and required rerouting in areas of existing Raceways and pipes within bid price.

1.09 SUPERVISION OF THE WORK

- A. Supervision: Provide one field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes, type and complexity. The Superintendent shall be present at all times when work is being performed. At least one member of the Electrical Contracting Firm shall hold a State Master Certificate of Competency.

1.10 COORDINATION

- A. General: Compare drawings and specifications with those of other trades and report any discrepancies between them to the Engineer. Obtain from the Engineer written instructions to make the necessary changes in any of the affected work. Work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Trades shall make proper provisions to avoid interferences in a manner approved by the Engineer.
- B. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to City including but not limited to electrical work required for mechanical division.

- C. Obtain set of Contract Documents from Cities Authorized Representative or Contractor for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.
- D. Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- E. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the City.
- F. Adjustments: Locations of raceway and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Determine the exact routing and location of systems prior to fabrication or installation.
- G. Priorities: Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have the right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- H. Modifications: Offsets and changes of direction in raceway systems shall be made to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. Provide elbows, boxes, etc., as required to allow offsets and changes to suit job conditions.
- I. Replacement: Work shall be installed in a way to permit removal (without damage to other parts) of other system components provided under this Contract requiring periodic replacement or maintenance. Raceway shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles.
- J. Layout: The Contract Drawings are diagrammatic only intending to show general runs and locations of raceway and equipment, and not necessarily showing required offsets, details and accessories and equipment to be connected. Work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operation, maintenance and headroom.
- K. Contract Conflicts: Where discrepancies exist in the Scope of Work as to what Trade provides items such as starters, disconnects, flow switches, etc. such conflicts shall be coordinated between the divisions involved. It is the intent of the Contract Documents that all work shall be provided complete as one bid price.

- L. Drawing Conflicts: Where drawing details, plans or specification requirements are in conflict and where sizes of the same item run are shown to be different within the contract documents, the most stringent requirement shall be included in the Contract. Systems and equipment called for in the specification or as shown on the drawings shall be provided as if it was required by both the drawings and specifications. Prior to ordering or installation of any portion of work, which appears to be in conflict, such work shall be brought to Engineer's attention for direction as to what is to be provided.
- M. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Cities Authorized Representative and Designer (and receive their approval) prior to rough-in. Locations indicated in Contract Documents are only approximate locations.
- N. The Contract Documents describe specific sizes of switches, breakers, fuses, Raceways, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). Coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. Adjust circuit breaker, fuse, Raceway, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the City.
- O. Working Clearances: Minimum working clearances about electrical equipment shall be as referenced in the applicable edition NEC Article 110, and shall include equipment installed in ceiling spaces.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Specified Method: Where several brand names, make or manufacturers are listed as acceptable each shall be regarded as equally acceptable, based on the design selection but each must meet all specification requirements. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance. Where manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance. No substitutions are permitted.
- B. Certification: When a product is specified to be in accordance with a trade association or government standard requested by the Engineer, Contractor shall provide a certificate that the product complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.
- C. Basis of Bid: Each bidder represents that his bid is based upon the manufacturer's, materials, and equipment described in the Contract Documents.

- D. Space Requirements: Equipment or optional equipment shall conform to established space requirements within the project. Equipment which does not meet space requirements, shall be replaced at no additional expense to the Contract. Modifications of related systems shall be made at no additional expense to the Contract. Submit modifications to the Engineer for acceptance.

2.02 SHOP DRAWINGS

- A. General: Shop drawings shall be submitted for every item listed within the Submittals section each individual specification section. One copy shall be submitted to the engineer prior to ordering equipment. Refer to Basis of approval paragraph.
- B. Responsibility: It is the Contractors responsibility to provide material in accordance with the plans and specifications. Material not provided in accordance with the plans and specifications shall be removed and replaced at the Contractors expense.
- C. Official Record: The shop drawing submittal shall become the official record of the materials to be installed. If materials are installed which do not correspond to the record submittal they shall be removed from the project without any additional cost or delays in construction completion.
- D. Information: The shop drawing record submittal shall include the following information to the extent applicable to the particular item;
 - 1. Manufacturer's name and product designation or catalog number.
 - 2. Standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEMA, NFPA, OSHA, UL, or other organizations, including the type, size, or other designation.
 - 3. Dimensioned plan, sections, and elevations showing means for mounting, Raceway connections, and grounding, and showing layout of components.
 - 4. Materials and finish specifications, including paints.
 - 5. List of components including manufacturer's names and catalog numbers.
 - 6. Internal wiring diagram indicating connections to components and the terminals for external connections.
 - 7. Manufacturer's instructions and recommendations for installation, operation, and maintenance.
 - 8. Manufacturer's recommended list of spare parts.
- E. Preparation: Prior to submittal, shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned to Contractor unreviewed.
- F. Basis of Review: Approval is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Contractor is responsible for quantities, dimensions, fabrication processes, and construction techniques.

- G. Responsibility: The responsibility that dimensions are confirmed and correlated with proper coordination of other trades shall be included as part of the Contract Documents. The responsibility and the necessity of providing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings shall be included as part of the Contract Documents. The Contractor is responsible for any delays in job progress occurring directly or indirectly from late submissions or re-submissions of shop drawings, product data, or samples.
- H. Ordering Equipment: No material shall be ordered or shop work started until the Engineer's has officially received the shop drawings record submittal and has formally released the Contractor for submittal requirements.
- I. Brochure Requirements: Submit Technical Information Brochures at the start of construction or no later than 30 days after Award of the Contract. Each brochure shall consist of an adequately sized, hardcover, 3-ring binder for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on end of brochure. When one binder is not enough to adequately catalog all data, an additional binder shall be submitted.
- J. Brochure Contents: First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be a list of Project Addresses for this project. Third sheet shall list Project Information. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Electrical Schedule. Technical Information consisting of marked catalog sheets or shop drawings shall be inserted in the brochure in proper order on all items specified and shown on drawings. At the end of the brochure, provide and insert a copy of the specifications for this Division and all addenda applicable to this Division.
- K. Contractor's Review: Review the brochures before submitting to the Engineer. No request for payment shall be considered until the brochure has been reviewed, stamped and submitted for review.
- L. Cost: Submit cost breakdown on work in the Technical Information Brochures. The cost of material and labor for each item shall be indicated. The cost of fittings and incidentals are not required.
- M. Title Drawings: Title drawings to include identification of project and names of Engineer, Contractors, and/or supplier, data, number sequentially and indicate in general;
 - 1. Fabrication and Erection dimensions.
 - 2. Arrangements and sectional views.
 - 3. Necessary details, including complete information for making connections with other work.
 - 4. Kinds of materials and finishes.
 - 5. Descriptive names of equipment.
 - 6. Modifications and options to standard equipment required by the contract.

7. Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's stamp imprint).
 8. In order to facilitate review of shop drawings, they shall be noted, indicating by cross-reference the contract drawings, notes, and specification paragraph numbers where items occur in the contract documents.
 9. See specific sections of specifications for further requirements.
- N. Technical Data: Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate optional equipment and changes from the standard item as called for in the specifications. Provide drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
- O. Same Manufacturer: In general, relays, contactors, starters, motor control centers, switchboards, panelboards, dry type transformers, disconnect switches, circuit breakers, manual motor starter switches, etc., shall be supplied and manufactured by the same manufacturer. This requirement shall apply to same type of electrical components specified in other Divisions.

2.03 EQUIPMENT, MATERIALS, AND SUPPORTS

- A. General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacture of the type and size of equipment, shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, and application, and shall bear the UL label.
- B. Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer, however, the methods shall not be less stringent than specified herein.
- C. Required Accessories: Provide all devices and materials, such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means, required to fasten enclosures, raceways, and other electrical equipment and materials to be mounted on structures which are existing or new.
- D. Protection: Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by the elements. Equipment shall be stored in dry permanent shelters. If apparatus has been damaged, such damage shall be repaired at no additional cost or time extension to the Contract. If apparatus has been subject to possible injury, it shall be thoroughly cleaned, dried out and put through tests as directed by the Manufacturer and Engineer, or shall be replaced, if directed by the Engineer, at no additional cost to the Contract.

2.04 IDENTIFICATION OF EQUIPMENT

- A. General: Electrical items shall be identified as specified in the Contract Documents. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the item's function and the equipment or system, which it serves or controls. Refer to Identification Section of the specifications for additional information.

2.05 SURFACE MOUNTED EQUIPMENT

- A. General: Surface mounted fixtures, outlets, cabinets, panels, etc. shall have a factory-applied finish or shall be painted as accepted by Engineer. Raceways and fittings, where allowed to be installed surface mounted, shall be painted to match the finish on which it was installed. Paint shall be in accordance with other applicable sections of these specifications.

2.06 CUTTING AND PATCHING

- A. Core Drilling: The Contractor shall be responsible for core drilling as required for work under this section, but in no case shall the Contractor cut into or weld onto any structural element of the project without the written approval of the Engineer.
- B. Cutting and Patching: Cutting, rough patching and finish patching shall be provided as specified in the contract documents. Cutting and patching shall be performed in a neat and workmanlike manner. Upon completion, the patched area shall match adjacent surfaces.
- C. Openings and Sleeves: Locate openings required for work performed under this section. Provide sleeves, guards or other accepted methods to allow passage of items installed under this section.
- D. Roof Penetration: Provide roofer with pitch pans, fittings, etc., required for electrical items which penetrate the roof. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force. Roof penetrations shall be coordinated with other Trades to ensure that roof warranty is not invalidated.

2.07 SLEEVES AND FORMS FOR OPENINGS

- A. Sleeves: Provide sleeves for Raceways penetrating floors, walls, partitions, etc. Locate necessary slots for electrical work and form before concrete is poured. Watertight sleeves shall be line seal type WS. Fire rated partition sleeves shall be mild steel. Size shall be one standard diameter larger than pipe being installed or of a larger diameter to below 1/4" minimum clearance.
- B. Forms: Provide boxed out forms for Raceway penetrations only where allowed by the Engineer. Fill opening after Raceway installation, with equivalent material.

2.08 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. General: Thoroughly instruct the Cities Representative, to the complete satisfaction of the Engineer, in the proper operation of all systems and equipment provided. The Contractor shall make all arrangements, via the Engineer, as to whom the instructions are to be given in the operation of the systems and the period of time in which they are to be given. The Engineer shall be completely satisfied that the Cities Representative has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Engineer determines that complete and thorough instructions have not been given by the Contractor to the Cities Representative, then the Contractor shall be directed by the Engineer to provide whatever instructions are necessary until the intent of this paragraph of the Specification has been complied with.
- B. Submittals: Submit to the Engineer for approval nine (9) typed sets, bound neatly in loose-leaf binders, of instructions for the installation, operation, care and maintenance of equipment and systems, including instructions for the ordering and stocking of spare parts for equipment installed under this contract. The lists shall include part number and suggested suppliers. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.
- C. Information Requirements: Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub index for each section shall also be provided.
- D. Instructions: The instructions shall contain information deemed necessary by the Engineer and include but not limited to the following:
1. Introduction:
 - a. Explanation of Manual and its use.
 - b. Summary description of the Electrical Systems.
 - c. Purpose of systems.
 2. System:
 - a. Detailed description of all systems.
 - b. Illustrations, schematics, block diagrams, catalog cuts and other exhibits.
 3. Operations:
 - a. Complete detailed, step by step, sequential description of all phases of operation for all portions of the systems, including start up, shutdown and balancing. Include posted instruction charts.
 4. Maintenance:
 - a. Parts list and part numbers.
 - b. Maintenance and replacement charts and the Manufacturer's recommendations for preventive maintenance.
 - c. Trouble shooting charts for systems and components.
 - d. Instructions for testing each type of part.
 - e. Recommended list of on-hand spare parts.

- f. Complete calibration instructions for all parts and entire systems.
 - g. General and miscellaneous maintenance notes.
5. Manufacturer's Literature:
- a. Complete listing for all parts.
 - b. Names, addresses and telephone numbers.
 - c. Care and operation.
 - d. All pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
 - e. Internal wiring diagrams and Engineering data sheets for all items and/or equipment furnished under each Contract.
 - f. Guarantee and warranty data.

2.09 TEMPORARY SERVICE

- A. Other Connections: Contractors of other trades shall furnish their own cords and sockets, as may be required for their work and shall also pay for cost of temporary wiring of construction offices and shanties used by them.
- B. Wiring: Temporary electrical work shall be furnished and installed in conformity with the National Electrical Code and in accordance with the requirements of the local ordinances and shall be maintained in a workmanlike manner throughout their entire construction period and shall be removed after installation of the permanent electrical systems. Extension cords shall be GFCI protected or shall be fed from GFCI circuit breakers.

PART 3 - EXECUTION

2.01 WORKMANSHIP

- A. General: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.
- B. Acceptable Workmanship: Acceptable workmanship is characterized by first-quality appearance and function, conforming to applicable standards of building system construction, and exhibiting a high degree of quality and proficiency which is judged by the Engineer as equivalent as or better than that ordinarily produced by qualified industry tradesmen.

- C. Performance: Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Engineer, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship and not acceptable to the Engineer, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

2.02 PROTECTION AND CLEAN UP

- A. Protection and Restoration: Suitably protect equipment provided under this Division during construction. Restore damaged surfaces and items to "like new" condition before a request for substantial completion inspection.
- B. Handling: Materials shall be properly protected and Raceway openings shall be temporarily closed by the Contractor to prevent obstruction and damage. Post notice prohibiting the use of systems provided under this Contract, prior to completion of work and acceptance of systems by the Cities representative. The Contractor shall take precautions to protect his materials from damage and theft.
- C. Safeguards: The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or systems provided under this contract.
- D. Cleanup: Keep the job site free from debris and rubbish. Remove debris and rubbish from the site and leave premises in clean condition on a daily basis.

2.03 SYSTEMS GUARANTEE

- A. General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the City for any defective workmanship or material, which has been provided under this Contract at no cost to the City for a period of one year from the date of substantial completion of the System. The guarantee shall include lamps, for ninety days after date of Substantial Completion of the System. Explain the provisions of guarantee to the City at the "Demonstration of Completed System".

2.04 FINAL OBSERVATION

- A. General: Work shall be completed, and forms and other information shall be submitted for acceptance one week prior to the request for final observation of the installation.

2.05 SPECIAL CONSIDERATIONS

- A. Comply with special requirements imposed at site by City. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

END OF SECTION 16010

CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

Note to Contractor: Do not submit this form at the time Technical Information Brochure is submitted. Submit five copies of information listed below for checking at least one week before scheduled completion of the building. After information has been accepted and inserted in each brochure, give the City a Demonstration of the Completed Electrical Systems and have the City sign five copies of this form. Provide one signed copy for each brochure. After this has been done, a written request for a final inspection of the System shall be made.

Re:

(Name of Project)

(Division Number and Name)

This memo is for the information of all concerned that the City has been given a Demonstration of the Completed Electrical Systems on the work covered under this Division. This conference consisted of the system operation, a tour on which all major items of equipment were pointed out, and the following items were given to the City;

- (a) Cities copy of Technical Information Brochure containing approved submittal sheets on all items, including the following; (To be inserted in the Technical Information Brochure after the correct tab).
- (1) Maintenance Information published by manufacturer on equipment items.
 - (2) Printed Warranties by manufacturers on equipment items.
 - (3) Performance verification information as recorded by the Contractor.
 - (4) Check-out Memo on equipment by manufacturer's representative.
 - (5) Written operating instructions on any specialized items.
 - (6) Explanation of the one-year guarantee on the system.
- (b) "As-Built" conditions as described in the record drawing specifications.
- (c) A demonstration of the System in Operation and of the maintenance procedures which shall be required.

(Name of General Contractor)

By:

(Authorized Signature, Title & Date)

(Name of SubContractor)

By:

(Authorized Signature, Title & Date)

Brochure, Instruction, Prints, Demonstration & Instruction in Operation Received:

(Name of Owner)

By:

(Authorized Signature, Title, Date)

cc: City, Engineer, Contractor, Sub Contractor and General Contractor
(List names as stated in cc: above)

SECTION 16020

TESTS AND PERFORMANCE VERIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.02 DESCRIPTION

- A. Time: Perform verification work as required to show that the System is operating correctly in accordance with contract documents and manufacturers literature. All verification shall be done after 3-day full operational period.
- B. Submission: Submit check out memos and completed testing results of all systems, cable, equipment, devices, etc., for acceptance prior to being energized or utilized.

1.03 QUALITY ASSURANCE

- A. Compliance: Testing shall comply to the following standards;
 - 1. NEMA
 - 2. ASTM
 - 3. NETA
 - 4. ANSI C2
 - 5. ICEA
 - 6. NFPA

PART 2 - TESTS

2.01 EQUIPMENT

- A. Instruments: Supply all instruments required to read and record data. Calibration date shall be submitted on test reports. All instruments shall be certified per NETA standards.
- B. Adjustments: Adjust system to operate at the required performance levels and within all tolerances as required by NETA Standards.

2.02 APPLICATIONS

- A. Panelboards and Mechanical Equipment Feeders: After feeders are in place, but before being connected to devices and equipment, test for shorts, opens, and for intentional and unintentional grounds.

- B. Ratings 600 Volts or Less: Cables 600 volts or less in size #1/0 AWG and larger shall be meggered using an industry approved "megger" with 500 internal generating voltage. Readings shall be recorded and submitted to the Engineer, for acceptance prior to energizing same. Submit 5 copies of tabulated megger test values for all cables.

2.03 MOTORS

- A. Procedure: Test run each motor, (5 HP) and larger. Tabulate and submit 5 copies of the Test Information at substantial completion for final inspection. Refer to form at the end of this Section.
- B. Provisions: With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. The condition shall be corrected when measured values deviate plus or minus 10% from the nameplate ratings.
- C. Insulation: Test the insulation resistance's of all motor windings to ground with an appropriate test instrument as recommended by the motor manufacturer, before applying line voltage to the motors. If these values are less than the manufacturer's recommended values, notify the contractor providing the motor for correction before initial start up.
- D. Power Factor: Check power factor of all motors (5 HP) and larger while driving it's intended load, and at all operating speeds.

2.04 GROUNDS

- A. Electrode Ground: The resistance of electrodes (main service, generators, transformer, etc.) shall not exceed 10 ohms and shall be measured by The Contractor before equipment is placed in operation. Testing shall be performed on all grounding electrode installations. Testing shall be 3 point method in accordance with IEEE Standard 81. Submit all ground test readings to the Engineer in tabulated format at substantial completion.

PART 3 - EXECUTION

3.01 SUBMITTALS

- A. Cable Test Report: Submit Cable Test Report in Triplicate.
- B. Check Out Memos: Complete all information on forms at the end of this specification, project information, and certificate of completed demonstration memo. Submit data for examination and acceptance prior to final inspection request.
- C. Tabulated Data: Submit data on 8-1/2 x 11 inch sheets with names of the personnel who performed the test.
- D. Final: Submit accepted memos before a request for final inspection.

3.02 QUANTITIES

- A. Quantity: Submit 5 copies of the check out memo on each major item of equipment. Insert accepted memos in each brochure with the performance verification information and submittal data.

END OF SECTION 16020

PROJECT NAME: _____

MOTOR TEST INFORMATION

Name of Checker: _____

Date Checked: _____

- (a) Name and identifying mark of motor _____
- (b) Manufacturer _____
- (c) Model Number _____
- (d) Serial Number _____
- (e) RPM _____
- (f) Frame Size _____
- (g) Code Letter _____
- (h) Horsepower _____
- (i) Nameplate Voltage and Phase _____
- (j) Nameplate Amps _____
- (k) Actual Voltage _____
- (l) Actual Amps _____
- (m) Starter Manufacturer _____
- (n) Starter Size _____
- (o) Heater Size, Catalog No. and Amp Rating _____
- (p) Manufacturer of dual-element fuse _____
- (q) Amp rating of fuse _____
- (r) Power Factor at _____ Speed
(For variable speed motors provide recording chart over operating range) _____

TABULATED DATA

VOLTAGE AND AMPERAGE READINGS

SWITCHGEAR OR PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE

TIME

PHASE A.

B.

C.

N.

FULL LOAD VOLTAGE READINGS:

DATE

TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

NO LOAD VOLTAGE READINGS

DATE

TIME

PHASE A TO N _____ A TO B

B TO N _____ A TO C

C TO N _____ B TO C

_____ ENGINEERS REPRESENTATIVE

_____ CONTRACTORS REPRESENTATIVE

NO TEXT FOR THIS PAGE

SECTION 16030

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.02 DESCRIPTION

- A. Extent: Electrical identification work as required by the Contract Documents or other specifications.
- B. Types: Electrical identification work specified in the Contract Documents include the following;
 - 1. Electrical power, control and communication conductors.
 - 2. Operational instructions and warnings.
 - 3. Danger signs.
 - 4. Conduits, boxes, etc.
 - 5. Distribution Equipment.
 - 6. Cabinets.
 - 7. Equipment/system identification signs and tags.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
- D. ANSI Compliance: Comply with applicable requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems", and ANSI Standard Z53.1 "Color Designation."
- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard No's. WC-1 and WC-2 pertaining to identification of power and control conductors.
- F. ADA Compliance: All signage shall meet ADA standards. Identification for maintenance purposes shall be as specified herein.

1.04 SUBMITTALS

- A. General: Submit shop drawings of all identification materials to be used for this project. Submit one sample of each item with the shop drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SUPPLIERS OR MANUFACTURERS

- A. General: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work include, but not limited to, the following:

1. Alarm Supply Co, Inc.
2. Direct Safety Co.
3. Ideal Industries, Inc.
4. LEM Products, Inc.
5. Markal Company
6. National Band and Tag Co.
7. Panduit Corp.
8. Seton Name Plate Co.
9. Thomas and Betts Co.
10. Carlton Industries, Inc.

2.02 LANGUAGE

- A. General: Provide all products in this section in English.

2.03 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one single type is specified for an application, selection shall be at the installer's option, however, provide a single selection for each application.
- B. Conduit System Markers: Provide manufacturer's standard pre-printed, flexible, permanent, conduit markers, extending 360 degrees around conduits. Markers shall be designed for attachment to conduit by adhesive, adhesive lap joint, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Color shall match system printing requirements.
- C. Voltage Marking: Except as otherwise indicated, provide lettering which indicates voltage of the conductor(s) in conduit. Provide 4 inch minimum length with 7/8 inch minimum lettering for 2 inch and smaller conduit. Provide 8 inch minimum length with 1-1/4 inch minimum lettering for larger than 2 inch conduit. Provide one marker for each 20' section of conduit. Color shall match system printing requirements.

- D. Plasticized Tags: Manufacturer's standard preprinted or partially preprinted accident prevention and operation tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4 x 5-5/8 inch, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.
- E. Baked Enamel Danger Signs: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gauge steel; of standard red, black and white graphics; 14 x 10 inch size except where 10 x 7 inch is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, and subsequent directive e.g. HIGH VOLTAGE, KEEP OUT; BURIED CABLE, DO NOT DIG; LIVE PARTS, DO NOT TOUCH SWITCH.
- F. Engraved Plastic Laminate Nameplates: Provide engraving phenolic plastic laminate, in sizes and thicknesses indicated, engraved with 1/16 inch thick lines with square standard pica lettering and wording as specified herein, black face and white core plies (letter color) for normal systems, kelly green and white for equipment, bright orange and white for critical, bright yellow and black for life safety, and red and white for fire alarm and where noted in the specifications. Punch for mechanical fastening, except where adhesive mounting is necessary because of substrate. Material thickness shall be 1/16 inch. Provide beveled edge in order to eliminate sharp corners. Provide self-tapping stainless steel round head screws. Provide contact type permanent adhesive where screws cannot or shall not penetrate the substrate. Adhesive nameplate shall be permanently installed. Titles shall be 1/2 inch high and all other lettering shall be 1/4 inch high.
- G. Junction Box Identification: Provide neat indelible felt tip, stenciled marking on junction box and pullbox covers indicating panel and circuit numbers contained in the box. Letter sizes shall be 1 inch high minimum. Provide non-stenciled markings inside the junction box and on the exterior edge to match the cover markings.

2.04 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by the manufacturer and as required for proper identification and operation/maintenance of the electrical system equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.
- B. Size: System identification labeling consists of providing minimum 1/2 inch high stenciled black letters for raceway systems.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. Installation: Install electrical identification products as indicated, in accordance with manufacturer's written instructions, as required by the NEC and as specified herein.
- B. Coordination: Where identification is to be applied to surfaces which require a field finish application, install identification after completion of such application.
- C. Regulations: Comply with governing regulations and requests of governing authorities for the identification of electrical work.
- D. Hazards: Identify all rooms, spaces, and equipment that house potential electrical hazards, and label with appropriate signage or indicators.

3.02 RACEWAY SYSTEM IDENTIFICATION

- A. Color Coding: All electrical conduit shall be identified by color-coding Per City Standards. Apply color-coded identification on electrical conduit in a neat and workmanlike manner. Utilize a stencil for application of paint.
- B. Identification: Identify all raceways provided or utilized as part of this project as follows;
 - 1. Apply bands 10 feet on center along the raceway system and at each side of walls or floors, and at branches from mains.
 - 2. Identify the following services:

<u>Service</u>	<u>Label</u>
a. High Voltage	277/480 Voltage
b. Low Voltage	120/208 Voltage

3.03 CABLE/CONDUCTOR IDENTIFICATION

- A. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where conductors of more than one circuit or communication (such as color coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for the project's electrical work.
- B. Color Coding: Color code all power and lighting cable. Use wire colored by integral pigmentation, making the wire 100 percent colored. Where not practicable or available (in larger conductor sizes), color code the wire by using colored plastic tape, painting the ends accessible at junction or pull boxes, or other method acceptable to the Engineer. Use the following chart as applicable;

3.04 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. General: Provide identification and warning wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems. Provide identification and warning identification if necessary for signage to help prevent misuse of electrical facilities by unauthorized personnel.
- B. Plasticized signs: Install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.
- C. Locations: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified as constituting dangers for persons in or about the project.
- D. High Voltage: Install danger signs wherever it is practicable, for persons to come into contact with electrical power of voltages 208 volts to ground or higher.
- E. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.
- F. Electrical Equipment Rooms: Provide warning signage at the entrance to each such room; identify the hazard, and direct non-qualified personnel to stay away.
- G. Equipment Identification:
 - 1. Nameplates: Install an engraved phenolic plastic laminate nameplate on each unit of electrical equipment in the building, including central or master unit of each electrical system unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text. Provide text matching terminology and numbering of the contract documents and shop drawings.
 - 2. Locations: Provide nameplates for each unit of the following categories of electrical work:
 - a. Electrical cabinets and enclosures.
 - (1) Provide a nameplate outside above the door (if equipped with one) listing its designation, voltage, source and circuit number.
 - b. Access panel/doors to electrical facilities.
 - c. Motor starters.
 - d. Disconnect switches.
 - e. Enclosed circuit breakers.

3. Viewing: Install nameplates at locations indicated and where not otherwise indicated at a location for the best convenience of viewing without interference with operation and maintenance of equipment.
 - a. Secure to substrate with rigid fasteners. Utilize adhesive where fasteners cannot penetrate substrate.
 - b. Names: The names or wording used for a particular machine shall be the same as existing.

END OF SECTION 16030

SECTION 16110

RACEWAY AND CONDUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION

- A. General: Provide all supports, hangers and inserts required to mount conduit, pullboxes and other equipment provided under this Division.
- B. Support: All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels. Do not install any devices supported by ceiling tiles.
- C. Installation: The Contractor shall lay out and provide his work in advance of the laying of floors or walls, and shall provide all sleeves that may be required for openings through floors, walls, etc. Where plans call for conduit to be run exposed, provide all inserts and clamps for the supporting of conduit.
- D. Systems: Provide conduit system of empty raceways including terminal cabinets, backboards and outlets as described and specified herein.

1.03 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Aluminum Conduit: Aluminum conduit shall be used with aluminum fittings only, when specified.
- C. Compliance: Materials shall comply with the latest edition of Raceway standards.

1.04 SUBMITTALS

- A. Products: Submit manufacturer's product data, including technical information on each type of raceway system;
 - 1. Conduit - Metal
 - 2. Conduit fittings
 - 3. Plastic (PVC) solvent
 - 4. Black mastic coating for conduit
 - 5. Insulating and grounding bushings for conduit
 - 6. Galvanizing and protective coatings for conduit
- B. Compliance: Product data shall show compliance with this section of the specifications, including U.L. label, manufacturer and manufacturer's written installation instructions.

1.05 CONDUIT

- A. General: Provide a complete and continuous system of raceways to maintain a protected path for wires and cables to distribute electric power, and low voltage systems throughout the project, utilizing U.L. listed and labeled materials.
- B. Accessories: Provide conduit accessories of types, sizes, and materials, as specified herein complying with manufacturers published product information, which match and mate conduit and tubing.
- C. Interior Minimum Size: Minimum conduit size for light and power systems shall be 3/4 inch conduit for all circuitry homeruns from source to outlet box at first power consuming devices.
- D. System Conduit: Provide end bushings on all conduits.
- E. Pull Strings: Provide pull strings in all empty raceways. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1 inch shall a tensile strength not less than 200 lbs.
- F. Conduit Bends: The use of NEC Table 346.10 Exception is not allowed.

1.06 LOCATIONS

- A. Materials Above Grade: The following conduit types are to be installed above grade where specifically noted herein;
 - 1. Aluminum Rigid Conduit
 - 2. Aluminum Flex Conduit. Flexible conduit shall be liquidtight non-metallic.

PART 2 - PRODUCTS

2.01 BUSHINGS

- A. Bushings: Bushings shall be provided on all terminations, mounted on the ends of all connectors 1-1/4 inches and larger and within all equipment.
- B. Construction: Bushings shall have a flared bottom and ribbed sides, with smooth insides to prevent damage to cable insulation.
- C. Insulating Ring: Mold a phenolic insulating ring into sizes 1-1/4 inches and larger.
- D. Grounding: Provide a screw type grounding terminal on all sizes.

2.02 ALUMINUM RIGID CONDUIT

- A. Conduit: Conduit ends shall have precision cut hi-torque threads. One end of the conduit shall have a coupling and the other shall be covered with a color-coded plastic thread protector. Conduit shall be manufactured in 10 foot lengths.
- B. Fittings: Fittings shall be cut groove steel. Cast fittings are not acceptable.
- C. Paint: Conduits shall be painted to match existing.

2.03 FLEXIBLE ALUMINUM CONDUIT

- A. Conduit and Standards: A continuous length, spirally wound strip each convolution interlocked with following convolution into a helix form.
- B. Fittings: Provide conduit fittings for use with flexible Aluminum conduit of the threadless hinged clamp type, and a male threaded end provided with a locknut.
 - 1. Straight terminal connectors shall be one piece body, female end with clamp and deep slotted machine screw for securing conduit.
 - 2. 45 and 90 degree terminal angle connectors shall be 2 piece body, with removable upper section, female end with clamp and deep slotted machine screw for securing conduit.
- C. Flexible conduit shall be liquidtight non-metallic

2.04 HEAVY WALL PVC CONDUIT (SCHEDULE 40)

- A. Conduit: Schedule 40, 90 degrees C. UL rated, PVC conduit shall be composed of High Impact PVC (polyvinyl chloride C-2000 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 PSI, at 70 degrees F., flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have five years extruding PVC experience.

2.05 SUPPORTING DEVICES

- A. Hangers: A stainless steel channel erector system shall be used to mount conduits, boxes, etc. All threaded rods shall be stainless steel.
- B. Materials: Insert anchors shall be installed on concrete or brick construction, with hex head machine screws. Recessed head screws shall be used in wood construction. An electric or hand drill shall be used for drilling holes for all inserts in concrete or similar construction. Installed inserts, brick, shall be near center of brick, not near edge or in joint. Drilled and tapped, and round head machine screws shall be used where steel members occur. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Gunpowder set anchors are not permitted. All mounting hardware shall be 316 stainless steel.
- C. PVC Coated Conduit: Supporting devices for PVC coated conduit shall be as manufactured by the PVC coated conduit manufacturer and shall match in color and appearance.

PART 3 - EXECUTION

3.01 CONDUITS

- A. Provide as a minimum 3/4 inch conduit from each of the following device locations to cable tray or corridor ceiling cavity when cable tray is not available. Provide insulated bushings at ends of all conduits.
 - 1. Telephone
 - 2. Data
 - 3.
 - 4.
- B. All fire alarm wiring shall be run in conduit.
- C.
- D. Provide plenum-rated cable for all systems conductors.

3.02 IDENTIFICATION OF BOXES

- A. Tags: During installation of pull strings all pull strings shall be marked with vinyl tags indicating where the opposite end may be found.

3.03 BLANK PLATES

- A. Plates: Unless otherwise noted all outlet boxes shall receive blank plates matching the finish of plates on electrical devices in the same room.

3.04 RACEWAY INSTALLATION

- A. Support: All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. Hanger Installation: Where 2 or more conduits 1 inch or larger run parallel trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- C. Sealant: Provide a closed cell silicone foam sealant rated to provide a rating equal to the wall, ceiling, or floor assembly rating. Provide seals for the exterior of conduit penetrations consisting of a cast-in-place sleeve with a compressible rubber gasket between the conduit and the sleeve. Provide seals for the interior of the conduit penetrations consisting of gland type sealing bushing or closed cell silicone foam. Provide duct seal inside an appropriate seal-off fitting to seal the interior of the conduit system from water seepage or hazardous gases.

- D. Routing: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- E. Location: All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Surface mounted devices and equipment shall be specifically noted on the contract drawings. It is the intent that all raceways shall be run concealed unless specifically noted.
- F. Protection: All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is complete.
- G. Coordination: All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- H. Masonry Installation: All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- I. Arrangement: All raceways shall be run connecting outlet to circuits generally as shown on the drawings. Provide circuit connection arrangement shown. Actual final arrangement shall be in accordance with the record drawings section as specified herein.
- J. Grounding: All branch circuit and feeder raceways shall have a copper system ground conductor within the conduit throughout the entire length of the circuit. All conduits shall be electrically continuous to establish redundant grounding.
 - 1. Branch circuit raceways shall have an insulated equipment grounding conductor installed within the conduit raceway system.
 - 2. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not shown on drawings.
 - 3. Grounding conductors run with feeders may be bare.
- K. Empty Raceways: Raceways which do not have conductors provided under this Division of the specifications shall be left with an acceptable nylon pullcord in raceway.
- L. Manufacturer: Rigid Metallic Conduit, Electrical Metallic Tubing, Flexible Conduit, Liquid-Tight Flexible Conduit, and PVC Conduit shall be manufactured within the United States, and each shall be as manufactured by one manufacturer.

- M. Firewall Installation: Provide pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300 where required.
- N. Dissimilar Metals: Avoid the use of dissimilar metals to reduce the possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
- O. Sealoff Fittings: Provide conduit sealoffs wherever the raceway system enters a hazardous or wet area or areas of drastic temperature change such as coolers, freezers, etc. as required.
- P. Identification: Provide appropriate identification as required by codes and as indicated on the drawings and in accordance with the methods specified herein.
- Q. Conduit: Conduits shall be anchored down to prevent floating while pouring in concrete.
- R. Where aluminum surfaces such as boxes, conduits, boxes, or structural supports come in contact with incompatible metals, lime, mortar, concrete, or other masonry materials, the contact areas shall be given one field coat of Koppers Metal Passivator No. 40 and one coat of Koppers Bitumastic Super Service Black or two coats of asphalt varnish conforming to Fed. Spec. TT-V-51.

3.05 RIGID METALLIC CONDUIT

- A. Locknuts: Rigid Aluminum box connections shall be made with double locknuts and bushings. Turn down on threads to solidly connect raceway to box or enclosure.
- B. Bushings: Grounded insulated bushings shall be used on all rigid conduits terminating in panels, wire gutters, or cabinets. Bushing shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

3.06 PVC CONDUIT

- A. Floor Penetrations Exposed: Where PVC penetrates a floor in an exposed location from underground or in slab, a black mastic coated steel conduit elbow shall be used.
- B. Location: No PVC shall be allowed anywhere except underground or in slab.
- C. Ground Conductor Installation: All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit.

- D. Joints: PVC joints shall be solvent welded. Threads shall not be permitted on PVC conduit and fittings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations.
- E. Restrict Support: PVC conduit shall not be used to support fixture or equipment.
- F. Bends: Field bends shall be made with an approved hotbox. Heating with flame and hand held dryers are prohibited.

3.07 FLEXIBLE CONNECTIONS

- A. Vibrating Equipment Connection: All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12 inches of flexible liquid-tight conduit, using special type of connectors with strain relief fittings at both terminations of conduit, Kellems Type 074-09 Series or accepted substitution.
- B. Normal Type: Flex connectors shall have insulated throat
- C. Angle Type: Use angle connectors wherever necessary to relieve angle strain on flex conduit.

END OF SECTION 16110

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.02 WIRES AND CABLES

- A. Description: Provide a complete and continuous system of conductors as specified herein. All conductors shall be in accordance with the latest edition of the NEC.

1.03 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of wire systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Compliance: Materials shall comply with the following standards as they apply to the different wire types specified herein.

1. UL:

- a. 44 - Rubber insulated wire and cables.
- b. 83 - Thermoplastic insulated wires.
- c. 486-A-80 - Wire connectors and soldering lugs for use with copper.
- d. 486B - Splicing wire connectors
- e. 493 - Thermoplastic insulated underground feeder and branch circuit cables.

2. NFPA:

- a. 70 NEC

1.04 SUBMITTALS

- A. General: Submit product data on all different types of conductors specified.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Conductors: Branch circuit and feeder conductors for electric power shall be stranded copper type. Utilize THHN/THWN insulation for branch circuits and THWN/XHHW insulation for feeders, unless specifically noted otherwise. No aluminum wiring shall be permitted. All wire shall be sized as shown on the drawings. If no size is shown, wire shall be #12 AWG, except that branch "homeruns" over 50 ft. in length shall be #10 AWG for 120/208V circuits. Wire in vicinity of heat-producing equipment shall be type XHHW insulation. All wiring shall be manufactured in the USA and of 98 percent resistivity.
- B. Taps and Splices: All copper taps and splices in #8 AWG or smaller wire shall be fastened together by means of "wirenut" connectors (Ideal or accepted substitution). All taps and splices in wire larger than #8 AWG shall be made with compression type connectors and taped to provide insulation equal to wire. All taps and splices in manholes or in ground pull box shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CTE or WCS) with type "S" sealant coating. Provide sleeve kits as per manufacturer's installation instructions.
- C. Color Coding, General: All power feeders, grounding conductors and branch circuits #6 AWG and smaller shall be installed with color-coded wire with the same color used for a system throughout the building. Conductors above #6 AWG shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape in all junction boxes and panels in accordance with NEC 310-12. Tape shall cover the conductor insulation within the box or panel in such a manner so as to allow standard markings to be readily observed.
- D. Colors: Unless otherwise accepted, color-code shall be as indicated in the Identification section of the specifications. All switchlegs, other voltage system wiring, control and interlock wiring shall be color-coded other than those listed in the Identification Section of these specifications.
- E. Submittals: Submit cut sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs or connectors and cable sleeves.

2.02 MANUFACTURERS

- A. General: Branch circuit and feeder conductors shall be manufactured by one of the following: General Cable Co., Anaconda, Pirelli, Rome Cable Corporation, or American Insulated Wire Corporation.

PART 3 - EXECUTION

3.01 EXECUTION

- A. General: All wiring shall be installed in conduit (power, low voltage and control wiring), unless otherwise indicated or specified under other Sections of this specification. All wiring shall be installed per the latest edition of the NEC.
- B. Connections: Conductors #10 and #12 AWG shall be connected with pre-insulated spring connectors incased in a steel shell and rated at not less than 105 degrees C. A minimum of 3/8 inch skirt shall cover the bare wires. The connector shall meet with UL approval for fixture and pressure work, and shall be "Scotch Lok" Type Y, R and B electrical spring connectors as manufactured by the 3M Company or approved equal.
- C. Connector Manufacturers: Lugs and wire connectors shall be one of the following: Burndy Corporation, Thomas & Betts, Co., Appleton or ILSCO.
- D. Equipment Installations: Neatly form, train and tie the cables in panelboards, cabinets, wireways, switches and equipment assemblies.

END OF SECTION 16120

NO TEXT FOR THIS PAGE

SECTION 16130

OUTLET BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

1.02 DESCRIPTION

- A. General: Outlet boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
- B. Ceiling Size: Ceiling outlet boxes shall be 4 inch octagonal or 4 inch square by 1-1/2 inches deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
- C. Wall Size: Switch, wall receptacle, telephone and other wall outlet boxes in drywall shall be 4 inch square by 1-1/2 inches deep. For exposed masonry, provide one piece 4 inch square by 1-1/2 inches deep wall boxes with appropriate 4 inches square cut tile wall covers Steel City series or accepted substitution. For furred-out block walls, provide 4 inch square box with required extension for block depth and required extension for drywall depth.
- D. Control boxes and enclosures shall be aluminum or stainless steel.

1.03 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Compliance: Materials shall comply with the following standards as they apply to the different raceway types specified herein.
 - 1. UL-50 & UL-514
 - 2. NEC 70

1.04 FLOOR OUTLETS

- A. General: Provide floor outlet boxes as shown on the plans. Installation shall be in accordance with the National Electrical Code, and shall be complete with service fittings as indicated. Equipment shall be listed by Underwriters' Laboratories, Inc.

1.05 SPECIAL PURPOSE OUTLETS

- A. Location: Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications.

1.06 SUBMITTALS

- A. Submittals: Submit product data on all different types of outlet boxes and associated trim/plaster rings.

PART 2 - PRODUCTS

2.01 GENERAL PURPOSE BOXES

- A. General: Provide standard aluminum or stainless steel one-piece outlet boxes at all concealed outlets for electric lights, switches, convenience receptacles, telephone outlets, etc. Acceptable manufacturers shall be T&B, Steel City, Raco. Surface outlet boxes and conduit bodies shall be the heavy cast aluminum Appleton, Crouse Hinds or Steel City or accepted substitution. Trim rings shall also be of one piece construction.

PART 3 - EXECUTION

3.01 INSTALLATION OF OUTLET BOXES

- A. Installation: All flush outlets shall be mounted so that covers and plates shall finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth ring or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8 inch of finish wall surface.

- B. Stud Walls: Outlet boxes mounted in metal stud walls, shall be supported to studs with 2 screws inside of outlet box to a horizontal stud brace between vertical studs.
- C. Blank Covers: All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

3.02 MOUNTING HEIGHT

- A. Mounting Height: Height of wall outlets to center or bottom of box above finished floor shall be as follows, unless specifically noted otherwise. The following dimensions are a guide only. Specific heights required by governing institutions and laws shall apply.

Switches & Dimmers	4 foot 0 inches to centerline
Receptacles	1 foot 6 inches to centerline
Branch Panelboards	6 foot 6 inches top of panel trim
Telephone & Data Outlets	1 foot 6 inches to centerline

END OF SECTION 16130

NO TEXT FOR THIS PAGE

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.02 GROUNDING ELECTRODE CONDUCTOR

- A. Grounding Electrode Conductor: A main grounding electrode conductor, bare copper, sized per NEC, shall be run in PVC conduit from main service equipment to the grounding electrodes. This conductor shall also be bonded to the following:
 - 1. Telecommunications service ground within 20' of the electrical service
 - 2. Gas and other interior metal piping – refer to NEC.

1.03 BONDING AND EQUIPMENT GROUNDING

- A. Description of System: In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated copper system grounding conductor in accordance with specific rules of Article 250 of the NEC Equipment grounding conductors through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
- B. Equipment Grounding Conductors: All raceways shall have an insulated copper system ground conductor run throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill when determining conduit sizes, even though not included or shown on drawings.
- C. Redundant Grounding: In general all branch circuits shall be provided with a redundant grounding system through the use of grounding conductors and metallic conduit.
- D. Bonding: In addition to connections to grounding electrodes, the main service ground shall be bonded to the lightning protection system and other underground metal piping.

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- E. Bushings: Provide insulated grounding bushings on all metallic feeder conduits terminated within panelboards, switchboards or enclosed overcurrent devices. Provide insulated grounding bushings on all branch circuit conduits where concentric knockouts are used.
- F. Connection to Other Systems: Provide all required grounding and bonding connections as specified herein and as required by the National Electrical Code.

1.04 SUBMITTALS

- A. General: Submit product data on ground wire and ground connectors.

1.05 QUALITY ASSURANCE

- A. Compliance: The entire ground system shall meet or exceed the minimum requirements NEC 250 and IEEE Std. 142 (green book).

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

- A. General: Except as specified in C below, provide UL and NEC approved types of copper with THWN, THHN, or XHHW with green insulation or green tape on black insulation the entire length of conductor not in conduit.
- B. Size: Grounding conductors shall be sized as specified herein and on the drawings, but in no case shall be smaller than required by NEC 250.
- C. Insulation: Conductors ground shall be insulated.
- D. All grounding conductors shall be stranded copper.

2.02 CONNECTIONS

- A. Bonding: One piece mechanical lugs or wire terminals, properly sized and approved by the local authority having jurisdiction shall be used to bond ground wires together or to junction boxes and panel cabinets.

2.03 INSPECTION WELLS

PART 3 - INSTALLATION

3.01 INTERIOR

- A. Installation: Equipment grounding conductors shall be installed as follows:
1. Where installed in metal conduit, both conductor and conduit shall be bonded at each end.
 2. Have connections accessible for inspection and made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded.
 3. Shall in NO case be a current carrying conductor.
 4. Have green insulation, except that grounding electrode conductors may be bare.
- B. Bushings: Bond all grounding bushings to the equipment ground bus of the panel or switchboard, or overcurrent device in which it is located. Bond shall be made via an insulated bonding conductor of same size as equipment ground conductor run in the circuit.

3.02 TESTING

- A. Testing: Provide testing as required in other sections of this specification, including but not limited to sections 16010 and 16020.
- B. Reports: Submit impedance test reports for all separately derived services to the Engineer prior to project completion.

3.03 CONNECTIONS

- A. Preparation: All contact surfaces shall be thoroughly cleaned before connections are made, to ensure good metal to metal contact.

END OF SECTION 16450