Invitation to Bid

NUMBER
ITB #17-ES-001

City of Edgewater

Variable Frequency Drives (VFD's) at Water Treatment Plant

Patricia Drosten

Purchasing Specialist

LEGAL NOTICE

Notice is hereby given that the City of Edgewater is accepting Sealed Bids for the construction of Variable Frequency Drives (VFD's) at Water Treatment Plant. Bids will be received until **3:00 p.m., on November 15, 2016** by the City Clerk's Office, City Hall, 104 N. Riverside Drive, Edgewater, Florida 32132.

ITB# 17-ES-001
"Variable Frequency Drives (VFD's) at Water Treatment Plant"

Services to be provided shall include, but not be limited to the following:

The City of Edgewater is seeking a qualified and licensed State of Florida Contractor to furnish all labor, equipment, materials, and services required to replace electrical gear for three (3) 200 HP high service distribution pumps, located at the water treatment plant, with three (3) VFDs in accordance with the terms, conditions, and specifications stated herein. Scope also includes re-programming existing control panel for automatic pump control to maintain system pressure.

Project location is at the City of Edgewater Alan R. Thomas Water Treatment Facility, located at 3315 State Road 442, Edgewater, FL 32132. The project shall be substantially complete in 90 days and final completion within 30 days of substantial completion or 120 days total.

☐ A pre-bid conference is not applicable for this solicitation.

A ☒ non-mandatory ☐ mandatory pre-bid conference will be held on October 27, 2016, commencing promptly at 10:00 a.m., and will be held in the conference room, Alan R. Thomas Water Treatment Facility, located at 3315 State Road 442, Edgewater, FL 32132. **Contractors are expected to be familiar with existing site conditions prior to submitting a bid.** A site visit will be conducted immediately following the pre-bid conference.

NOTE: This is a secured facility. **Proposers that are unable to attend the pre-bid conference must email the Purchasing Specialist at pdrosten@cityofedgewater.org, no later than October 27, 2016, to request a site visit.** If needed, one additional site visit time other than the pre-bid meeting will be established at the City's convenience.

One (1) original and one (1) electronic copy on a USB flash drive, of the proposal should be delivered to the City Clerk's Office, City of Edgewater, 104 North Riverside Drive, P.O. Box 100, Edgewater, Florida 32132-0100 in a sealed envelope plainly marked on the outside: **"VARIABLE FREQUENCY DRIVES (VFD'S) AT WATER TREATMENT PLANT", ITB # 17-ES-001.**

All statements shall be made upon the official bid form which may be obtained on the City's E-Procurement site: www.demandstar.com.

City of Edgewater does not discriminate based on age, race, color, sex, religion, national origin, disability or marital status.

This Public Notice has been posted on the City of Edgewater Finance website: www.cityofedgewater.org, www.demandstar.com, and also posted in the Lobby of City Hall on October 20, 2016

TABLE OF CONTENTS

1) Introduction/Overview

A) Purpose/Objective

The City of Edgewater Environmental Services Department (herein after, "City") has issued this Invitation to Bid (hereinafter, "**ITB**") with the sole purpose and intent of obtaining bids from interested and qualified firms offering to furnish all labor, equipment, materials, and services required to replace electrical gear for three (3) 200 HP high service distribution pumps, located at the water treatment plant, with three (3) VFDs in accordance with the terms, conditions, and specifications stated herein. Scope also includes re-programming existing control panel for automatic pump control to maintain system pressure.

Project location is at the City of Edgewater Alan R. Thomas Water Treatment Facility, located at 3315 State Road 442, Edgewater, FL 32132. The successful proposer will hereinafter be referred to as the "Contractor".

If awarded, a contract to provide these services will be effective on the date such contract is approved by the City of Edgewater, City Council (herein after, the "Council"), signed by all required parties and filed with the City Clerk.

As is more fully explained in Section "6L" of this **ITB**, an award, if made, will be made to the best overall proposer(s) whose bid is most advantageous to the City, taking into consideration the evaluation factors set forth in this **ITB**. The City will not use any other factors or criteria in the evaluation of the bids received.

B) Background

The City serves an area of 22.59 square miles with a population of approximately 21,958. The City's fiscal year begins on October 1st and ends on September 30th. The Finance Department maintains the funds and accounts of the City. The Finance Department is responsible for the custody and accounting of funds of each department.

More detailed information on the government and its finances can be found in City of Edgewater's Comprehensive Annual Financial Report for fiscal year 2015 and in the City's Annual Budget for fiscal year 2017. Copies of these documents may be viewed on www.cityofedgewater.org. The City of Edgewater is exempt from any and all state, local and federal taxes.

The City owns a water treatment facility that supplies 1.8 mgd for 10,500 metered customers. The wastewater treatment facility treats 1.6 mgd for 9,800 wastewater customers. In addition, the City supplies 0.20 mgd of water on a wholesale basis to Volusia County in Southeast Service Area.

The City owns its own water treatment facility and wastewater treatment plants which are all operated under a utility enterprise fund. It maintains water transmission mains, storage tanks, and water distribution systems. In addition, it owns and maintains the sanitary sewer collection system, and various wastewater pump stations. The City's last rate study conducted and implemented was in 2016 for water, sewer refuse and stormwater. The current City rates and fees may be found on the City website www.cityofedgewater.org.

C) Inquiries

Direct questions related to this **ITB** to Pat Drosten, Purchasing Specialist, and submit such questions in writing to pdrosten@cityofedgewater.org. Please include the page and paragraph number for each question in order to ensure that questions asked are responded to correctly.

Proposers must clearly understand that the only official answer or position of the City will be the one stated in writing from pdrosten@cityofedgewater.org. All questions asked, along with the answers will be electronically distributed to firms registered for this solicitation and additionally posted on this site as an addendum.

D) Method of Source Selection

The City is using the Competitive Sealed Proposals methodology of source selection for this procurement, as authorized by Resolution 2016-R-33 establishing and adopting the City Purchasing Policy. Each proposal will be reviewed to determine if the proposal is responsive to the **ITB**. Proposals deemed to be non-responsive may be rejected without being evaluated by the Evaluation Committee appointed by the city manager, which shall be comprised of a minimum of three (3) City employees. The committee will make a recommendation to the City Council who will make the final selection(s). **ITB's that are solely priced based will be reviewed by the Purchasing Specialist and Project Manager and will not be subject to the Evaluation Committee process.** A responsive proposal is one which has been signed and submitted by the specified Proposal deadline, and has provided the information required to be submitted with the Proposal. While poor formatting, poor documentation and/or incomplete or unclear information may not be cause to reject a proposal without evaluation, such substandard submissions may adversely impact the evaluation of a Proposal. Respondents who fail to comply with the required and/or desired elements of this **ITB** do so at their own risk.

The City may, as it deems necessary, conduct discussions with responsible proposers determined to be in contention for being selected for award for the purpose of clarification to assure full understanding of, and responsiveness to solicitation requirements.

E) Pre-Bid Conference

☐ A pre-bid conference is not applicable for this solicitation.

A ☒ non-mandatory ☐ mandatory pre-bid conference will be held on **October 27, 2016** commencing promptly at **10:00 a.m.**, and will be held in the conference room, Alan R. Thomas Water Treatment Facility, located at 3315 State Road 442, Edgewater, FL 32132. **Contractors are expected to be familiar with existing site conditions prior to submitting a bid.** A site visit will be conducted immediately following the pre-bid conference.

NOTE: This is a secured facility. **Proposers that are unable to attend the pre-bid conference must email the Purchasing Specialist at pdrosten@cityofedgewater.org, no later than 4:00 pm on October 27, 2016 to request a site visit.** If needed, one additional site visit time other than the pre-bid meeting will be established at the City's convenience.

The purpose of the pre-bid conference is to allow an open forum for discussion and questioning with City staff regarding the **ITB** with all prospective proposers having an equal opportunity to hear and

participate. Oral questions will receive oral responses, neither of which will be official, nor become part of the **ITB**. Only written responses to written questions will be considered official, and will be included as part of the **ITB** as an addendum. All prospective proposers are strongly encouraged to attend, as, unless requested by the department, this will be the only pre-bid conference for this solicitation. If this pre-bid conference is denoted at "mandatory", prospective bidders must be present in order to submit a bid response.

F) Projected Timetable

The following projected timetable should be used as a working guide for planning purposes only. The City reserves the right to adjust this timetable as required during the course of the **ITB** process.

Event	**Date**
ITB Notice	October 20, 2016
Non-Mandatory Pre Bid Meeting	October 27, 2016 10:00 am
Last Date for Receipt of Written Questions	November 1, 2016 3:00 pm
Addendum due	November 7, 2016
Bid Due/Opening Date	November 15, 2016 3:00 pm
Evaluation	November 17, 2016
Notice of Recommendation	November 17, 2016
City Council Approval	December 5, 2016

2) General Description of Specifications or Scope of Work

The City of Edgewater is seeking a qualified and licensed State of Florida Contractor to furnish all labor, equipment, materials, and services required to replace electrical gear for three (3) 200 HP high service distribution pumps, located at the water treatment plant, with three (3) VFDs in accordance with the terms, conditions, and specifications stated herein. Scope also includes re-programming existing control panel for automatic pump control to maintain system pressure.

Project location is at the City of Edgewater Alan R. Thomas Water Treatment Facility, located at 3315 State Road 442, Edgewater, FL 32132.

The project shall be substantially complete in 90 days and final completion within 30 days of substantial completion or 120 days total.

The Engineer's estimated budget for this project is $179,300.00.

Delivery and setup are to be included in the proposal. Contractor is responsible for all permits and associated fees.

A) Scope of Work

The City of Edgewater is seeking a qualified and licensed State of Florida Contractor to furnish all labor, equipment, materials, and services required to replace electrical gear for three (3) 200 HP high service distribution pumps, located at the water treatment plant, with three (3) VFDs in accordance with the

terms, conditions, and specifications stated herein. Scope also includes re-programming existing control panel for automatic pump control to maintain system pressure.

In general, the basis of design is to remove the existing 400 amp constant speed starter, the existing 400 amp VFD, the existing drive selection breakers which currently enable HSP #1 to run on VFD while HSP #2 runs on constant speed or vice-versa, and the 400 amp constant speed starter serving HSP #3. These components would be replaced with three (3) individual VFD's for each 200 hp High Service Pump.

All work shall be in accordance with the plans and technical specifications. Integration is included in this scope of work and must be the work of Precision Control Instruments, Inc. (7839 Bayberry Road, Jacksonville, FL 32256).

Two (2) High Service Pumps must remain in operation during construction, minimum one (1) on VFD. The facility is fenced and secured with staff onsite 24 hours per day. There is available area for material staging onsite. Opportunity for prospective bidders to visit the site will be limited to the non-mandatory pre-bid meeting and a potential second site visit as described elsewhere in this package.

B) SUBMITTALS

1.01 REQUIREMENTS INCLUDED

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

B. Within twenty (20) calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete materials list of preliminary data on items for which Shop Drawings are to be submitted. Included in this materials list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way be expressed or implied relief to the Contractor from submitting complete Shop Drawings and providing material, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.

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

1. Submittal-Description and Number assigned.
2. Date to Engineer
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (Approved, Approved as Noted, Not Approved/Resubmit).
5. Date of Re submittal and Return (as applicable).
6. Date material release (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Status of O&M manuals submitted.

10. Specification Section.
11. Drawings Sheet Number.

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the drawings and data shall bear Contractor's stamp and signature showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp and signature will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer. Shop drawings submittals shall not be used as a vehicle for requesting approval of substitute or alternative equipment and materials. Substitution requests will be considered only when submitted in accordance with the applicable provisions of Section 01600.

B. Determine and Verify:

1. Field measurements
2. Field construction criteria
3. Catalog numbers and similar data
4. Conformance with Specifications

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

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with approval.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking and appropriate action from the time the Engineer receives them.

F. All submittals shall be accompanied by a transmittal letter prepared in duplicate containing the following information:

1. Date
2. Project Title and Number
3. Contractor's name and address
4. The number of each Shop Drawing, Product Data, and Sample submitted
5. Notification of deviations from Contract Documents
6. Submittal Log Number conforming to Specification Section Numbers.

G. The Contractor shall submit four (4) copies of descriptive or product data submittals/drawings to the Engineer. The Engineer will review the submittals/drawings and

return to the Contractor the sets of marked-up submittals/drawings with appropriate review comments. All shop drawings, when practical, shall be 24 inch by 36 inch in size.

H. Once submittals/drawings are approved, they are to be distributed as follows:

1. Owner: One (1) copy
2. Engineer: one (1) copies
3. Contractor: Two (2) copies

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

J. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposed to supply both as pertaining to his own work and any work affected under other parts, headings, or divisions of Drawings and Specifications.

1.03. ENGINEER'S REVIEW OF SHOP DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor will cover only general conformity to the Specifications, external connections, and dimensions which affect the installation. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, quantities, and details of the material, equipment, device, or item shown.

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

1. As permitting any departure from the Contract requirements;

2. As relieving the Contractor of responsibility of any errors, including details, dimensions, and materials;

3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

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

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

E. Re submittals will be handled in the same manner as first submittals. On Re submittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to

revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

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

G. Shop drawings and submittal data shall be reviewed by the Engineer for each original submittal and first Re submittal; thereafter review time for subsequent Re submittals shall be charged to the Contractor in accordance with the terms of the Engineer's Agreement with the Owner.

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

I. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor for Re submittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:

1. Systems

2. Processes

3. As indicated in Specifications Sections. All drawings, schematics, manufacturer's product data, certifications and other shop drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface checking.

C) MEASUREMENT AND PAYMENT

1. General

a. Separate payment will be made only for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the work, shall be considered to be included in the scope of the appropriate listed work items.

b. The Contractor's attention is called to the fact that cleanup is considered a part of the work of construction. No payment will be made until cleanup is essentially complete.

c. No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work if not shown as a separate pay item.

01) Clearing and grubbing.

02) Excavation, including necessary pavement base removal.

03) Shoring and sheeting.

04) Dewatering and disposal of surplus water.

05) Structural Fill.

06) Backfill.

07) Grading.

08) Replacement of unpaved roadways, grass and shrubbery plots.

09) Cleanup.

10) Testing and placing system in operation.

11) Any material and equipment required to be installed and utilized for the test.

12) Pipe, structures, pavement replacement and/or appurtenances included within the limits of lump sum work.

13) Maintaining the existing quality of service during construction.

14) Appurtenant work as required for a complete and operable system.

15) Maintaining or detouring of traffic

d. No payment shall be made for work constructed outside the authorized limits of work.

2. Materials and Equipment

a. Electrical Improvements **Bid Item 1**

Lump sum payment shall be full compensation for all labor, equipment and materials required to install all of the upgrades in accordance with the plans and specifications, the City's electrical standards, and the National Electric Code. Payment also includes all costs associated with general conditions, sub-contractor coordination, overhead, and profit for this work as required for the general contractor. Contractor shall obtain all electrical permits for the proposed improvements, if required, prior to commencement of work. (Engineer's estimated cost $120,000)

b. Instrumentation Improvements **Bid Item 2**

Lump sum payment shall be full compensation for all labor, equipment and materials required to integrate and connect the proposed VFDs to the existing control panel in accordance with the contract plans and specifications. Payment shall also be full compensation for integration into the plant's SCADA system to allow for remote monitoring and control of the proposed VFDs. Payment also includes all costs associated with general conditions, sub-contractor coordination, overhead, and profit for this work as required for the general contractor. Contractor shall be required to demonstrate completion of the proposed systems to the owner and engineer as described by the specifications. (Engineer's estimated cost $40,000)

c. Permit Allowance **Bid Item 3**

An allowance is established to pay costs associated with building permit fees and ancillary costs associated with construction of the project. No provision for mark-up is included within this allowance. (Engineer's estimated cost $3,000)

3) City's Right to Inspect

The City or its authorized Agent shall have the right to inspect the Contractor's facilities/project site during and after each work assignment the Contractor is performing.

4) Terms and Conditions of Contract

The City has developed standard contracts/agreements. The Contractor shall be required to return a signed standard City contract/agreement contained within this **ITB** with your submittal.

A contract/agreement resulting from this **ITB** shall be subject to the terms and conditions set forth in a standard City Contract and any terms and conditions included in this **ITB**. The City reserves the right to include in any contract document such terms and conditions, as it deems necessary for the proper protection of the rights of the City. The City will not be obligated to sign any contracts, maintenance and/or service agreements or other documents provided by the Contractor with their submittal until approved by Council.

5) General Terms and Conditions

A) Licenses

The Contractor is required to possess the correct occupational license, professional license, and any other authorizations necessary to carry out and perform the work required by the project pursuant to all applicable Federal, State and Local Law, Statute, Ordinances, and rules and regulations of any kind.

If required and/or requested, copies of the required licenses must be submitted with the bid response indicating that the entity proposing, as well as the team assigned to the City account, are properly licensed to perform the activities or work included in the contract documents. A Contractor, with an office within the City is also required to have a business tax receipt and certificate of use.

If you have questions regarding required professional licenses and Business Tax Receipt and Certificate of use, contact the Finance Department, (386) 424-2400.

B) Principals/Collusion

By submission of this Bid, the undersigned, as Proposer, does declare that the only person or persons interested in this Bid as principal or principals is/are named therein and that no person other than therein mentioned has any interest in this Bid or in the contract to be entered into; that this Bid is made without connection with any person, company or parties making a Bid, and that it is in all respects fair and in good faith without collusion or fraud.

C) Taxes

The City is exempt from Federal Excise and State of Florida Sales Tax.

D) Relation of City

It is the intent of the parties hereto that the Contractor shall be legally considered an independent contractor, and that neither the Contractor nor their employees shall, under any circumstances, be considered employees or agents of the City, and that the City shall be at no time legally responsible for any negligence on the part of said Contractor, their employees or agents, resulting in either bodily or personal injury or property damage to any individual, firm, or corporation.

E) Term Contracts

If funds are not appropriated for continuance of a term contract to completion, cancellation will be accepted by this Contractor on thirty (30) days prior written notice.

F) Termination

Should the Contractor be found to have failed to perform his services in a manner satisfactory to the City, the City may terminate this Agreement immediately for cause; further the City may terminate this Agreement for convenience with a thirty (30) day written notice. The City shall be sole judge of non-performance.

G) Liability

The Contractor will not be held responsible for failure to complete contract due to causes beyond its control, including, but not limited to, work stoppage, fires, civil disobedience, riots, rebellions, Acts of Nature and similar occurrences making performance impossible or illegal.

H) Assignment

The Contractor(s) shall not assign, transfer, convey, sublet or otherwise dispose of this contract, or of any or all of its rights, Variable Frequency Drives (VFD's) at Water Treatment Plant or interest therein, or his or its power to execute such contract to any person, company or corporation without prior written consent of the City.

I) Lobbying

All firms are hereby placed on **NOTICE** that the City does not wish to be lobbied, either individually or collectively about a matter for which a firm has submitted a Bid.

Firms and their agents are not to contact members of the City Council for such purposes as meeting or introduction, luncheons, dinners, etc. During the process, **from Bid announcement to final Council approval**, no firm or their agent shall contact any other employee of the City in reference to this Bid, with the exception of the Finance Director or his designee(s). Failure to abide by this provision may serve as grounds for disqualification for award of this contract to the firm.

J) Single Bid

Each Proposer must submit, with their bid, the required signed contract/agreement and all forms included in this **ITB**. Only **one** bid from a legal entity as a primary will be considered. A legal entity that submits a bid as a primary or as part of a partnership or joint venture submitting as primary may not then act as a sub-consultant to any other firm submitting under the same **ITB**.

If a legal entity is not submitting as a primary, or, that legal entity may not act as a sub-consultant to any other firm or firms submitting under the same **ITB** nor act as part of a partnership or joint venture to the primary. All submittals in violation of this requirement will be deemed non-responsive and rejected from further consideration.

K) Protest Procedures

Any appeal or protest to the Request for Bid shall be governed by the City of Edgewater's Purchasing Policies and Procedures.

L) Public Entity Crime

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, bid, or reply on a contract to provide any goods or services to a public entity; may not submit a bid, bid, or reply on a contract with a public entity for the construction or repair of a public building or public work; may not submit bids, bids, or replies 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 for a period of 36 months following the date of being placed on the convicted vendor list.

M) Conflict of Interest

Proposer shall complete the Conflict of Interest Affidavit included as an attachment to this **ITB** document.

Disclosure of any potential or actual conflict of interest is subject to City staff review and does not in and of itself disqualify a firm from consideration.

These disclosures are intended to identify and or preclude conflict of interest situations during contract selection and execution.

N) Prohibition of Gifts to City Employees

No organization or individual shall offer or give, either directly or indirectly, any favor, gift, loan, fee, service or other item of value to any City employee, as set forth in Chapter 112, Part III, Florida Statutes, the current City Ethics Ordinance, and City Administrative Policy. Violation of this provision may result in one or more of the following consequences: a. Prohibition by the individual, firm, and/or any employee of the firm from contact with City staff for a specified period of time; b. Prohibition by the individual and/or firm from doing business with the City for a specified period of time, including but not limited to: submitting bids, **ITB**, and/or quotes; and, c. immediate termination of any contract held by the individual and/or firm for cause.

O) Immigration Reform and Control Act

Proposer acknowledges, and without exception or stipulation, any firm(s) receiving an award shall be fully responsible for complying with the provisions of the Immigration Reform and Control Act of 1986 as located at 8 U.S.C. 1324, et seq. and regulations relating thereto, as either may be amended. Failure by the awarded firm(s) to comply with the laws referenced herein shall constitute a breach of the award agreement and the City shall have the discretion to unilaterally terminate said agreement immediately.

6) Instructions for Bid

A) Compliance with the ITB

Bids must be in strict compliance with this **ITB**. Failure to comply with all provisions of the **ITB** may result in disqualification.

B) Acknowledgment of Insurance Requirements

By signing the Insurance Requirements included in this **ITB**, Proposer acknowledges these conditions include Insurance Requirements.

It should be noted by the Proposer that, in order to meet the City's requirements, there may be additional insurance costs to the Proposer's firm. It is, therefore, imperative that the proposer discuss these requirements with the Proposer's insurance agent, as noted on the Insurance Check List, so that allowances for any additional costs can be made by the Proposer.
The Proposer's obligation under this provision shall not be limited in any way by the agreed upon contract price, or the Proposer's limit of, or lack of, sufficient insurance protection.

Proposer also understands that the evidence of required insurance may be required within five (5) business days following notification of its offer being accepted; otherwise, the City may rescind its acceptance of the Proposer's bid.

The specific insurance requirements for this solicitation are included as part of this solicitation.

C) Acknowledgment of Bonding Requirements

By signing its bid, and if applicable, Proposer acknowledges that it has read and understands the bonding requirements for this bid. Requirements for this solicitation are checked.

☐ Not Applicable

☒ Bid Bond: Shall be submitted with bid response in the form of certified funds, cashiers' check, or an irrevocable letter of credit, a cash bond posted with the City Clerk, or bid bond in a sum equal to 5% of the cost bid. All checks shall be made payable to the City of Edgewater on a bank or trust company located in the State of Florida and insured by the Federal Deposit Insurance Corporation.

The Bid Bond shall be retained by the City as liquidated damages if the successful Proposer fails to execute and deliver to the City the unaltered contract, or fails to deliver any required Performance and Payment Bonds or Certificates of Insurance, all within twenty-one (21) calendar days after receipt of the Notice of Selection for Award. Bid Bonds shall be executed by a corporate surety licensed under the laws of the State of Florida to execute such bonds, with conditions that the surety will, upon demand, forthwith make payment to the City upon said bond. The Bid Bonds of the three (3) highest ranked

Proposers shall be held until the contract has been executed by the successful Proposer and same has been delivered to the City together with the required bonds and insurance, after which all three (3) Bid Bonds shall be released to the respective Bidders. All other Bid Bonds shall be released within fourteen (14) calendar days of the Selection Committee meeting date. No bids including alternates shall be withdrawn within one hundred and eighty (180) days after the bid closing date thereof. If a bid is not accepted within said time period it shall be deemed rejected and the Bid Bond shall be released to the Proposer. In the event that the City awards the contract prior to the expiration of the one hundred and eighty (180) day period without selecting any or all alternates, the City shall retain the right to subsequently award to the successful Proposer said alternates at a later time and approved by the Finance Director or designee, and the successful Proposer.

☐ Performance and Payment Bonds: For projects in excess of $200,000, bonds shall be submitted with the executed contract by Proposers receiving award, and written for 100% of the Contract award amount, the cost borne by the Proposer receiving an award. The Performance and Payment Bonds shall be underwritten by a surety authorized to do business in the State of Florida and otherwise acceptable to Owner; provided, however, the surety shall be rated as "A-" or better as to general policy holders rating and Class V or higher rating as to financial size category and the amount required shall not exceed 5% of the reported policy holders surplus, all as reported in the most current Best Key Rating Guide, published by A.M. Best Company, Inc. of 75 Fulton Street, New York, New York 10038.

Should the contract amount be less than $500,000, the requirements of Section 287.0935, F.S. shall govern the rating and classification of the surety.

All performance security under the subsequent contract shall be in force throughout the final completion and acceptance of the project awarded.

If the surety for any bond furnished by Contractor is declared bankrupt, becomes insolvent, its right to do business is terminated in the State of Florida, or it ceases to meet the requirements imposed by the Contract Documents, the Contractor shall, within five (5) calendar days thereafter, substitute another bond and surety, both of which shall be subject to the Owner's approval.

D) Delivery of Bids

All bids are to be delivered before 3:00 p.m., local time, on or before November 15, 2016 to:

City of Edgewater
City Clerk
104 N. Riverside Drive
Edgewater, Florida 32132

The City shall not bear the responsibility for bids delivered to the City Clerk past the stated date and/or time indicated, or to an incorrect address by proposer's personnel or by the proposer's outside carrier. However, the City Clerk, or designee, shall reserve the right to accept bids received after the posted close time only under the following condition:

The tardy submission of the bid is due to the following circumstances, which shall include but not be limited to: late delivery by commercial carrier such as Fed Ex, UPS or courier where delivery was scheduled before the deadline.

Proposers must submit two (2) total copies of the proposal, one (1) original and one (1) electronic copy in PDF format, on a USB flash drive.

List the Bid Number on the outside of the box or envelope and note "Invitation to Bid enclosed."

E) Evaluation of Bids (Procedure)

The City's procedure for selecting is as follows:

1. Invitation to Bid issued.

2. Subsequent to the closing of bids, the Department and the Purchasing Specialist shall review the bids received and verify whether each bid appears to be minimally responsive to the requirements of the published **ITB**

3. Vendor selection will be based on the lowest, compliant, qualified bid unless specified otherwise in the Invitation to Bid.

4. The City reserves the right to withdraw this ITB at any time and for any reason, and to issue such clarifications, modifications, and/or amendments as it may deem appropriate.
5. Receipt of a bid by the City or a submission of a bid to the City offers no rights upon the Proposer nor obligates the City in any manner.

6. Acceptance of the bid does not guarantee issuance of any other governmental approvals.

The City reserves the right to withdraw this **ITB** at any time and for any reason, and to issue such clarifications, modifications, and/or amendments as it may deem appropriate.

Receipt of a proposal by the City or a submission of a proposal to the City offers no rights upon the Proposer nor obligates the City in any manner.

Acceptance of the proposal does not guarantee issuance of any other governmental approvals.

F) Ambiguity, Conflict, or Other Errors in the ITB

If a Proposer discovers any ambiguity, conflict, discrepancy, omission, or other error in the **ITB**, Proposer shall immediately notify the Purchasing Specialist, noted herein, of such error in writing and request modification or clarification of the document. The Purchasing Specialist will make modifications by issuing a written revision and will give written notice to all parties who have received this **ITB** from the Finance Department.

The Proposer is responsible for clarifying any ambiguity, conflict, discrepancy, omission, or other error in the **ITB** prior to submitting the bid otherwise determination of the governing provision will be at the discretion of the City at no impact to the terms of the bid.

G) Bid, Presentation, and Protest Costs

The City will not be liable in any way for any costs incurred by any proposer in the preparation of its proposal in response to this **ITB**, nor for the presentation of its proposal and/or participation in any discussions, negotiations, or, if applicable, any protest procedures.

H) Acceptance or Rejection of Bids

The right is reserved by the City to waive any irregularities in any proposal, to reject any or all proposals, to re-solicit for proposals, if desired, and upon recommendation and justification by the City to accept the proposal which in the judgment of the City is deemed the most advantageous for the public and the City.

Any proposal which is incomplete, conditional, obscure or which contains irregularities of any kind, may be cause for rejection. In the event of default of the successful proposer, or their refusal to enter into the City contract, the City reserves the right to accept the proposal of any other proposer or to re-advertise using the same or revised documentation, at its sole discretion.

I) Requests for Clarification of Proposals

Requests by the Purchasing Specialist to a proposer(s) for clarification of bid(s) shall be in writing. Proposer's failure to respond to request for clarification may deem proposer to be non-responsive, and may be just cause to reject its proposal.

J) Validity of Proposals

No bid can be withdrawn after it is filed unless the Proposer makes their request in writing to the City prior to the time set for the closing of Proposals.

All bids shall be valid for a period of one hundred eighty (180) days from the submission date to accommodate evaluation and selection process.

K) Response Format

The bid shall be deemed an offer to provide services to the City. In submitting a bid, the Proposer declares that he/she understands and agrees to abide by all specifications, provisions, terms and conditions of same, and all ordinances and policies of the City. The Proposer agrees that if the contract is awarded to him/her, he/she will perform the work in accordance with the provisions, terms and conditions of the contract.

To facilitate the fair evaluation and comparison of bids, all bids must conform to the guidelines set forth in this **ITB**. Any portions of the bid that do not comply with these guidelines must be so noted and explained the Acceptance of Conditions section of the bid. However, any bid that contains such variances may be considered non-responsive.

Bids should be prepared simply and economically, providing a straightforward concise description of the Proposer's approach and ability to meet the City's needs, as stated in the **ITB**. All copies of the bid should be bound and tabbed. The utilization of recycled paper for bid submission is strongly encouraged.

The items listed as required forms shall be submitted with each bid and should be submitted in the order shown. Each section should be clearly labeled, with pages numbered and separated by tabs. Failure by a proposer to include all listed items may result in the rejection of its bid.

All costs associated with delivering the requested services shall be detailed in the format requested on the Proposal Form.

Calculation of points for cost will be completed as described in the following **EXAMPLE**. Lowest Cost Proposed with a weighted multiplier of 85% of an available 100% total value (85-points):

	PROPOSAL COST	LOWEST COST PROPOSED	% OF LOW	MULTIPLIER	TOTAL POINTS ASSIGNED
Company #1	$100,000.00	$100,000.00	100.0%	85	85.0
Company #2	$108,000.00	$100,000.00	92.6%	85	78.7
Company #2	$120,000.00	$100,000.00	83.3%	85	70.8

L) Bid Evaluation Committee and Evaluation Factors

As previously stated, award of contract shall be based on the lowest, compliant, qualified bid unless specified otherwise in the Invitation to Bid.

Drug-Free Workplace: In accordance with Florida Statute 287.087, preference shall be given to businesses with drug-free workplace programs. Whenever two or more proposals which are equal with respect to price, quality, and service are received by the City for the procurement of commodities or contractual services, a proposal received from a business that furnishes a form certifying that it is a Drug Free Workplace shall be given preference in the award process. NOTE: In the event, the submitter wishes to provide items specified above and beyond the stated requirements of this request at "no cost" to the City of Edgewater, these services should be identified and included in the request response.

Tie Breaker: In the event of a tie (with each business certifying that it is a Drug-Free Workplace), **both in individual scoring and in final ranking,** the firm with the lowest volume of work on City projects within the last five (5) years will receive the higher individual ranking. This information will be based on information provided by the Proposer, subject to verification at the City's option. If there is a multiple firm tie in either individual scoring or final ranking, the firm with the lowest volume of work shall receive the higher ranking, the firm with the next lowest volume of work shall receive the next highest ranking and so on. If neither vendor has performed in work in the last five years, the preference will be given to the Proposer within the city limits or principal office closest to City Hall.

7) Contract / Agreement and All Required Forms

Required forms:

- Standard Construction Contract
- Proposers Checklist
- Conflict of Interest Affidavit
- Proposers Qualification Form
- Declaration Statement
- Insurance Requirements
- Drug Free Workplace Certification
- Non-Collusion Affidavit of Prime Bidder
- References Form

- Public Entity Crimes Statement
- Vendor Information
- W9
- Subcontractor Listing
- Price Proposal Form
- Proposal Form (including schedule of Major Manufacturer's/Alternates)
- Proposal Label

PROPOSER CHECK LIST

I M P O R T A N T: **Please read carefully, sign in the spaces indicated and return with your Bid.**
Proposer should check off each of the following items as the necessary action is completed:

☐ The standard contract/ agreement has been signed and included.

☐ All applicable forms have been signed and included

☐ All information as requested in the Proposer's Qualification Form is included.

☐ Any addenda have been signed and included.

☐ The mailing envelope has been addressed to:

CITY CLERK
City of Edgewater
104 N. Riverside Dr.
Edgewater, Florida 32132

☐ The **mailing envelope must be sealed and marked** with Bid Number "**ITB 17-ES-001",** Bid Title "**Variable Frequency Drives (VFD's) at Water Treatment Plant**" and Due Date "**November 15, 2016 @ 3:00 pm**".

☐ The Bid will be mailed or delivered in time to be received no later than the specified due date and time. (Otherwise Bid cannot be considered.)

ALL COURIER-DELIVERED BIDS MUST HAVE THE ITB NUMBER AND BID NAME ON THE OUTSIDE OF THE COURIER PACKET

Company	Address
Authorized Signature	City, State, Zip Code
Printed Name & Title	Telephone No.
Email	Fax No.

CONSTRUCTION CONTRACT
ITB 17-ES-001 – VARIABLE FREQUENCY DRIVES (VFD'S) AT WATER TREATMENT PLANT
CITY OF EDGEWATER
VOLUSIA COUNTY, FLORIDA

THIS AGREEMENT is made and entered into this _____ day of _____, 2015, by and between _____duly authorized to conduct business in the State of Florida and whose address is_____, hereinafter, called "CONTRACTOR" and the **CITY OF EDGEWATER**, a political subdivision of the State of Florida, whose address is 104 North Riverside Drive, Edgewater, FL 32132, hereinafter called "CITY".

WITNESSETH: The Owner and the Contractor, for the consideration stated herein, agree as follows:

ARTICLE I. SCOPE OF WORK. The Contractor shall perform all required work and shall provide and furnish all labor, materials, necessary tools, expendable equipment and all utility and transportation services required to complete the construction of and all appurtenant work thereto, as described in the **ITB 17-ES-001 – VARIABLE FREQUENCY DRIVES (VFD'S) AT WATER TREATMENT PLANT** document.

All work shall be in strict compliance with the drawings and specifications, including any and all Addenda, and together with all Contract Documents hereinafter enumerated and made a part thereof.

It is understood and agreed that said labor, materials, tools, equipment and service shall be furnished and said work performed and completed subject to the approval of the Owner.

ARTICLE II. CONTRACT PRICE. The Owner shall pay the Contractor for performance of the work in accordance with the Contract Documents in current funds as follows:

$ _____
Figures

_____
In Words

Payment will be made at the unit prices listed in the attached ITB for the actual completed quantity of each item, subject to additions and deductions as provided for in the ITB.

RETAINAGE. The City shall have the right to withhold retainage from Compensation paid to a Contractor Should the City decide that retainage shall be withheld from Compensation, the amount to be retained from each payment to the Contractor shall be:

A. ____ % of the total contract price.

B. ____ % of each payment of a milestone payment based on a Project milestone schedule.

C. ___ No retainage will be taken.

The City shall have the right to withhold retainage from Compensation paid to a Contractor. Should the City decide that retainage shall be withheld from Compensation, the amount to be retained from each payment to the Contractor shall be stated in the Work Order. The retainage shall be included with the final payment after all Work or Services for the Work Order have been approved and accepted by the City and all disputed invoices have been resolved by the parties. The City shall never be required to pay an amount that would leave unpaid from the contract price or Compensation an amount less than the amount City would need to have in order to pay another consultant to complete the Work or Services should Contractor fail to complete the Work in a Work Order remaining incomplete as of that date.

ARTICLE III. CONTRACT TIME. The Contractor agrees to commence work within **_____( )** **DAYS** after the date of the Notice to Proceed letter and shall complete the work within **_____( )** consecutive calendar days thereafter.

ARTICLE IV. INSPECTION BY CONTRACTOR. The undersigned Contractor agrees that he has carefully inspected all Contract Documents and is familiar with same; the Contractor agrees that he is responsible for having heretofore examined the site, the location and route of all the proposed work and for having satisfied himself as to the character of the route, the location, surface and under- ground obstructions and nature thereof, the nature of the ground water conditions and other physical characteristics of the work and work area in order that he may include in the prices which he has bid and the prices of the Contract, all costs pertaining to the work and thereby provide for the satisfactory completion thereof and determination of the Contract prices herein agreed upon, and that this Contract price is based upon these inspections and examination.

ARTICLE V. LIQUIDATED DAMAGES. If the work is not completed within the time specified in Article III of this Contract, the Contractor shall pay the Owner, as liquidated damages, the sum of **Five Hundred ($500.00) DOLLARS** for each consecutive calendar day thereafter until the work is completed, and as outlined in the Supplemental General Conditions.

ARTICLE VI. COMPONENT PARTS OF THE CONTRACT. This Contract consists of the following Contract Documents, all of which are hereby made a part hereof as if herein set out in full and all of which are familiar to the Contractor:

1. Invitation to Bid – ITB #17-ES-001
2. Bid Proposal
3. Bid Bond Form
4. Public Entity Crime Affidavit
5. Construction Contract
6. Performance/Payment Bond
7. Certificate of Compliance
   Re: Insurance
9. Addenda
10. Construction Specifications

ARTICLE VII. SEVERABILITY. Should any term, covenant, condition, provision or sentence or part thereof of this Contract, including all Contract Documents which comprise the entire agreement, be held invalid or unenforceable by any court of competent jurisdiction, the remaining terms and provisions shall nevertheless remain in full force and effect.

ARTICLE VIII. CONSTRUCTION. The headings and subheadings used throughout the Contract Documents are for convenience only and have no other significance in the interpretation of the body of the Contract Document.

ARTICLE IX. NOTICES. Whenever either party desires to give notice unto the other, it must be given by written notice, sent by registered or certified United States mail, return receipts requested, addressed to the party for whom it is intended at the place last specified. The place for giving of notice shall remain such until it shall have been changed by written notice in compliance with the provisions of this Section. For the present, the parties designate the following as the respective places for giving of notice, to-wit:

For City:	**For Contractor:**
Robin L. Matusick, Paralegal	_____, _____(Name, Title)
City of Edgewater	_____. (Company)
104 N. Riverside Drive	_____ (Address)
Edgewater, FL 32132	_____ (City, State, Zip)
(386)424-2400 #1203	_____ (Phone)

ARTICLE X. RIGHTS AT LAW RETAINED. The rights and remedies of City, provided for under this Contract, are in addition and supplemental to any other rights and remedies provided by law.

ARTICLE XI. CONTROLLING LAW, VENUE, ATTORNEY'S FEES. This Contract is to be governed, construed, and interpreted by, through and under the laws of Florida. Venue for any litigation between the parties to this Contract shall be in the County of Volusia, Florida and any trial shall be non-jury. Each party agrees to bear its own costs and attorney's fees relating to any dispute arising under this Contract.

ARTICLE XII. MODFICATIONS TO AGREEMENT. This Contract and any exhibits, amendments and schedules may only be amended, supplemented, modified or canceled by a written instrument duly executed by the parties hereto of equal dignity herewith.

ARTICLE XIII. WAIVER OF JURY TRIAL. THE CITY AND CONTRACTOR HAVE SPECIFICALLY WAIVED THE RIGHT TO A JURY TRIAL CONCERNNG ANY DISPUTES WHICH MAY ARISE CONCERNING THIS AGREEMENT.

ARTICLE XIV NON-WAIVER. No indulgence, waiver, election or non-election by City under this Contract shall affect Contractor's duties and obligations hereunder.

ARTICLE XV. ASSIGNMENT. This Contract, or any interest herein, shall not be assigned, transferred, or otherwise encumbered, under any circumstances, by the parties hereto without prior written consent of the opposite party and only by a document of equal dignity herewith. However, this Contract shall run to the Edgewater City Government and its successors.

ARTICLE XVI. INDEPENDENT CONTRACTOR. It is the intent of the parties hereto that Contractor shall be legally considered an independent contractor and that neither Contractor nor its employees shall under any circumstances be considered employees or agents of the City and that the City shall be at no time legally responsible for any negligence on the part of Contractor, its employees or agents, resulting in either bodily or personal injury or property damage to any individual, Contractor or corporation.

ARTICLE XVII. NO THIRD-PARTY BENEFICIARIES. The agreements contained herein are for the sole benefit of the parties hereto and their successors and permitted assigns and no other party shall have the right to enforce any provision of this Contract or to rely upon the provisions of this Contract.

ARTICLE XVIII. WARRANTY OF TITLE OF CONTRACTOR. Contractor warrants to the City that all goods and materials furnished under the Contract will be new unless otherwise specified and that Contractor possess good, clear, and marketable title to said goods and there are no pending liens, claims or encumbrances whatsoever against said goods. All work not conforming to these requirements, including substitutions not properly approved and authorized may be considered defective. If at any time there shall be evidence of any claim for which, if established, the City might become liable, and which may be chargeable to the Contractor, or if the Contractor shall incur any liability to the City, or the City shall have any claim or demand against the Contractor, of any kind or for any reason, whether related to or arising out of this Agreement or any other agreement between the Contractor and the City, and whether or not reduced to judgment or award, the City shall have the right to retain out of any payment due the Contractor, or which may become due to the Contractor, under this Contract or any other Contract between the Contractor and the City, an amount sufficient to indemnify the City against such claim, and/or to compensate the City for, and fully satisfy, such liability, claim or demand, and to charge or deduct all cost of defense or collection with respect thereto, including, but not limited to, reasonable attorneys' fees, expert consultant fees, and expert witness fees. Should any claim develop after final payment has been made, the Contractor shall refund to the City all monies that the latter may be compelled to pay in discharging such claims, or that the latter may have incurred in collecting said monies from the Contractor.

IN WITNESS WHEREOF, the parties hereto have made and executed this Agreement on the date written above for execution by CITY.

WITNESSES:

_____

_____

CITY OF EDGEWATER

_____
Tracey T. Barlow, City Manager

_____
Robin L. Matusick, Paralegal
Dated: _____

WITNESSES:

_____

_____

_____
(Firm Name)
By: _____
(Authorized Officer)

Dated:_____

Approved by the City Council of the City of Edgewater at a meeting held on this _____ day of _____, 2016 under Agenda Item No. _____.

CONFLICT OF INTEREST AFFIDAVIT

By the signature below, the firm (employees, officers and/or agents) certifies, and hereby discloses, that, to the best of their knowledge and belief, all relevant facts concerning past, present, or currently planned interest or activity (financial, contractual, organizational, or otherwise) which relates to the proposed work; and bear on whether the firm (employees, officers and/or agents) has a possible conflict have been fully disclosed.

Additionally, the firm (employees, officers and/or agents) agrees to immediately notify in writing the Finance Director, or designee, if any actual or potential conflict of interest arises during the contract and/or project duration.

_____	_____
Company	Address
_____	_____
Authorized Signature	City, State, Zip Code
_____	_____
Printed Name & Title	Telephone No.
_____	_____
Email	Fax No.

State of _____)
City of _____)

SUBSCRIBED AND SWORN to before me this ____ day of _____, 20____, by _____, who is personally known to me to be the _____ for the Firm, OR who produced the following identification:_____.

_____

Notary Public

My Commission Expires: _____

PROPOSERS QUALIFICATION FORM

LIST MAJOR WORK PRESENTLY UNDER CONTRACT:

% Completed	Project	Contract Amount
		$
		$
		$

LIST CURRENT PROJECTS ON WHICH YOUR FIRM IS THE CANDIDATE FOR AWARD:

_____

_____

_____

OTHER INFORMATION ABOUT PROJECTS:

_____

_____

_____

Have you, at any time, failed to complete a project? ☐ Yes ☐ No

STATEMENT OF LITIGATION:

Are there any judgments, claims or suits pending or outstanding by or against you?
☐ Yes ☐ No

If the answer to either question is yes, submit details on separate sheet. List all lawsuits that have been filed by or against your firm in the last five (5) years:

FEES:

List total fees for work done on all City projects in the past five (5) years, whether as an individual firm or as part of a joint venture. **Fees must be listed individually by contract or project and then summarized as a total dollar amount.** Attach additional page if necessary.

$_____Total Fees for work done on all City projects

REFERENCES:
Bank(s) Maintaining Account(s): _____

_____

Surety/Underwriter: (if required)_____

_____

Other References: (Use additional sheets if necessary)
_____

_____

TYPE OF FIRM:

☐ Corporation/Years in Business: _____. If firm is a corporation, please list state in which it is incorporated: _____. If firm is a corporation, by signing this form, Proposer certifies that the firm is authorized to do business in the State of Florida.
☐ Partnership/Years in Business: _____
☐ Sole Proprietorship/Years in Business: _____
☐ Other: Please list: _____ _____

Pursuant to information for prospective Proposers for the above-mentioned proposed project, the undersigned is submitting the information as required with the understanding that it is only to assist in determining the qualifications of the organization to perform the type and magnitude of work intended, and further, guarantee the truth and accuracy of all statements herein made. We will accept your determination of qualifications without prejudice.

_____	_____
Company	Address
_____	_____
Authorized Signature	City, State, Zip Code
_____	_____
Printed Name & Title	Telephone No.
_____	_____
Email	Fax No.

DECLARATION STATEMENT

City of Edgewater
104 N. Riverside Dr.
Edgewater, FL 32132

RE: ITB NO. 17-ES-001 - "Variable Frequency Drives (VFD's) at Water Treatment Plant for City of Edgewater"

Dear Mayor and Council Members:

The undersigned, as Proposer (herein used in the masculine, singular, irrespective of actual gender and number) declares that he is the only person interested in this bid or in the contract to which this bid pertains, and that this bid is made without connection or arrangement with any other person and this bid is in every respect fair and made in good faith, without collusion or fraud.

The Proposer further declares that he has complied in every respect with all the Instructions to Proposers issued prior to the opening of bids, and that he has satisfied himself fully relative to all matters and conditions with respect to the general condition of the contract to which the bid pertains.

The Proposer puts forth and agrees, if this bid is accepted, to execute an appropriate City document for the purpose of establishing a formal contractual relationship between him, and the City, for the performance of all requirements to which the bid pertains. The Proposer states that the bid is based upon the bid documents listed by **ITB #17-ES-001.**

IN WITNESS WHEREOF, WE have hereunto subscribed our names on this _____ day of _____, 20__ in the City of _____, in the State of _____.

_____	_____
Company	Address
_____	_____
Authorized Signature	City, State, Zip Code
_____	_____
Printed Name & Title	Telephone No.
_____	_____
Email	Fax No.

INSURANCE REQUIREMENTS

INSURANCE TYPE	REQUIRED LIMITS
☒ 1. Worker's Compensation	Statutory Limits of Florida Statutes, Chapter 440 and all Federal Government Statutory Limits and Requirements.
☒ 2. Commercial General Liability (Occurrence Form) patterned after the current I.S.O form with no limiting endorsements.	Bodily Injury & Property Damage **$1,000,000** single limit per occurrence

☒ 3. Indemnification: To the maximum extent permitted by Florida law, the Contractor/Vendor/Consultant shall indemnify and hold harmless the City of Edgewater, its officers and employees from any and all liabilities, damages, losses and costs, including, but not limited to, reasonable attorneys' fees and paralegals' fees, to the extent caused by the negligence, recklessness, or intentionally wrongful conduct of the Contractor/Vendor/Consultant or anyone employed or utilized by the Contractor/Vendor/Consultant in the performance of this Agreement. This indemnification obligation shall not be construed to negate, abridge or reduce any other rights or remedies which otherwise may be available to an indemnified party or person described in this paragraph.

This section does not pertain to any incident arising from the sole negligence of the City of Edgewater.

☒ 4. Automobile Liability	**$ 500,000** Each Occurrence Owned/Non-owned/Hired Automobile Included
☒ 5. Other Insurance as indicated below: Errors and Omissions or Professional Malpractice Coverage	**$** 1,000,000 Per Occurrence

☐ 6. Aircraft Liability $1,000,000 each occurrence combined single limit for bodily injury liability and property damage liability.

☒ 7. Contractor shall ensure that all subcontractors comply with the same insurance requirements that he is required to meet. The same Contractor shall provide City with certificates of insurance meeting the required insurance provisions.

☒ 8. The City of Edgewater must be named as "**ADDITIONAL INSURED**" on the Insurance Certificate for Commercial General Liability where required.

INSURANCE REQUIREMENTS
(Continued)

☒ 9. The City of Edgewater shall be named as the Certificate Holder. NOTE--The "Certificate Holder" should read as follows:

City of Edgewater
Edgewater, Florida

No City Division, Department, or individual name should appear on the Certificate. No other format will be acceptable.

☒ 10. **Thirty (30) Days Cancellation Notice** required.

☒ 11. The Certificate must state the **ITB** Number and Variable Frequency Drives (VFD's) at Water Treatment Plant.

= =

PROPOSER'S AND INSURANCE AGENT'S STATEMENT:

We understand the insurance requirements of these specifications and that the evidence of insurability may be required within five (5) days of the award of **ITB**.

Company	Address
Authorized Signature	City, State, Zip Code
Printed Name & Title	Telephone No.
Email	Fax No.

Insurance Agency

Signature of Proposer's Agent

DRUG-FREE WORKPLACE PROGRAM CERTIFICATION

Preference to businesses with drug-free workplace programs. -- Whenever two or more bids, proposals, or replies that are equal with respect to price, quality, and service are received by the state or by any political subdivision for the procurement of commodities or contractual services, a bid, proposal, or reply received from a business that certifies that it has implemented a drug-free workplace program shall be given preference in the award process. In order to have a drug-free workplace program, a business shall:

(1) Publish a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace and specifying the actions that will be taken against employees for violations of such prohibition.

(2) Inform employees about the dangers of drug abuse in the workplace, the business's policy of maintaining a drug-free workplace, any available drug counseling, rehabilitation, and employee assistance programs, and the penalties that may be imposed upon employees for drug abuse violations.

(3) Give each employee engaged in providing the commodities or contractual services that are under bid a copy of the statement specified in subsection (1).

(4) In the statement specified in subsection (1), notify the employees that, as a condition of working on the commodities or contractual services that are under bid, the employee will abide by the terms of the statement and will notify the employer of any conviction of, or plea of guilty or nolo contendere to, any violation of Chapter 893 or of any controlled substance law of the United States or any state, for a violation occurring in the workplace no later than 5 days after such conviction.

(5) Impose a sanction on, or require the satisfactory participation in a drug abuse assistance or rehabilitation program if such is available in the employee's community by, any employee who is so convicted.

(6) Make a good faith effort to continue to maintain a drug-free workplace through implementation of this section.

Does the individual responding to this solicitation certify that their firm has implemented a drug-free workplace program in accordance with the provision of Section 287.087, Florida Statues, as stated above?

☐ **YES**
☐ **NO**

Company	Address
Authorized Signature	City, State, Zip Code
Printed Name & Title	Telephone No.
Email	Fax No.

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of_____

County of_____

_____, being first duly sworn, deposes and says that:

He/she is _____of_____, Proposer that has submitted the attached Proposal;

He/she is fully informed respecting the preparation and contents of the attached Proposal and of all pertinent circumstances respecting such Proposal;

Neither the said Proposer nor any of its officers, partners, owners, agent representatives, employees, or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly, sought by agreement or collusion or communication or conference with any other Proposer, firm or person, to fix the price or prices in the attached Proposal or of any other Proposer, or to fix any overhead, profit or cost element of the Proposal price or the Proposal price of any other Proposer, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the CITY OF EDGEWATER.

The price or prices quoted in the attached Proposal are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Proposer or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

_____	_____
Company	Address
_____	_____
Authorized Signature	City, State, Zip Code
_____	_____
Printed Name & Title	Telephone No.
_____	_____
Email	Fax No.

Subscribed and sworn to before me this _____day of_____, 20___.

_____

_____
Title

My Commission Expires: _____

REFERENCES FORM

Provide the business names, contact persons and telephone numbers of five (5) references for which the firm has provided services described in this proposal for three (3) years or more with the last five (5) years. Include relationships with governmental agencies. It is our intent to contact these references during the evaluation process.

1. Name of Company: _____

   Address: _____

   Point of Contact: _____ Phone #: _____

   Service(s) Provided: _____

   _____

   Dates of Service: _____

2. Name of Company: _____

   Address: _____

   Point of Contact: _____ Phone #: _____

   Service(s) Provided: _____

   _____

   Dates of Service: _____

3. Name of Company: _____

   Address: _____

   Point of Contact: _____ Phone #: _____

   Service(s) Provided: _____

   _____

   Dates of Service: _____

4. Name of Company: _____

   Address: _____

   Point of Contact: _____ Phone #: _____

   Service(s) Provided: _____

   _____

   Dates of Service: _____

5. Name of Company: _____

   Address: _____

   Point of Contact: _____ Phone #: _____

   Service(s) Provided: _____

   _____

   Dates of Service: _____

SWORN STATEMENT PURSUANT TO SECTION 287.133(3)(A), FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES

THIS FORM MUST BE SIGNED AND SWORN TO IN THE PRESENCE OF A NOTARY PUBLIC OR OTHER OFFICIAL AUTHORIZED TO ADMINISTER OATHS.

1. THIS SWORN STATEMENT IS SUBMITTED TO City of Edgewater

by_____
(Print Individual's Name and Title)
for _____
(Print Name of Entity Submitting Sworn Statement)
whose business is
_____

and (if applicable) its Federal Employer Identification Number (FEIN) is_____

2. I understand that a "public entity crime" as defined in Paragraph 287.133 (1)(g), Florida Statutes, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), Florida Statutes, means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.

4. I understand that an "affiliate" as defined in Paragraph 287.133(1)(a), Florida Statutes, means:

    a. A predecessor or successor of a person convicted of a public entity crime; or

    b. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.

5. I understand that a "person" as defined in Paragraph 287.133(1)(e), Florida Statutes, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provisions of goods or services let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors,

executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

6. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (Indicate which statement applies).

_____ Neither the entity submitting this sworn statement, nor any of its officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity, nor any affiliates of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. (Attach a copy of the final order).

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, FLORIDA STATUTES, FOR A CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

_____
(Signature)

Sworn and subscribed before me this_____day of_____, 2014.

Personally known_____ _____
(Notary)

OR produced identification_____ Notary Public State of_____

_____ My commission expires:_____
(Type of Identification)

VENDOR INFORMATION

Vendor is:
( ) Corporation
( ) Partnership
( ) Sole Proprietorship
( ) Other _____(Explain)

Federal Employer Identification Number: _____

Firm Name: _____

Mailing Address: _____

_____

Telephone No.: _____ Fax No.: _____

Email Address: _____Web Address:_____

If remittance address is different from the mailing address so indicate below.

Firm Name: _____

Remittance Address: _____

_____

_____

Submitted by: _____

Name & Title Printed: _____

Form **W-9**
(Rev. October 2007)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give form to the requester. Do not send to the IRS.

Print or type See **Specific Instructions** on page 2.

Name (as shown on your income tax return)

Business name, if different from above

Check appropriate box: ☐ Individual/Sole proprietor ☐ Corporation ☐ Partnership
☐ Limited liability company. Enter the tax classification (D=disregarded entity, C=corporation, P=partnership) ▶ _____
☐ Other (see instructions) ▶

☐ Exempt payee

Address (number, street, and apt. or suite no.)

Requester's name and address (optional)

City, state, and ZIP code

List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on Line 1 to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number

or

Employer identification number

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below).

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the Certification, but you must provide your correct TIN. See the instructions on page 4.

Sign Here **Signature of U.S. person ▶** **Date ▶**

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income.

Note. If a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax on any foreign partners' share of income from such business. Further, in certain cases where a Form W-9 has not been received, a partnership is required to presume that a partner is a foreign person, and pay the withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid withholding on your share of partnership income.

The person who gives Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States is in the following cases:

- The U.S. owner of a disregarded entity and not the entity,

SUBCONTRACTOR LIST

THE BIDDER HAS FULLY INVESTIGATED EACH SUBCONTRACTOR LISTED AND HAS IN HIS FILE EVIDENCE EACH SUBCONTRACTOR HAS ENGAGED SUCCESSFULLY IN HIS LINE OF WORK FOR A REASONABLE PERIOD OF TIME, THAT HE MAINTAINS A FULLY EQUIPPED ORGANIZATION CAPABLE, TECHNICALLY AND FINANCIALLY, OF PERFORMING THE WORK REQUIRED, AND THAT HE HAS MADE SIMILAR INSTALLATIONS IN A SATISFACTORY MANNER.

TYPE OF WORK	NAME AND ADDRESS OF SUBCONTRACTOR

TOTAL PRICE PROPSAL FORM
ITB 17-ES-001 –VFD's at Water Treatment Plant

ITEM NO.	*DESCRIPTION*	*QTY*	*UNIT*	*UNIT COST*	*TOTAL*
1	Electrical Improvements	1	LS		
2	Instrumentation Improvements	1	LS		
3	Permit Fee Allowance	1	LS	$10,000.00	$10,000.00
				BID TOTAL	

Total Price Proposal Amount in Figures: _____

Total Price Proposal Amount in Words: _____

Bid prices must include all freight charges and delivery charges for any and all material delivered to the work sight.

THE ABOVE AMOUNTS INCLUDE SALARY COST, FRINGE BENEFITS, OVERHEAD, OPERATING MARGIN AND PROFIT, AND ALL DIRECT AND INDIRECT EXPENSES.

PLEASE INCLUDE BELOW ANY OTHER POTENTIAL ADDITIONAL SERVICES THAT MAY BE REQUIRED AND ASSOCIATED COSTS.

_____

_____

_____	_____
Company	Address
_____	_____
Authorized Signature	City, State, Zip Code
_____	_____
Printed Name & Title	Telephone No.
_____	_____
Email	Fax No.
_____	
Date	

PROPOSAL FORM

Variable Frequency Drives (VFD's) at Water Treatment Plant
BID NO. 17-ES-001

Bidder's Name:_____Submitted:_____, 20___

City of Edgewater
City Clerk
P.O. Box 100
Edgewater, FL 32132-0100

The undersigned, as Bidder, hereby declares that the only person or persons interested in the Bid, as principal or principals, is or are named herein and that no other persons than herein mentioned has any interest in the Bid or the Contract to which the work pertains; that this Bid is made without connection or arrangement with any other person, company, or parties making a bid or proposal and that the Bid is in all respects fair and made in good faith without collusion or fraud.

The Bidder further declares that he/she has examined the site of the work and that from personal knowledge and experience, or that he/she has made sufficient test holes and/or other subsurface investigations to fully satisfy him/her self that such site is a correct and suitable one for this work and he/she assumes full responsibility therefore; that he/she is familiar with all legal requirements (Federal, State and local laws, ordinances, rules and regulations) pertaining to the Work; that he/she has examined the Drawings and Specifications for the work and from his/her own experience or from professional advice that the Drawings and Specifications are sufficient for the work to be done and he/she has examined the other Contract Documents and all addenda relating thereto, and that he/she has satisfied him/her self fully, relative to all matters and conditions with respect to the work to which this Bid pertains.

The Bidder proposes and agrees, if this Bid is accepted, to contract with the City of Edgewater, (Owner) in the form of contract specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, transportation, and labor and to perform all work necessary to complete the Work specified in the Bid and other Contract Documents.

The Bidder further proposes and agrees to comply in all respects with the time limits for commencement and completion of the Work as stated in the Contract Form.

The Bidder further agrees that the deductions for liquidated damages, as stated in the Contract Form, constitute fixed and agreed liquidated damages to reimburse the Owner for additional costs to the Owner resulting from the Work not being completed within the time limit stated in the Contract Form.

The Bidder further agrees to execute a Contract and furnish satisfactory Certificates of Insurance, within ten (10) consecutive calendar days after written notice being given by the Owner of the award of the Contract, and the undersigned agrees that in case of failure on his/her part to execute the said Contract, and Insurance Certificates within ten (10) consecutive calendar days after the award of the Contract, the bid guarantee accompanying his/her bid and the money payable thereon shall be paid to the Owner as liquidation of damages sustained by the Owner; otherwise, the bid guarantee shall be returned

to the undersigned within fifteen (15) days after the Contract is signed and Insurance Certificates are filed.

The undersigned agrees to accept as full compensation for completion of the project in full compliance with the Contract Documents, the unit prices for the items named in Section 00310, Schedule of Unit Prices, submitted herein with this Bid.

The undersigned offers to furnish all materials, equipment and labor for construction of

Variable Frequency Drives (VFD's) at Water Treatment Plant
BID NO. 17-ES-001

for the City of Edgewater, Florida, complete in every respect in strict accordance with the Drawings, Specifications and any future changes therein. The Contractor shall perform these obligations for the prices listed in the Schedule of Unit Prices, attached and made a part of this Bid. The estimated bid total:

_____Dollars
(In Words)

$_____
(In Figures)

1.01 COMPLETION TIME OF CONTRACT

A. The Contractor agrees that the work shall be started not later than the date indicated in the Notice to Proceed and that the work shall be substantially completed in **90 (ninety) calendar days** with an additional **30 (Thirty) calendar days** for final completion.

B. The Contractor further agrees that for each calendar day, with the exception of Sundays and legal holidays that any work that shall remain uncompleted after the completion time stipulated above the sum of **$500 (Five Hundred Dollars)** shall be deducted from monies due the contractor, not as a penalty, but as liquidated damages. If the Contractor is declared in default in accordance with the provisions of the Specifications, liquidated damages shall be charged as provided herein, and such amounts shall be deducted from the final amount payable to the Contractor. Should the total amount chargeable as liquidated damages exceed the amount due or payable to the Contractor, then such excess shall be paid to the Owner by the Contractor.

1.02 REQUIRED DISCLOSURE

A. At its sole discretion, the City of Edgewater, Florida may reject any bidder the City finds to lack, or whose present or former executive employees, officers, directors, stockholders, partners or owners are found by the City to lack honesty, integrity, or moral responsibility. The discretion of the City may be exercised based on the City's own investigation, public records, or any other reliable sources of information. By submitting a bid, bidder recognizes and accepts that the City may reject the bid based upon the exercise of its sole discretion and bidder waives any claim it might have for damages or other relief resulting from the rejection of its bid based on these grounds.

1.03 SCHEDULE OF MAJOR MANUFACTURERS AND SUPPLIERS

A. The equipment manufacturers/suppliers on this project shall be as delineated in the following schedule. Bidders should note that the Owner and Engineer have made rigorous investigations of equipment performance and features, and as a result, Bidders are to note that the contract price for this project shall be based on Base Bid equipment. The Base Bid equipment for this project falls under one of two categories. The first category is equipment that the Owner and Engineer have determined will be supplied by a sole source of supply, for which no substitutions or alternates will be entertained or allowed. Bidder is advised that offering of any alternatives to the sole source supplied equipment will be grounds for rejection of his bid as not responsive. The second category of equipment includes those items where the Owner and Engineer deem there to be more than one acceptable supplier of the particular item listed. The equipment which falls under these two categories is a shown on the subsequent pages of this Schedule of Major Manufacturers and Suppliers. Bidder is advised that the award of this Contract will be based solely on the use of Base Bid equipment.

B. The following comments relate only to the second category of equipment, where the Contract Documents are based upon the equipment or products available from the suppliers denoted as A, B, C, etc. below. These equipment manufacturers, along with the sole source suppliers constitute the Base Bid.

C. Provision is made in the Contract Documents for alternate manufacturers and suppliers whose equipment or product may be deemed equivalent in quality (see General Conditions). However, the Bidder must indicate in his Bid which Base Bid supplier he intends to use for each item of equipment listed by circling one of the listed manufacturers/suppliers. If the Bidder fails to indicate which listed manufacturer/supplier he intends to use if an alternate is rejected, he must use the supplier listed as "A". Also, if the Bidder circles more than one listed supplier, he must use the first supplier circled (unless an alternate is approved).

D. If the Bidder desires to propose one or more alternate manufacturers/suppliers, he may write in the name of such alternates in the spaces provided on the Alternate Manufactures/Suppliers page following the schedule. He must, nevertheless, also circle one of the listed manufacturers/suppliers because Bidders' Bid price must be based upon this Base Bid list. Wherever an alternate supplier is proposed, the Bidder must insert the amount to be deducted from the Contract Price (either lump sum or unit price) if the alternate supplier is eventually approved. If the proposed alternate supplier is determined "not equivalent" by the Engineer, the Bidder must use the circled supplier.

E. For any alternate supplier accepted by the Owner, the Contract Price will be reduced by the deductive amount stated in the Bid. However, the Contract Price will not be adjusted for any alternate supplier rejected.

F. Each proposed alternate will be evaluated in accordance with the General Conditions. The deductive amount specified for alternate manufacturers/suppliers will not be used in determining the successful Bidder. Alternates will be considered only after award of the contract.

G. The Contractor shall reimburse the Owner for any costs directly attributable to the change in suppliers, such as additional field trips for the Engineer, additional redesign costs, additional review and inspection costs, etc.

H. The Owner may request and the Bidder shall supply complete information on proposed alternates prior to the Notice of Award.

SCHEDULE OF MAJOR MANUFACTURERS AND SUPPLIERS

Category I - Sole Source Equipment Items:

Specification Section	Equipment	Manufacturer
Plansheets	PICS	Precision Control Instruments, Inc.

Category II - Major Equipment Items:

Specification Section	Equipment	Manufacturer
	Variable Frequency Drives	A) Square-D B) Yaskawa C) ABB D) Eaton

ALTERNATE MANUFACTURERS/SUPPLIERS

EQUIPMENT ITEM MATERIAL	SPEC. SECTION	ALTERNATIVE MANUFACTURER/ SUPPLIER (LIST ONE ONLY)	DEDUCTIBLE AMOUNT (indicate whether lump sum or unit price) ALTERNATE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			

Name (signature) Date

Name (typed and printed)

Title

Addenda will be issued via email and it is the Bidder's sole responsibility to confirm that all addenda have been received prior to submitting a bid for this project. Acknowledgment is hereby made of the following Addenda received since issuance of Drawings and Specifications:

Addendum No. _____ Dated: _____ Addendum No. _____ Dated:
Addendum No. _____ Dated: _____ Addendum No. _____ Dated:
Addendum No. _____ Dated: _____ Addendum No. _____ Dated:

Attached hereto is a cashier's check on the _____

Bank of _____

or Bid Bond for the sum of _____Dollars

(_____), made payable to _____(Owner).

(Name of Bidder) (Affix Seal)

(Signature of Officer)

(Title of Officer)

_____
Name of Bidder

_____
Address

_____
City/State/Zip

_____
Telephone

_____
Contractor's Florida License Number

The full names and residences of persons and firms interested in the foregoing bid, as principals, are as follows:

_____

_____

_____

Cut and use this label for Bid Package

CITY OF EDGEWATER
CITY CLERK
104 N. RIVERSIDE DRIVE
EDGEWATER, FL 32132

ITB 17-ES-001

VARIABLE FREQUENCY DRIVES (VFD's) AT WATER TREATMENT PLANT

OPENING DATE/TIME:
November 15, 2016 by 3:00 p.m.

Plans and Specifications

CITY OF EDGEWATER

TECHNICAL SPECIFICATIONS
For
WTP High Service Pump VFD Upgrades
BID #17-ES-001

Prepared by:
QUENTIN L. HAMPTON ASSOCIATES, INC.
-Consulting Engineers-
October 2016

TABLE OF CONTENTS
CITY OF EDGEWATER
WTP High Service Pump VFD Upgrades
BID NO. 17-ES-001

END OF TABLE OF CONTENTS

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - 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. Provide 120V and low voltage surge protection equipment in accordance with Section 16289 at equipment as required. 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 Civil Engineer.

B. Discrepancies: Notify the Civil Engineer of any discrepancies found during construction of the project. The Civil 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 Civil 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 ensure 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 Civil 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 Civil Engineer. The "As-Built" drawings shall be made available to the Civil 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
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
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
∅	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. Volusia County.

E. Utility Company: Comply with latest utility company regulations.

F. Building Code: Florida Building Code (2012 w/addendums).

G. Standards: American Society of Mechanical Engineers

H. 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.

I. NFPA: National Fire Protection Association (NFPA) Standards

NFPA-1	Uniform Fire Code™
NFPA-13	Standard for the Installation of Sprinkler Systems
NFPA-20	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA-37	Standard for the Installation and Use of Stationary Combustion Engines And Gas Turbines
NFPA-54	National Fuel Gas Code
NFPA-70	National Electrical Code
NFPA-72	National Fire Alarm Code
NFPA-75	Standard for the Protection of Information Technology Equipment
NFPA-90A	Standard for the Installation of Air Conditioning And Ventilating Systems

NFPA-96	(2004)	Standard for Ventilation Control and Fire Prevention of Commercial Cooking Operations. Subdivision 7-2.2 of NFPA 96 applies prospectively only. Existing installations are permitted to remain in place – subject to the approval of the authority having jurisdiction
NFPA-101A		Guide on Alternative Approaches to Life Safety
NFPA-101B		Standard on Means of Egress for Buildings and Structures
NFPA-110		Standard for Emergency and Standby Power Systems
NFPA-418		Standard for Heliports
NFPA-780		Installation of Lightning Protection Systems

1.08 INVESTIGATION OF SITE

A. General: Before commencing work, verify existing conditions at the premises including, but not limited to, existing structural frame, existing openings; existing wall and partition locations, existing mechanical and electrical work, equipment type, and examine adjoining work on which work is in anyway dependent.

B. Responsibility: No waiver of responsibility for defective and inadequate work or additional cost as a result of existing conditions which should have been verified shall be considered unless notice of same has been filed by the Contractor and agreed to in writing by the Civil Engineer before the bid date.

C. 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.

D. Renovation: Investigate site thoroughly and reroute raceway and wiring in area of new construction in order to maintain continuity of existing circuitry. Existing Raceways shown on plans show approximate locations only.

E. Special Considerations: Special attention is called to the fact that there will be piping, fixtures or other items in the existing building which must be removed or relocated in order to perform the alteration work. Include removal and relocation required for completion of the alterations and the new construction. All existing wiring that is to remain in renovated areas shall be made code compliant.

F. Power Outage: Special attention is called to the fact that work involved is in connection with existing buildings which shall remain in operation while work is being performed. Work must be done in accordance with the priority schedule. Schedule work for a minimum outage to Owner. Request written permission and receive written acceptance from the Owner no later than 72 hours in advance of power and communication shut-downs. Perform work required at other than standard working hours where outages cannot be accepted by Owner during regular working hours. Protect existing buildings and equipment during construction.

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 Civil Engineer. Obtain from the Civil 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 Civil 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 Owner including but not limited to electrical work required for:

1. Door hardware
2. Roll-up doors
3. Roll-up grilles
4. Signage
5. Fire shutters
6. Mechanical Division of the Specifications

C. Obtain set of Contract Documents from Owner's 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 Owner.

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 Civil 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 Owner’s 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 Owner.

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.

1.11 DEMOLITION

A. General: Relocate existing equipment and reroute existing raceways in areas being renovated as required to facilitate the installation of the new systems. The Owner shall require continuous operation of the existing systems, while demolition, relocation work or new tie-ins are performed.

B. Coordination: Prior to any deactivation, relocation or demolition work, arrange a conference with the Civil Engineer and the Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect equipment designated as being relocated and reused or equipment remaining in operation and integrated with the new systems.

C. Provisions: Deactivation, relocation, and temporary tie-ins shall be provided by the Contractor. Demolition, removal and the legal disposal of demolished materials shall be provided by the Contractor.

D. Owner’s Salvage: The Owner reserves the right to inspect the material scheduled for removal and salvage any items he deems usable as spare parts.

E. Phasing: The Contractor shall perform work in phases as directed by the Civil Engineer to suit the project progress schedule, as well as the completion date of the project.

1.12 COORDINATION STUDY

A. Specified Manufacturers: All panelboard and circuit breakers shall be of the manufacturer and type specified herein, and as indicated on the drawings or the Coordination Study. Any discrepancies or conflicts in specified equipment shall be brought to the attention of the engineer during bid, for formal clarification.

B. Substitutions: Alternate manufacturers listed will be considered under the following conditions:

1. Ability of alternate manufacturer to meet the requirements of the Construction Documents.
2. Alternate equipment selection shall provide selective overcurrent device coordination, including coordination with existing equipment.
3. Submission of coordination plots, showing proper selective coordination of proposed equipment for reference and review. Provide coordination plots for all distribution branches indicated on Construction Documents.

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 Civil Engineer/Engineer for acceptance.

E. Samples: Samples are to be submitted for items requested within Specification Sections to determine that the item meets specifications and requirements before being accepted for use on Project. Samples shall be submitted within 30 days after the award of the contract. Each sample shall be tagged, labeled, or marked, "Sample of ..... for (Project). Accompany samples with copy, in duplicate of manufacturer's instructions regarding installation, and maintenance.

1. Provide samples of the following items:

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.
9. Provide 1/2” = 1’-0” enlarged electrical room layout drawings for all electrical rooms. All equipment shall be indicated at actual size of equipment being provided. All dimensions and required working clearances shall be shown.

E. Coordination Study: This project has been designed and coordinated (electrical distribution system) utilizing the specified manufacturer(s).

F. 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.

G. 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.

H. 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.

I. Ordering Equipment: No material shall be ordered or shop work started until the Engineer has officially received the shop drawings record submittal and has formally released the Contractor for submittal requirements.

J. 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.

K. 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.

L. 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.

M. 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.

N. Title Drawings: Title drawings to include identification of project and names of Civil Engineer-Engineer, 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", 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.

O. 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.

P. 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 manufacturer 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 CONCRETE PADS

A. General: Provide reinforced concrete pads for floor mounted electrical equipment. Unless otherwise noted, pads shall be nominal 4" high and shall exceed dimensions of equipment being set on them, including future sections, by 6" on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges

1/2". Trowel surfaces smooth. Reinforce pads with #5 reinforcing bars at 24" centers each way, unless specifically detailed on drawings.

2.06 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.

2.07 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 Civil 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.

2.08 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. Sleeves shall be Schedule 40 PVC or galvanized rigid steel unless specifically noted otherwise. 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 Civil Engineer. Fill opening after Raceway installation, with equivalent material.

2.09 OPERATING AND MAINTENANCE INSTRUCTIONS

A. General: Thoroughly instruct the Owner’s Representative, to the complete satisfaction of the Civil Engineer and Engineer, in the proper operation of all systems and equipment provided. The Contractor shall make all arrangements, via the Civil 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 Civil Engineer shall be completely satisfied that the Owner’s Representative has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Civil Engineer determines that complete and thorough instructions have not been given by the Contractor to the Owner's Representative, then the Contractor shall be directed by the Civil 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 Civil Engineer for approval five (5) 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 Civil 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.

2.10 SERVICE AND METERING

A. Company: The utility company serving this project is FPL which will be referred to as the Utility Company herein.

B. Service: Make arrangements with the Utility Company for obtaining a complete service. Pay charges and provide labor and material for the service. Service shall be obtained at 480Y/277 volts, 3 phase, 4-wire, 60 hertz from the Utility Company. Provide underground cables and raceways for incoming services from the utility's transformer to equipment

C. Fees: Contact the Utility Company to determine if any fees, charges or costs will be due the Company, as required for temporary power, permanent power, installations, hook-ups, etc. This fee, charge or cost shall be included in the bid price.

D. Payment: Pay for required licenses, fees and inspections. Include costs in the proposed construction cost submission. These costs shall include but not be limited to applicable taxes, permits, necessary notices, certificates and costs required to obtain same.

E. Codes: Install a complete system in accordance with the latest edition of the National Electrical Code and the latest regulations of governing local, State, County and other applicable codes, including the Utility Company requirements.

F. Provide transformer pad per Utility Company requirements.

2.11 TEMPORARY LIGHT AND POWER

A. Capacity: Provide capacity from new temporary service. Make arrangements with the Owner for temporary service and pay all related expenses. Temporary light and power shall be provided constantly during the project dependent upon Owner's safety requirements.

B. Capacity: Make arrangements with the Owner for existing temporary service and pay all related expenses. Temporary light and power shall be provided constantly during the project dependent upon Owner's safety requirements.

C. Lighting: Temporary light shall be based on one 200 watt lamp covering each 1,000 square foot of floor area in the building. Each room 100 square foot and over shall have a minimum of one 100-watt lamp with guards. Provide power for motors up to 3/4 horsepower only. Provisions are to be made for electric welders, if required.

D. Outlets: Provide outlets located at convenient points so that extension cords of not over fifty (50) feet will reach work requiring artificial light or power.

E. 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.

F. New Fixtures: Permanently installed lighting fixtures may be used for temporary lighting at the Contractor's option with the provision that cool white lamps for fluorescent, clear lamps for

incandescent and marked temporary for other types shall be installed. At job completion, lamps shall be replaced with permanent lamps specified.

G. 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.

H. Payment: The Contractor will pay for the cost of energy consumed by all trades. Any temporary wiring of a special nature for light and power required other than mentioned above shall be paid for by the Contractor using same.

2.12 EXISTING CONDITIONS

A. Support: Existing Raceway and cables within the area of renovation shall be provided with proper supports as specified for new work in other sections of this specification.

B. Installation: Existing electrical which is designated for reworking or requires relocation, repair or adjustment shall conform to applicable codes and shall be treated as new work complying to all sections of this specification.

C. Violations: Where existing conditions are discovered which are not in compliance with the codes and standards, the Contractor shall submit proper documentation to the Civil Engineer for clarification and corrective work direction. Existing conditions shall not remain which will create a disapproval of the renovated area.

D. Patching: Existing Raceway and cable penetrations shall be properly fire treated per code and specification requirements. The Contractor shall thoroughly inspect existing locations and include the cost of patching and repair in his proposed construction cost.

PART 3 - EXECUTION

3.01 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 Civil 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 Civil 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 Civil Engineer, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

3.02 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 Owner's 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.

3.03 SYSTEMS GUARANTEE

A. General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the Owner for any defective workmanship or material, which has been provided under this Contract at no cost to the Owner 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 Owner at the "Demonstration of Completed System".

3.04 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.

3.05 SPECIAL CONSIDERATIONS

A. Comply with special requirements imposed at site by Owner. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

END OF SECTION

CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

Provide certification of completion as stated in specification section 01650.

SECTION 16060 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to grounding Section 16450 at the end of this section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Common ground bonding with lightning protection system.

1.3 GROUNDING ELECTRODES

A. General: Provide a grounding electrode system, as described in NEC 250, as specified herein and as indicated on plans.

B. Ground Field / Ground Rods: The ground field shall consist of three 20 ft long vertically driven ground rods arranged in a triangular pattern spaced 20 feet apart. Additional ground rods shall be added as necessary to achieve the desired resistance.

C. Main Metallic Water Pipe: The building's main metallic underground water piping shall be utilized as a grounding electrode, provided the metal pipe is installed in direct contact with the earth for a minimum of 10 feet. Bond the main metallic water service within 5 ft. of the entrance of the water pipe into the building.

D. Building Steel: The building steel shall be utilized as a grounding electrode, provided the steel is in direct contact with the earth or is otherwise effectively grounded.

E. Rebar: In concrete buildings, provide bond to rebar in concrete.

F. Resistance: Grounding electrode resistance shall not exceed 10 ohms. Overall resistance of the entire grounding electrode system shall not exceed 5 ohms. Provide additional grounding electrodes as required to meet this value.

1.4 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. Lightning protection system.
3. Gas and other interior metal piping – refer to NEC.

1.5 SEPARATELY DERIVED GROUNDING SYSTEMS

A. Description: Provide a separately derived grounding system where indicated herein and as required by the National Electrical Code. Bond neutral and ground busses together.

B. Services: Provide a separately derived grounding system for all building electrical services and step-down transformers.

C. Emergency Generator: Provide a separately derived grounding system for the emergency system where 4-pole transfer switches are used (neutral and phase conductors switched).

D. Multiple Buildings: Multiple buildings fed from the same electrical service shall be provided with separate grounding electrode systems, as required by the NEC and specified herein.

1.6 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. 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.

D. Light Poles: All exterior light poles shall have their enclosures grounded directly to a separate driven ground at the light pole in addition to the building ground connection, via the circuit equipment ground conductor.

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.

1.7 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS NFPA 70B.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
b. Include recommended testing intervals.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

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

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by ~~2~~ 4 inches (~~6~~ 6.3 by ~~50~~ 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600V. Lexan or PVC, impulse tested at 5000V.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by10 feet (19 mm by 3 m) in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 ~~1~~ inch (50 ~~25~~ mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4 ~~2~~-by-12-inch (6.3 ~~6~~-by-100 ~~50~~-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building area or item indicated.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building foundation.

J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 LABELING

A. Comply with requirements in Division 16 Section "Electrical Identification" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and

their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 3 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060

EQUIPOTENTIAL GROUND TEST REPORT

FACILITY NAME:_____ PROJECT NAME:_____

DATE: _____TESTED BY:_____

MAXIMUM TEST INTERVALS:
GENERAL CARE - 12 MOS.
CRITICAL CARE - 6 MOS.
WET LOCATIONS - 12 MOS.

NAME:_____

COMPANY:_____

TYPE METER USED AND EXTERNAL NETWORK IF USED:

NOTE: MAXIMUM READINGS PERMITTED - 20 MV NEW - CONSTRUCTION / RENOVATION
0.1 OHM NEW - CONSTRUCTION / RENOVATION

Room No.	AREA TYPE Description (C) = CRITICAL CARE (G) = GENERAL CARE	VOLTAGE MEASUREMENT			IMPEDANCE MEASUREMENT		REMARKS - IF VOLTAGE READINGS MORE THAN 20MV IN EXISTING CONST. NOTE TESTS & INVESTIGATION REQUIRED.
		NO. OF RECEPTS.	NO. OF OTHER	MAX. READING IN MILIVOLTS	NO. OF RECEPTS.	MAX READING IN OHMS	

SECTION 16073 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. Fabco Plastics Wholesale Limited.
    d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 9 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 16073

SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.
2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Arc Flash: Provide permanent warning labels on all electrical switchboards, switchgear, electrical panels, meter socket enclosures, and motor control centers, to warn personnel of potential electric arc flash hazards per NEC 110.16. The Owner shall determine the potential for arc flash hazard level in accordance with NFPA 70E and OSHA.

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior concrete and masonry primer.
2) Finish Coats: Exterior semigloss acrylic enamel.

2. Exterior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Exterior semigloss acrylic enamel.

3. Exterior Ferrous Metal:

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

4. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.
2) Finish Coats: Exterior semigloss alkyd enamel.

5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior concrete and masonry primer.
2) Finish Coats: Interior semigloss alkyd enamel.

6. Interior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.
2) Finish Coats: Interior semigloss acrylic enamel.

7. Interior Gypsum Board:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior gypsum board primer.
2) Finish Coats: Interior semigloss acrylic enamel.

8. Interior Ferrous Metal:

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior ferrous-metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

9. Interior Zinc-Coated Metal (except Raceways):

a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.

1) Primer: Interior zinc-coated metal primer.
2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

D. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Fire Alarm System: Red.
2. Fire-Suppression Supervisory and Control System: Red and yellow.
3. Combined Fire Alarm and Security System: Red and blue.
4. Security System: Blue and yellow.
5. Mechanical and Electrical Supervisory System: Green and blue.
6. Telecommunication System: Green and yellow.
7. Control Wiring: Green and red.

E. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

G. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

M. Engraved Plastic Laminate Nameplates:

1. 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.

    a. black face with white core plies (letter color) for normal systems

2. Punch for mechanical fastening, except where adhesive mounting is necessary because of substrate.
3. Material thickness shall be 1/16 inch. Titles shall be 1/2 inch high and all other lettering shall be 1/4 inch high.
4. Provide beveled edge in order to eliminate sharp corners.
5. 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.

N. Labeling Instructions:

1. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
2. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
3. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

O. Equipment to Be Labeled:
1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards.
4. Transformers.
5. Electrical substations.
6. Emergency system boxes and enclosures.
7. Motor-control centers.
8. Disconnect switches.
9. Enclosed circuit breakers.
10. Motor starters.
11. Push-button stations.
12. Power transfer equipment.
13. Contactors.
14. Remote-controlled switches, dimmer modules, and control devices.
15. Battery inverter units.
16. Battery racks.
17. Power-generating units.
18. Voice and data cable terminal equipment.
19. Fire-alarm control panel and annunciators.
20. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
21. Monitoring and control equipment.
22. Uninterruptible power supply equipment.
23. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

24. Light switch cover plate. Provide 3/16 inch engraved and "filled in" lettering indicating panelboard and circuit number "where fed from" for all switches. Fill red coverplates with white filler. Fill white coverplates with black filler.
25. Receptacle coverplate: Provide 3/16 inch engraved and "filled in" lettering indicating panelboard and circuit number "where fed from" for all receptacles. Fill red coverplates with white filler. Fill white coverplates with black filler.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

1. Use following colors for color bands and for color coding:

System	Color
Normal Power	Royal Blue
Miscellaneous Comm	Brown
Fire Alarm	Red
Telephone\Computer	Black

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION 16075

SECTION 16091 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content.
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 16091

SECTION 16120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

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

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Aluminum and Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.4 SLEEVE SEALS

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger; except for specific grounding and bonding purposes.

B. Branch Circuits: Copper. Stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger; except for specific grounding and bonding purposes.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

M. Class 1 Control Circuits: Type THHN-THWN, in raceway.

N. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Electrical Supports and Seismic Restraints."

F. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 7 Section "Through-Penetration Firestop Systems."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 16120

SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. EMT: Electrical metallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. GRC: Galvanized rigid steel conduit.

F. IMC: Intermediate metal conduit.

G. LFMC: Liquidtight flexible metal conduit.

H. LFNC: Liquidtight flexible nonmetallic conduit.

I. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings:

1. For custom enclosures and cabinets.
2. Include plans, elevations, sections, and attachment details.
3. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel.
    b. Type: Setscrew.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. RTRC: Comply with UL 1684A and NEMA TC 14.

F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Comply with UL 514B.

H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 4X 316 SS unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be stainless steel 316 & listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Moulded Products, Inc.
2. Hoffman; a Pentair company.
3. Lamson & Sessions; Carlon Electrical Products.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Civil Engineer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Mono-Systems, Inc.
    b. Panduit Corp.
    c. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hubbell Incorporated; Wiring Device-Kellems Division.
    b. Mono-Systems, Inc.
    c. Panduit Corp.

d. Wiremold / Legrand.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

2. Material: Galvanized steel with ivory baked-enamel finish.
3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.
17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, round.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

N. Gangable boxes are allowed.

O. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

P. Cabinets:

1. NEMA 250, Type 4 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. NEMA 250 Type 4x stainless (316).
3. Hinged door in front cover with flush latch and concealed hinge.
4. Key latch to match panelboards.
5. Metal barriers to separate wiring of different systems and voltage.

6. Accessory feet where required for freestanding equipment.
7. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation; Hubbell Power Systems.
    d. NewBasis.
    e. Oldcastle Precast, Inc.; Christy Concrete Products.
    f. Strongwell / Quazite.
    g. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: EPC-80-PVC.
3. Underground Conduit: Type EPC-80-PVC, concrete encased. ARC underground and encased conduits shall be bistumastic coated. RMC underground conduits should have supplemental coating
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X SS 316.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: RNC.
2. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC or PVC Sch. 80.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Division 16 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. A. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from **RNC** to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.

3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 2 Section "Earthwork."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Division 16 Section "Electrical Identification."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 16 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

SECTION 16269 - VARIABLE FREQUENCY CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. Related Sections:

1. Division 16 Section "Motor-Control Centers" for VFCs installed in motor-control centers.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCP: Motor-circuit protector.

I. NC: Normally closed.

J. NO: Normally open.

K. OCPD: Overcurrent protective device.

L. PCC: Point of common coupling.

M. PID: Control action, proportional plus integral plus derivative.

N. PWM: Pulse-width modulated.

O. RFI: Radio-frequency interference.

P. TDD: Total demand (harmonic current) distortion.

Q. THD(V): Total harmonic voltage demand.

R. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of enclosed unit.
f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
g. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

B. Qualification Data: For qualified testing agency.

C. Product Certificates: For each VFC, from manufacturer.

D. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating

scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

E. Source quality-control reports.

F. Field quality-control reports.

G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.

H. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than and not exceeding.
2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
3. Humidity: Less than 95 percent (non-condensing).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Civil Engineer no fewer than two days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary electrical service.
3. Do not proceed with interruption of electrical systems without Civil Engineer's written permission.
4. Comply with NFPA 70E.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.11 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.
2. Ratings and characteristics of supply circuit and required control sequence.
3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Yaskawa Electric America, Inc; Drives Division.
3. ABB.
4. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: Constant torque and variable torque.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 5 percent.

3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 97 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 65 kA.
7. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.
8. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
9. Humidity Rating: Less than 95 percent (noncondensing).
10. Altitude Rating: Not exceeding 3300 feet.
11. Vibration Withstand: Comply with IEC 60068-2-6.
12. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
14. Speed Regulation: Plus or minus 10 percent.
15. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.
2. Signal: Pneumatic.

J. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.

10. Short-circuit protection.
11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Q. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
3. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
5. NC alarm contact that operates only when circuit breaker has tripped.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

    a. A minimum of two programmable analog inputs: 4- to 20-mA dc.
    b. A minimum of six multifunction programmable digital inputs.

2. Pneumatic Input Signal Interface: 3 to 15 psig.
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

    a. 0- to 10-V dc.
    b. 4- to 20-mA dc.
    c. Potentiometer using up/down digital inputs.
    d. Fixed frequencies using digital inputs.

4. Output Signal Interface: A minimum of one programmable analog output signal(s) (4- to 20-mA dc), which can be configured for any of the following:

    a. Output frequency (Hz).
    b. Output current (load).
    c. DC-link voltage (V dc).

d. Motor torque (percent).
e. Motor speed (rpm).
f. Set point frequency (Hz).

5. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

a. Motor running.
b. Set point speed reached.
c. Fault and warning indication (overtemperature or overcurrent).
d. PID high- or low-speed limits reached.

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: One.

G. SCADA (Emerson CWM PAC PLC will be used for this project) Interface: Factory-installed hardware and software to enable the SCADA to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.
2. Embedded SCADA Protocols for Network Communications:Modbus, Modbus/Memobus; protocols accessible via the communications ports.
3. Any interfaces from VFD’s to the CWM PAC shall be via Modbus TCP or Modbus Serial connections.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of all VFCs to less than 5 percent and THD (V) to 5 percent.

B. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD (V) at the defined PCC per IEEE 519.

C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

C. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.

D. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

E. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

F. Bypass Contactor Configuration: Reduced-voltage (autotransformer) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: 100 VA.

6. Overload Relays: NEMA ICS 2.

    a. Solid-State Overload Relays:

        1) Switch or dial selectable for motor-running overload protection.
        2) Sensors in each phase.
        3) Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
        4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
        5) Analog communication module.

    b. NC isolated overload alarm contact.
    c. External overload reset push button.

2.5 OPTIONAL FEATURES

A. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications, when overload protection activates.

1. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
2. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
3. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.

B. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

C. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

D. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station, this password-protected input:

1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
3. Forces VFC to transfer to Bypass Mode and operate motor at full speed.
4. Causes display of Override Mode on the VFC display.
5. Reset VFC to normal operation on removal of override signal automatically.

E. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

F. Remote digital operator kit.

G. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.6 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 12.
2. Outdoor Locations: Type 4X.
3. Other Wet or Damp Indoor Locations: Type 4.

2.7 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.

a. Push Buttons: Covered.
b. Pilot Lights: LED types; push to test.
c. Selector Switches: Rotary type.
d. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. Reversible NC/NO bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

E. Supplemental Digital Meters:

1. Elapsed-time meter.
2. Kilowatt meter.
3. Kilowatt-hour meter.

F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

H. Cooling Fan and Exhaust System: For NEMA 250, Type 12; UL 508 component recognized: Supply fan, with stainless steel intake and exhaust grills and filters; 120 -V ac; obtained from integral CPT.

I. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

J. Spare control-wiring terminal blocks; wired.

2.8 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

B. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 16 Section "Hangers and Supports for Electrical Systems."

C. Floor-Mounting Controllers: Install VFCs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Division 3 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

1. Curbs and roof penetrations are specified in Division 7 Section "Roof Accessories."
2. Structural-steel channels are specified in Division 16 Section "Hangers and Supports for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses in each fusible-switch VFC.

G. Install fuses in control circuits if not factory installed. Comply with requirements in Division 16 Section "Fuses."

H. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

I. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

J. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Division 16 Section "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Civil Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Civil Engineer before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Division 16 Section "Overcurrent Protective Device Coordination."

F. Set field-adjustable pressure switches.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 16269

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Civil Engineer no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Civil Engineer’s written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Siemens Energy & Automation, Inc.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 12.
2. Outdoor Locations: NEMA 250, Type 4X.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
5. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 16 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

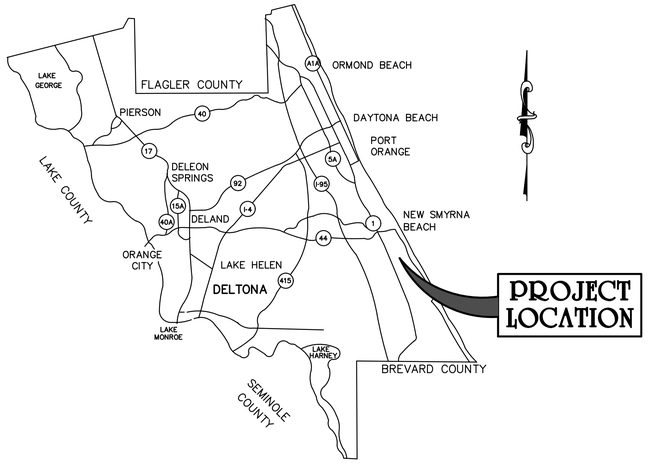
3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 16 Section "Overcurrent Protective Device Coordination".

END OF SECTION 16410

CITY of
EDGEWATER, FLORIDA



City of EDGEWATER Florida

MAYOR:	**MICHAEL IGNASIAK**
DISTRICT 1 COUNCILWOMAN	**CHRISTINE POWER**
DISTRICT 2 COUNCILWOMAN	**GIGI BENNINGTON**
DISTRICT 3 COUNCILMAN	**DAN BLAZI**
DISTRICT 4 COUNCILMAN	**GARY CONROY**
CITY MANAGER:	**TRACEY BARLOW**

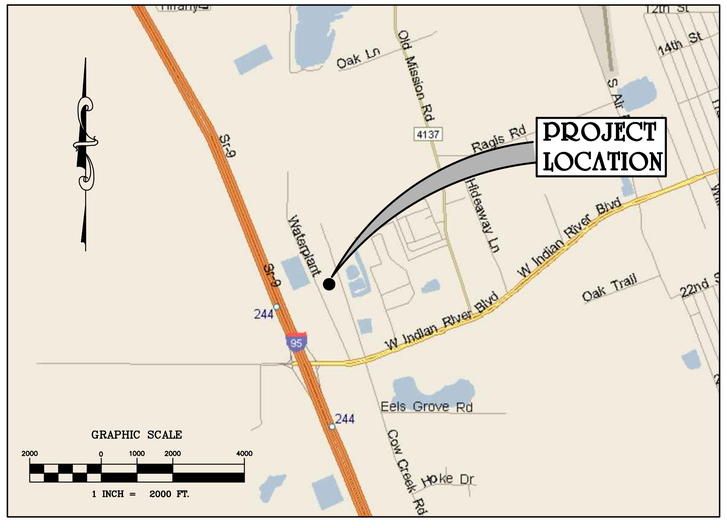
WATER TREATMENT PLANT
HIGH SERVICE PUMP
VFD UPGRADES

BID No. 17-ES-001

BID SET

OCTOBER 2016

INDEX



VICINITY MAP

(SECTION 5, TOWNSHIP 18 SOUTH, RANGE 34 EAST)

FLORIDA CERTIFICATE–of–AUTHORIZATION No. 626
phone: (386) 761–6810 fax: (386) 761–3977
P.O. DRAWER 290247, PORT ORANGE, FLORIDA 32129–0247

Prepared by:
QUENTIN L. HAMPTON ASSOCIATES, INC.
CONSULTING ENGINEERS
P.O. DRAWER 290247 PORT ORANGE, FL. 32129-0247
(386) 761-6810

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN ALTERED IN SIZE BY REPORDUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

ELECTRICAL SYMBOL LEGEND

BASIC MATERIALS

SYMBOL	DESCRIPTION
	DUPLEX RECEPTACLE
	FLOOR OUTLET BOX AND DUPLEX RECEPTACLE WITH APPROPRIATE FLANGE.
	FLOOR OUTLET BOX WITH DUPLEX RECEPTACLE AND ONE COMBINATION W/ VOICE/DATA OUTLET
	FLOOR OUTLET BOX WITH TWO DUPLEX RECEPTACLES AND ONE COMBINATION W/ VOICE/DATA OUTLET
	DUPLEX RECEPTACLE MOUNTED ABOVE COUNTER
	DUPLEX RECEPTACLE WITH TOP HALF SWITCHED
WP	GFI RECEPTACLE. WP DENOTES UL LISTED AS WEATHERPROOF IN USE AND UL LISTED WEATHER RESISTANT. MOUNTED AT 48" AFF.
	GFI RECEPTACLE MOUNTED ABOVE COUNTER
	TWO DUPLEX RECEPTACLES WITH COMMON COVER
	TWO DUPLEX RECEPTACLES WITH COMMON COVER MOUNTED ABOVE COUNTER
IG	ISOLATED GROUND DUPLEX RECEPTACLE, (ORANGE DEVICE)
	DUPLEX RECEPTACLE
	NOTE: TICK MARKS SHOWN ON ANY DEVICE REPRESENTS RECEPTACLE CONNECTED TO THE EMERGENCY CIRCUIT (RED DEVICE) TYPICAL FOR ANY DEVICE IN LEGEND
	SPECIAL PURPOSE RECEPTACLE, RATING AS NOTED
	LIGHTING CONTROL TIME CLOCK
	PHOTOCELL, MOUNTED ON ROOF FACING NORTH
GND	GROUND BAR
J	JUNCTION BOX
J	JUNCTION BOX- WALL MOUNTED
SPD	SURGE PROTECTION DEVICE
ST	SHUNT-TRIP BUTTON - FLUSH MOUNTED UNLESS OTHERWISE NOTED NEMA 3R FOR EXTERIOR LOCATIONS
	MAGNETIC MOTOR STARTER OR CONTACTOR SIZE AS NOTED
5	MOTOR CONNECTION, NUMBER DENOTES HORSEPOWER
VFD	VARIABLE FREQUENCY DRIVE
DDC	DIRECT DIGITAL CONTROL PANEL
T	TRANSFORMER
	AUTOMATIC TRANSFER SWITCH
30AR / NF	NON-FUSED DISCONNECT SWITCH, SIZE AS NOTED NF DENOTES NON-FUSED
30AR / 20AF	FUSED DISCONNECT AR DENOTES AMP RATING OF SWITCH AF DENOTES AMP FUSE SIZE, * DENOTES SIZE PER MANUFACTURER RECOMMENDATIONS.
MCP SIZE, # OF POLES, 3003 / 0, 3R	COMBINATION MAGNETIC MOTOR STARTER, SIZE & # OF POLES 3 POLE UNLESS OTHERWISE NOTED; ENCLOSURE NEMA RATING; NEMA STARTER SIZE

BASIC MATERIALS CONT.

SYMBOL	DESCRIPTION
	BRANCH CIRCUIT PANELBOARD, UNDER 250 VOLTS, SURFACE MOUNTED
	BRANCH CIRCUIT PANELBOARD, UNDER 250 VOLTS, FLUSH MOUNTED
	BRANCH CIRCUIT PANELBOARD, OVER 250 VOLTS, SURFACE MOUNTED
	BRANCH CIRCUIT PANELBOARD, OVER 250 VOLTS, FLUSH MOUNTED
	BRANCH CIRCUIT CONDUIT CONCEALED ABOVE CEILING OR IN WALL. CONDUIT SHALL INCLUDE PHASE, NEUTRAL AND GROUND CONDUCTORS AS REQUIRED FOR CIRCUITS (UNLESS OTHERWISE NOTED).
	GROUND ROD 3/4" x 20'
UP	CONDUIT TURNING UP
DN	CONDUIT TURNING DOWN
	CONDUIT STUB
	CONDUIT CONTINUED
	EQUIPMENT TO BE DEMOLISHED
	EXISTING EQUIPMENT TO REMAIN
	NEW EQUIPMENT AND DEVICES
	4" CONDUIT SLEEVES
	GROUND BUS
XX	DISCRETE CONTROL CABLES IN 1" CONDUIT. "XX" INDICATES NUMBER OF CABLES. 19 STRAND #16 AWG THHN - THWN 90° INSTALLATION.
XX	ANALOG CONTROL CABLES IN 1" CONDUIT. "XX" INDICATES NUMBER OF CABLES. BELDEN #8760 OR EQUAL.
XX	CAT 6 CABLES IN 1" CONDUIT. "XX" INDICATES NUMBER OF CABLES.
XX	12 STRAND MM FIBER CABLE IN 1" CONDUIT. "XX" INDICATED NUMBER OF CABLES.

TELEPHONE/COMPUTER RACEWAY SYSTEM

C X N N	MOUNTING 2" ABOVE COUNTER OR BACK SPLASH X = MOUNTING (F)LUSH, (S)URFACE, (M)ODULAR FURNITURE ADAPTER (P)OLE, (R)ACEWAY, (D)OUBLE GANG FLUSH, (PD) PEDESTAL N = # OF VOICE JACKS N = # OF CAT 6 CABLE DATA/COMM OUTLET WITH FLUSH MOUNTED 4" SQUARE SINGLE GANG JUNCTION BOX. PROVIDE COVER PLATE. EXTEND 1" CONDUIT TO ELECTRICAL ROOM NEAR TELEPHONE TERMINAL BOARD AND STUB-OUT WITH PLASTIC BUSHING. INSTALL (2) CAT5e CABLE FROM OUTLET TO PATCH PANEL IN SERVERS ROOM.
	TELEPHONE OUTLET WITH FLUSH MOUNTED 4" SQUARE SINGLE GANG JUNCTION BOX. PROVIDE COVER PLATE. EXTEND 1" CONDUIT TO TELEPHONE TERMINAL BOARD AND STUB-OUT WITH PLASTIC BUSHING. INSTALL (2) CAT5e CABLE FROM OUTLET TO PATCH PANEL IN SERVERS ROOM.
TTB	TELEPHONE/COMPUTER TERMINAL BOARD
TTC	TELEPHONE TERMINAL CABINET

NOTE: SOME SYMBOLS SHOWN ON THIS LEGEND MAY NOT PERTAIN TO THIS PROJECT.

ELECTRICAL DEMOLITION NOTES

1. DEVICES, LIGHT FIXTURES AND EQUIPMENT SHOWN IN DASHED LINE TYPE ARE EXISTING TO BE DEMOLISHED; DEVICES, LIGHT FIXTURES AND EQUIPMENT SHOWN IN LIGHT SOLID LINE TYPE ARE EXISTING TO REMAIN, UNLESS OTHERWISE NOTED.
2. EXISTING EQUIPMENT, LIGHT FIXTURES, DEVICES SHOWN ARE BASED ON FIELD SURVEYS AND RECORD DRAWINGS PROVIDED BY THE OWNER, AND IS NOT NECESSARILY ALL INCLUSIVE IN EVERY AREA AS FAR AS EXISTING ELECTRICAL EQUIPMENT, LIGHT FIXTURES AND DEVICES. EXISTING CIRCUITING SHOWN IS BASED ON RECORD DRAWINGS AND THE SURVEYED PANEL DIRECTORIES, WHERE THEY WERE AVAILABLE. THE ACTUAL CONDITIONS MAY VARY. ALL EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO BID. THE CONDITIONS SHOWN ARE INTENDED TO SHOW THE LOCATIONS OF EXISTING DEVICES, LIGHT FIXTURES AND EQUIPMENT, WHERE SHOWN ON THE PLAN DRAWINGS, AND IN NO WAY RELIEVES THE CONTRACTOR FROM PROVIDING ANY AND ALL COORDINATION NECESSARY TO COMPLETE THE NEW WORK. FIELD CONDITIONS SHALL GOVERN.
3. WHERE EXISTING DEVICES ARE INDICATED TO REMAIN, LOCATED WITHIN THE SCOPE OF THIS PROJECT AND EXISTING CIRCUITING INFORMATION IS UNAVAILABLE, CONTRACTOR IS TO PROVIDE CIRCUIT TRACING TO IDENTIFY PANEL AND CIRCUIT DEVICES ARE CONNECTED TO AND PROVIDE THAT INFORMATION TO A/E PRIOR TO ROUTING CONDUITS AND WIRING FOR NEW DEVICES AND EQUIPMENT WITHIN THE SCOPE OF THIS PROJECT.
4. WHERE EXISTING DEVICES ARE INDICATED TO REMAIN, IT IS THE INTENT THAT THE EXISTING HOMERUN CIRCUIT BE INTERCEPTED AT THE EXISTING SOURCE PANEL AND EXTENDED TO A NEW PANEL OR RELOCATED EXISTING PANEL DURING THE APPROPRIATE PHASING DURING CONSTRUCTION, WHERE NEW APPLICABLE TO ELECTRICAL DISTRIBUTION SYSTEM. CONTRACTOR IS TO PROVIDE CIRCUIT TRACING AND IDENTIFY CIRCUITS AND PANELBOARDS WHERE NECESSARY TO VERIFY EXISTING CIRCUIT TERMINATIONS.
5. WHERE EXISTING DEVICES ARE TO REMAIN, CONTRACTOR MUST EXTEND EXISTING CIRCUITING WHERE NECESSARY TO MAINTAIN CONTINUITY OF CIRCUIT.
6. COORDINATE WITH THE OWNER FOR DISPOSITION OF ELECTRICAL ITEMS TO BE DEMOLISHED. OWNER SHALL HAVE THE OPTION TO RETAIN REUSABLE ITEMS SUCH AS COVERPLATES, RECEPTACLES, LIGHT FIXTURES, PANELBOARDS, TRANSFORMERS, ETC. NOT BEING USED IN THE FINISHED WORK. COORDINATE WITH THE OWNER PRIOR TO START OF DEMOLITION. PROPERLY AND LEGALLY DISPOSE OF ALL EQUIPMENT AND MATERIALS BEING REMOVED.
7. COORDINATE EXACT AREAS, WALLS, CEILINGS, ETC. TO BE DEMOLISHED WITH ARCHITECTURAL, STRUCTURAL, PLUMBING AND MECHANICAL DEMOLITION PLANS.
8. WHERE EXISTING DEVICES, LIGHT FIXTURES AND EQUIPMENT ARE INDICATED TO BE DEMOLISHED, REMOVE ASSOCIATED CONDUIT AND WIRING BACK TO SOURCE PANEL OR TO NEAREST JUNCTION BOX TO MAINTAIN CIRCUIT CONTINUITY OF DEVICES TO REMAIN AND EQUIPMENT TO REMAIN. WHERE PANELS ARE TO BE REMAIN, TURN BREAKER TO "OFF" POSITION AND LABEL THE CIRCUIT AS "SPARE" ON THE PANEL DIRECTORY.
9. ALL AREAS OUTSIDE THE SCOPE OF CONSTRUCTION ARE TO REMAIN ENERGIZED. COORDINATE PHASING WITH CONSTRUCTION MANAGER AND OWNER PRIOR TO DEMOLITION WHICH MAY RESULT IN INTERRUPTION OF POWER.
10. REMOVE ALL CONDUIT LEFT EXPOSED BY REMOVAL OF WALLS AND CEILINGS IN REMODELED OR RENOVATED AREA. CAP BOTH ENDS OF REMAINING CONDUIT IN WALL OR FLOOR WHERE CUT.
11. ELECTRICAL DEVICES CONCEALED BY STORAGE SHELVING, CASEWORK, FURNITURE, ETC., AND NOT NOTED ON THE DEMOLITION DRAWINGS ARE TO BE REMOVED AS REQUIRED, UNLESS SHOWN AS EXISTING TO REMAIN.
12. CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING ALL OPENINGS IN EXISTING CONSTRUCTION AFTER REMOVAL OF EQUIPMENT AND ELECTRICAL DEVICES, UNLESS OTHERWISE NOTED ON ARCHITECTURAL PLANS. REPAIRS ARE TO BE DONE TO LOGICAL EDGES OF SURFACES AFFECTED AND SHALL MATCH IMMEDIATE ADJACENT AREAS IN CONSTRUCTION, MATERIAL, FIRE RATING, FINISH AND COLOR.
13. PROVIDE BLANK COVERPLATES WHERE DEVICES ARE BEING REMOVED FROM EXISTING WALLS TO REMAIN. MATCH COLOR OF NEW ADJACENT DEVICE COVERPLATES.
14. FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS PRIOR TO COMMENCEMENT OF WORK AND OBTAIN CLARIFICATIONS FROM ARCHITECT/ENGINEER IF NECESSARY.
15. COORDINATE SERVICE INTERRUPTION WITH CONSTRUCTION MANAGER, OWNER, LANDLORD, AND UTILITY COMPANY, WHERE APPLICABLE, AND DO NOT INTERRUPT POWER WITHOUT WRITTEN PERMISSION. PROVIDE A MINIMUM OF ONE WEEK'S WRITTEN NOTIFICATION WHEN POWER IS DESIRED TO BE INTERRUPTED.
16. EXERCISE EXTREME CAUTION WHEN REMOVING/ RELOCATING WIRING AND EQUIPMENT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT OTHER WIRING DEVICES, EQUIPMENT AND LIGHT FIXTURES THAT MAY BE CONNECTED TO THE SAME CIRCUIT REMAIN OPERATIONAL AND ACTIVE.
17. INFORMATION INDICATED IN THE DEMOLITION PORTION OF THE CONTRACT DRAWINGS IS DIAGRAMMATIC IN NATURE. FIELD VERIFY ELECTRICAL CIRCUIT HOMERUNS TO ALL ELECTRICAL ITEMS SCHEDULED TO BE DEMOLISHED AND PERFORM THE WORK AS INTENDED AND DEPICTED ON THE DRAWINGS.
18. UPDATE ALL EXISTING ELECTRICAL EQUIPMENT NAMEPLATES AND DIRECTORIES AS NECESSARY TO REFLECT FINAL AS-BUILT CONDITIONS AT THE END OF CONSTRUCTION.
19. STORE ITEMS INDICATED TO BE RETURNED TO THE OWNER IN A DRY, CLEAN AND PROTECTED AREA. NOTIFY OWNER WHEN ITEMS ARE READY TO BE REMOVED.
20. COORDINATE ANY ALTERATION AND CHANGES TO THE ELECTRICAL SERVICE WITH THE LOCAL UTILITY COMPANY AND THE OWNER PRIOR TO COMMENCEMENT OF WORK.
21. SCHEDULE ALL POWER INTERRUPTION WITH OWNER FOR EXACT DATE, TIME AND DURATION. PROVIDE A MINIMUM OF 72 HOURS NOTICE PRIOR TO DISCONNECTING ANY POWER TO ANY PORTION OF THE BUILDING, AND MAKE ARRANGEMENTS TO MAINTAIN POWER TO ALL CRITICAL EQUIPMENT AS NEEDED AND REQUESTED BY THE OWNER PRIOR TO COMMENCEMENT OF WORK.
22. PROVIDE ANY NECESSARY REPROGRAMMING OF EXISTING BUILDING FIRE ALARM SYSTEMS TO DISABLE FIRE ALARM DEVICES THAT ARE BEING DISCONNECTED AND REMOVED, AND FOR ANY NEW DEVICES THAT ARE ADDED, AS PART OF BID PRICE.
23. THE DEMOLITION PLAN IS NOT INCLUSIVE OF ALL ELECTRICAL DEVICES WITHIN THE PROJECT AREA. IT IS INTENDED TO PROVIDE A GENERAL KNOWLEDGE OF THE EXISTING CONDITIONS WITHIN THE PROJECT AREA. ANY DISCREPANCIES OR CONDITIONS NOT SHOWN ON THE PLAN SHALL BE BROUGHT TO THE ATTENTION OF THE A/E. THE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED ELECTRICAL DEMOLITION WHETHER INDICATED ON THE PLANS OR NOT.
24. ALL CONDUITS SERVING OTHER SPACES THAT RUN THROUGH THE PROJECT AREA SHALL REMAIN ACTIVE DURING CONSTRUCTION SO AS NOT TO CAUSE DISRUPTION TO THESE OTHER SPACES. ENSURE THAT ALL CONDUITS, NEW OR EXISTING WITHIN THE PROJECT AREA ARE PROPERLY SUPPORTED WITH BONDING BUSHINGS IN ACCORDANCE WITH THE NEC.
25. REMOVE ALL ABANDONED WIRING AND CONDUIT THAT IS WITHIN THE PROJECT AREA PRIOR TO THE END OF CONSTRUCTION.

GENERAL NOTES:

1. ALL WORK AND EQUIPMENT UNDER DIVISION 26 AND 27 SHALL BE IN STRICT COMPLIANCE WITH THE CODES, STANDARDS AND PRACTICES LISTED HEREIN, AND THEIR RESPECTIVE DATES ARE FURNISHED AS THE MINIMUM LATEST REQUIREMENTS.
   1. STATE OF FLORIDA.
   2. LIFE SAFETY CODE - NFPA 101.
   3. UNDERWRITERS LABORATORIES, INC. PUBLICATIONS
   4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).
   5. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).
   6. NATIONAL ELECTRICAL CODE - NFPA 70.
   7. INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE).
   8. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA).
   9. REQUIREMENTS OF LOCAL POWER COMPANY.
   10. 2010 FLORIDA BUILDING CODE.
   11. THE AMERICANS WITH DISABILITIES ACT (ADA)
   12. FLORIDA ACCESSIBILITY CODE.
   13. CITY LOCAL CODES.
2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
3. COORDINATE OUTLET BOX LOCATIONS WITH MASONRY TO MINIMIZE CUTTING OF BRICK OR BLOCK.
4. ALL MOUNTING HEIGHTS TO CENTERLINE OF DEVICE UNLESS OTHERWISE NOTED. VERIFY ALL OUTLET LOCATIONS ON THE JOB PRIOR TO ROUGH-IN.
5. WHEN INCREASED CONDUCTOR SIZES ARE SHOWN ON THE PLANS, THE LARGER CONDUCTOR SIZE SHALL BE USED THROUGHOUT THE LENGTH OF THE CIRCUIT, INCLUDING NEUTRAL AND GROUND.
6. ALL CONDUITS SHALL BE PVC.
7. EACH BRANCH CIRCUIT RACEWAY SHALL HAVE A FULL SIZE EQUIPMENT GROUND CONDUCTOR. WHERE ISOLATED GROUND CIRCUITS ARE SHOWN ON THE PLANS. PROVIDE AN ISOLATED GROUND CONDUCTOR THROUGHOUT THE LENGTH OF THE CIRCUIT IN ADDITION TO THE PHASE, NEUTRAL AND EQUIPMENT GROUND CONDUCTORS.
8. ALL BRANCH CIRCUIT HOMERUNS SHALL BE ROUTED IN 3/4"C. MINIMUM.
9. EQUIPMENT SHALL BE OF MATERIALS SUITABLE FOR AND RATED FOR THE ENVIRONMENT IN WHICH THEY ARE TO BE INSTALLED, WITH APPROPRIATE NEMA ENCLOSURE RATING.
   A. WORKING CLEARANCES AND DEDICATED SPACE FOR ELECTRICAL EQUIPMENT SHALL BE IN COMPLIANCE WITH NEC 110.
10. WHEN ELECTRICAL BOXES ARE LOCATED IN VERTICAL FIRE-RESISTIVE ASSEMBLIES, (CLASSIFIED AS FIRE/SMOKE AND SMOKE PARTITIONS), THEY SHALL BE INSTALLED WITHOUT AFFECTING THE FIRE CLASSIFICATION. ALL OF THE FOLLOWING CONDITIONS SHALL BE MET:
    A. ALL ELECTRICAL BOXES SHALL BE METALLIC.
    B. BOX OPENING SHALL OCCUR ONLY ON ONE SIDE OF FRAMING SPACE.
    C. BOX OPENING SHALL NOT EXCEED 16 SQUARE INCHES.
    D. ALL CLEARANCES BETWEEN OUTLET BOX AND GYPSUM BOARD SHALL BE COMPLETELY FILLED WITH JOINT COMPOUND (OR OTHER APPROVED MATERIAL).
    E. PROVIDE A WALL AROUND OUTLETS LARGER THAT 16 SQUARE INCHES. THE INTEGRITY OF THE WALL RATING SHALL BE MAINTAINED.
    F. THE TOTAL AGGREGATE SURFACE AREA OF THE BOXES SHALL NOT EXCEED 100 SQUARE INCHES PER 100 SQUARE FEET.
    G. OUTLET BOXES LOCATED ON OPPOSITE SIDES OF FIRE-RESISTIVE ASSEMBLIES SHALL BE SEPARATED BY A MINIMUM HORIZONTAL DISTANCE OF 24 INCHES.
    H. OUTLET BOXES SHALL BE SECURELY FASTENED TO WALL FRAMING MEMBERS.
    I. THE OPENING IN THE GYPSUM BOARD FACING SHALL BE CUT NOT TO EXCEED 1/8 INCH BETWEEN THE EDGES OF THE OUTLET BOX AND THE EDGES OF THE OPENING.
11. ALL DEVICES SHALL BE MOUNTED VERTICAL, UNLESS OTHERWISE NOTED.
12. ALL RECEPTACLES SHALL BE MOUNTED SUCH THAT THE GROUND PIN IS MOUNTED UP.
13. ALL BRANCH CIRCUIT CONDUITS SHALL CONTAIN A MINIMUM OF (2) #12AWG INSULATED COPPER CONDUCTORS, PLUS A MINIMUM OF (1) #12AWG GROUND WIRE UNLESS OTHERWISE NOTED. ALL BRANCH CIRCUITS AND FEEDERS SHALL HAVE INDIVIDUAL NEUTRAL CONDUCTORS.
14. COORDINATE THE LOCATION OF ALL DEVICES AND BOXES WITH WINDOWS, BUILT-INS, AND CABINETS PRIOR TO INSTALLATION OF CONDUITS OR BOXES. CONTRACTOR SHALL CONSULT ALL CONTRACT DRAWINGS TO VERIFY CONFLICTS PRIOR TO BIDDING.
15. LOCATIONS OF EQUIPMENT SPECIFIED BY OTHER TRADES OR PROVIDED BY OWNER ARE APPROXIMATE. COORDINATE EXACT LOCATIONS IN FIELD PRIOR TO ROUGHING IN AND ROUTING CONDUIT.
16. CONTRACTOR SHALL UPSIZE FEEDER AND BRANCH CIRCUIT WIRE SIZE AS REQUIRED TO COMPENSATE VOLTAGE DROP FROM LENGTHENING OF CIRCUITS DUE TO FIELD ROUTING. FINAL INSTALLATION SHALL MEET FLORIDA BUILDING CODE REQUIREMENT OF: MAXIMUM BRANCH CIRCUIT VOLTAGE DROP OF 3%:
17. ELECTRICAL CONTRACTOR SHALL PROVIDE COORDINATION SHOP DRAWINGS WITH PLUMBING, FIRE PROTECTION, AND MECHANICAL DEMONSTRATING COMPLIANCE WITH DEDICATED SPACE AND WORKING CLEARANCE PER NEC.
18. CONTRACTOR SHALL PROVIDE WITHIN 30 DAYS AFTER THE DATE OF SYSTEM ACCEPTANCE RECORD DRAWINGS OF THE ACTUAL INSTALLATION INCLUDING: SINGLE LINE DIAGRAM OF THE BUILDING ELECTRICAL DISTRIBUTION SYSTEM AND FLOOR PLANS INDICATING LOCATION AND AREA SERVED FOR ALL DISTRIBUTION.
19. TO THE BEST OF THE ENGINEER'S KNOWLEDGE, THESE PLANS AND SPECIFICATIONS COMPLY WITH THE 2010 FLORIDA BUILDING CODE AND THE FLORIDA FIRE PREVENTION CODE (2010) AND ALL LOCAL CODES AND ORDINANCES.
20. CONTRACTOR SHALL PROVIDE TEMPORARY ELECTRICAL SERVICE FOR USE BY ALL TRADES DURING CONSTRUCTION. REMOVE TEMPORARY POWER AT THE COMPLETION OF THE PROJECT. CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS TO OBTAIN TEMPORARY ELECTRICAL SERVICE.
21. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL CONDUITS, BACK BOXES, RACEWAYS, SLEEVES, SITE CONDUIT DUCT BANKS AND MANHOLES FOR THE TELECOMMUNICATIONS SYSTEM. THE STRUCTURED CABLING CONTRACTOR (SCC) SHALL PROVIDE AND INSTALL THE WIRE AND CABLE FOR THE SYSTEMS THEY ARE INSTALLING. THE SCC SUPERVISE THE CONDUIT INSTALLATION AND VERIFY EXACT BACK BOX LOCATIONS AND CONDUIT STUB-UP LOCATIONS IN THE EQUIPMENT ROOMS.
22. EQUIPMENT SHUTDOWN RELAY SHALL BE LOCATED WITHIN 3 FEET OF THE EQUIPMENT CONTROLS AND THE WIRING TO THE RELAY SHALL BE MONITORED.
23. PROVIDE PERMANENT LABEL ON ALL PANELS STATING "DO NOT WORK ON EQUIPMENT WHILE ENERGIZED, LOCK-OUT TAG-OUT REQUIRED".

874 Dixon Boulevard
Cocoa, FL 32922
Phone: 321-636-0274
Fax: 321-639-8986
ENGINEERING FOR ARCHITECTURE www.tlc-engineers.com

COA #15 TLC NO: 516059

No.	BY	REVISIONS	DATE

QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS
FLORIDA CERTIFICATE-of-AUTHORIZATION No. 626
PHONE: (386) 761-6810 FAX: (386) 761-3977
P.O. DRAWER 290247, PORT ORANGE, FL. 32129-0247

CITY of EDGEWATER
VOLUSIA COUNTY, FLORIDA

WATER TREATMENT PLANT HIGH SERVICE PUMP VFD UPGRADES
PROJECT No. EW115

ELECTRICAL LEGEND
DRAWN BY: DRS

M. MONCEF HADIJI, P.E.
Florida License #48022

10/14/2016

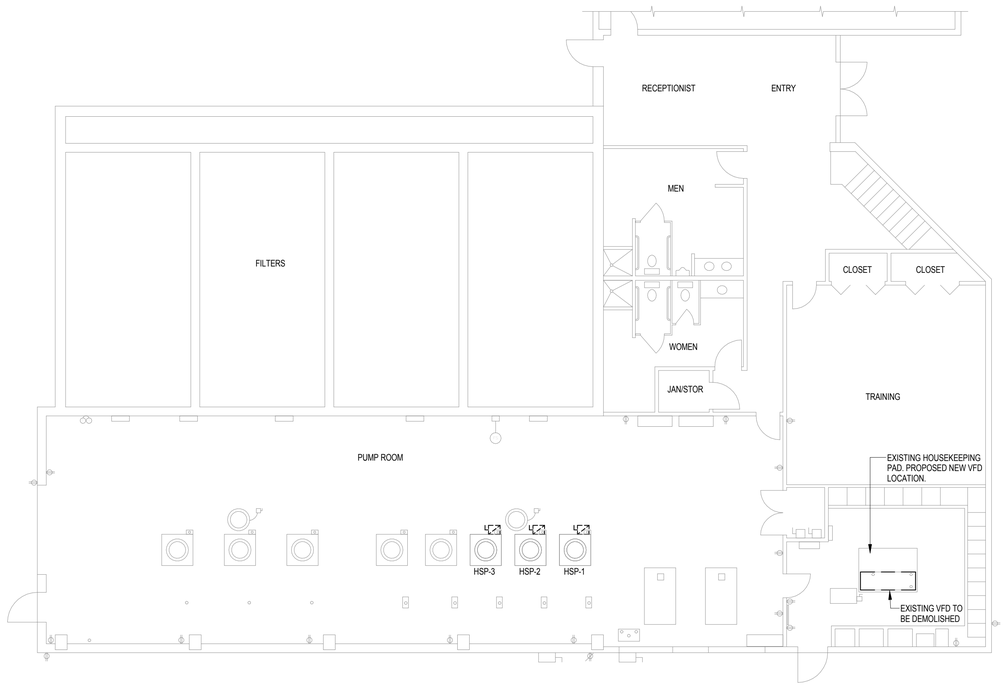
SHEET No.
E-1
OF 5

PHASING DESCRIPTION

1. EXISTING VFD MANUALLY SWITCHED BETWEEN TWO PUMPS (HSP-1 & 2). VFD SHALL REMAIN OPPERATIONAL UNTIL THE TWO NEW PUMPS (HSP-2 & 3) ARE INSTALLED AND FUNCTIONAL AND FULLY CONTROLLED BY SCADA VFD'S.COORDINATE PHASING WITH STAFF.

GENERAL NOTES

A. CONTRACTOR SHALL CAREFULLY COORDINATE AND SCHEDULE ALL WORK WITH OWNER. TWO PUMPS MUST REMAIN OPERATIONAL AT ALL TIMES.



1 DEMOLITION PLAN - FIRST FLOOR MAINTENANCE BUILDING
1/8" = 1'-0"

874 Dixon Boulevard
Cocoa, FL 32922
Phone: 321-636-0274
Fax: 321-639-8986
ENGINEERING FOR ARCHITECTURE www.tlc-engineers.com

COA #15 TLC NO: 516059

No.	BY	REVISIONS	DATE	No.	BY	REVISIONS	DATE

QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS
FLORIDA CERTIFICATE-of-AUTHORIZATION No. 626
PHONE: (386) 761-6810 FAX: (386) 761-3977
P.O. DRAWER 290247, PORT ORANGE, FL. 32129-0247

CITY of EDGEWATER
VOLUSIA COUNTY, FLORIDA

WATER TREATMENT PLANT HIGH SERVICE PUMP VFD UPGRADES
PROJECT No. EW115

ELECTRICAL DEMOLITION PLAN
DRAWN BY: DRS

10/14/2016

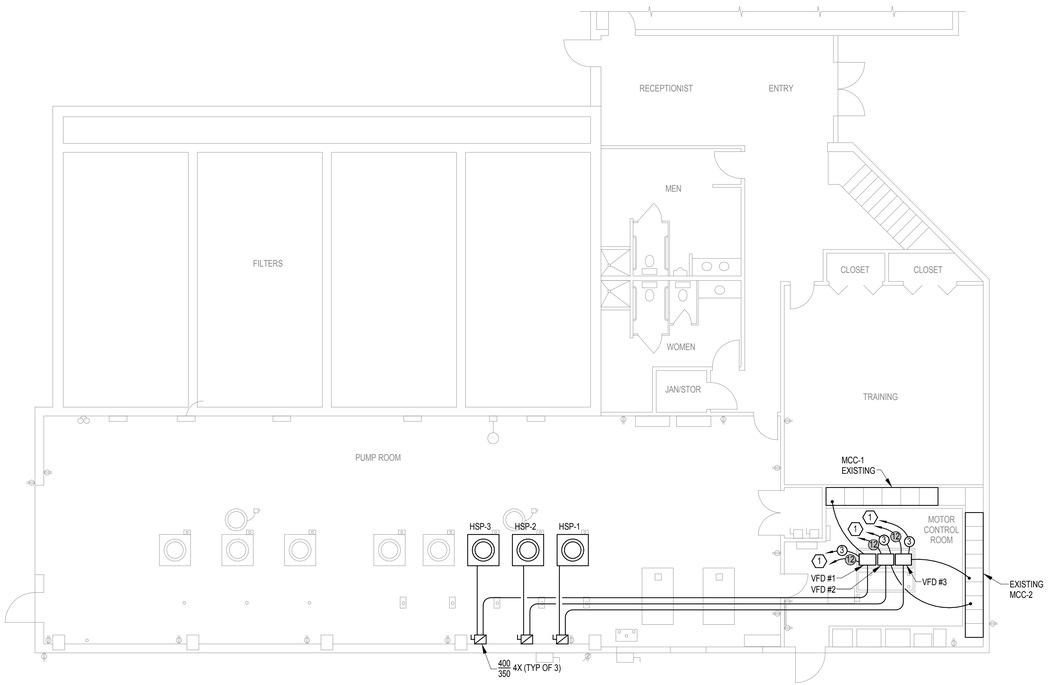
SHEET No.
E-2
OF 5

GENERAL NOTES

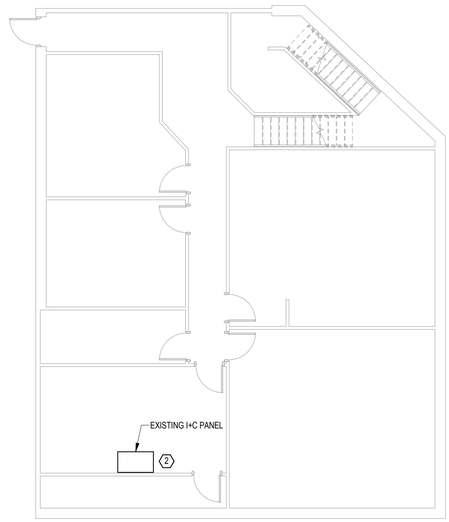
A. CONTRACTOR SHALL CAREFULLY COORDINATE AND SCHEDULE ALL WORK WITH OWNER. TWO PUMPS MUST REMAIN OPERATIONAL AT ALL TIMES.

SHEET KEYNOTES

1. TO EXISTING ALLEN BRADLEY SLC505 PLC ON FLOOR ABOVE.
2. TERMINATE ALL NEW VFD CONTROL WIRING INTO EXISTING CONTROL PANEL. PROVIDE TERMINATION BLOCKS, (1) ANALOG I/O CARD, (1) DISCRETE I/O CARD AND INTEGRATE/PROGRAM EXISTING SLC 505 FOR PRESSURE CONTROL AND PUMP STAGING FOR 3 NEW VFD'S. AUTOMATIC CONTROL IS BASED ON USER CONFIGURABLE PRESSURE SETTINGS. MODIFY HMI SCREEN TO INTEGRATE NEW VFD'S IN CONTROL SYSTEM. MODIFY TWO EXISTING SCADA FACTORY VIEW SYSTEMS TO INCORPORATE AUTOMATIC AND MANUAL CONTROLS.



1 ELECTRICAL PLAN - FIRST FLOOR MAINTENANCE BUILDING
1/8" = 1'-0"



2 ELECTRICAL PLAN - SECOND FLOOR MAINTENANCE BUILDING
1/8" = 1'-0"

874 Dixon Boulevard
Cocoa, FL 32922
Phone: 321-636-0274
Fax: 321-639-8986
ENGINEERING FOR ARCHITECTURE www.tlc-engineers.com

COA #15 TLC NO: 516059

No.	BY	REVISIONS	DATE	No.	BY	REVISIONS	DATE

QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS
FLORIDA CERTIFICATE-of-AUTHORIZATION No. 626
PHONE: (386) 761-6810 FAX: (386) 761-3977
P.O. DRAWER 290247, PORT ORANGE, FL. 32129-0247

CITY of EDGEWATER
VOLUSIA COUNTY, FLORIDA

WATER TREATMENT PLANT HIGH SERVICE PUMP VFD UPGRADES
PROJECT No. EW115

ELECTRICAL MAINTENANCE BUILDING
DRAWN BY: DRS

M. MONCEF HADIJI, P.E.
Florida License #48022

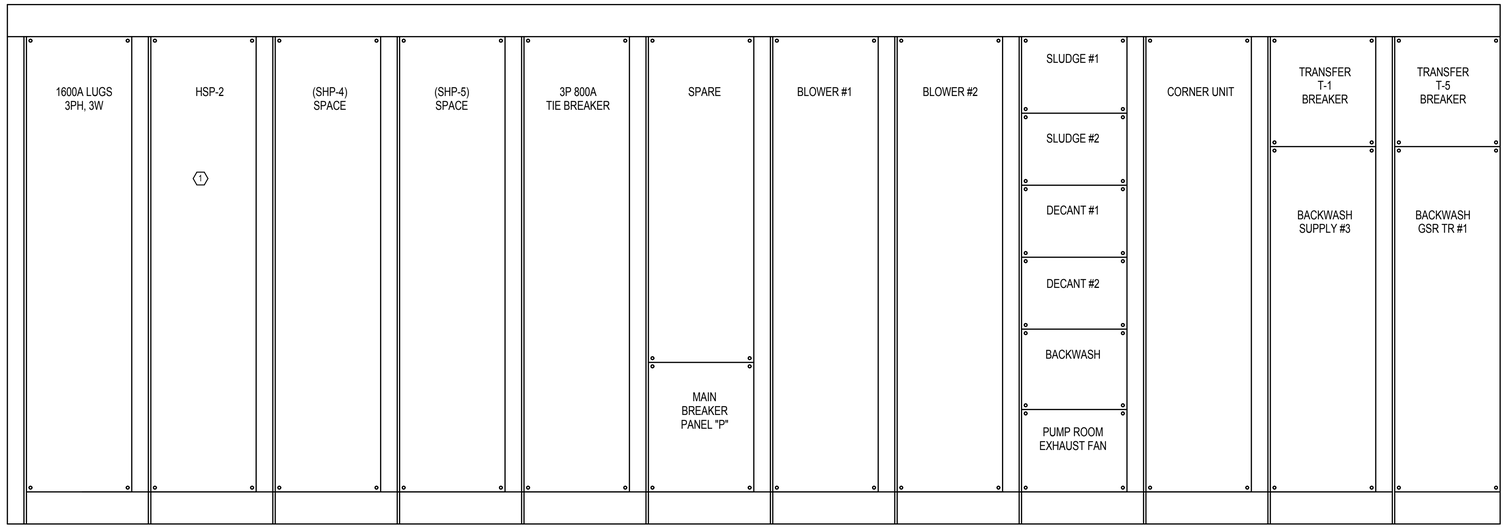
10/14/2016

SHEET No.
E-3
OF 5

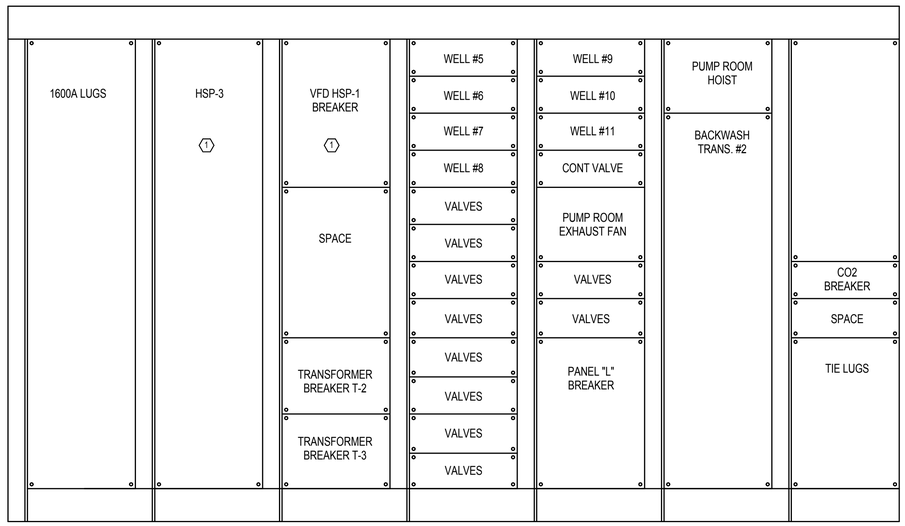
SHEET KEYNOTES

1. REMOVE EXISTING STARTERS/BREAKERS AND PROVIDE NEW BREAKERS AND BLANK COVER OVER THE REMOVED STARTER.

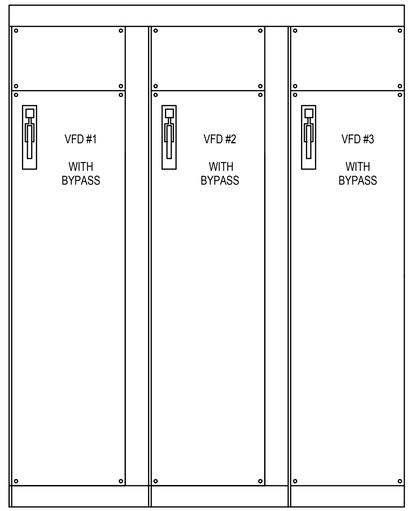
EXISTING MCC-1 SQ. D 1600A, 480V 3PH, 3W, NEMA 1

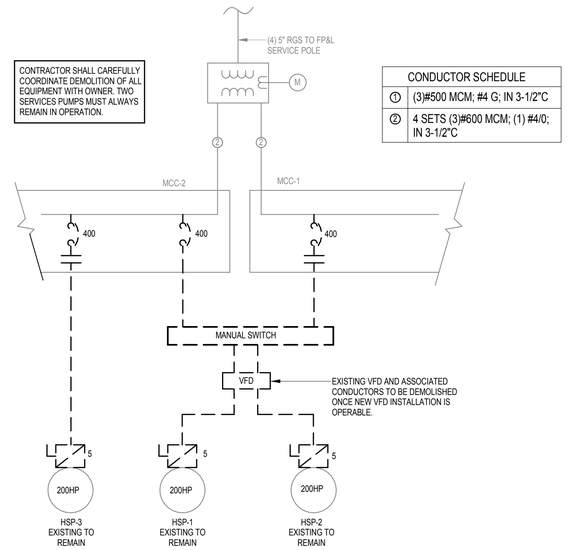


EXISTING MCC-2 SQ. D 1600A, 480V 3PH, 3W, NEMA 1

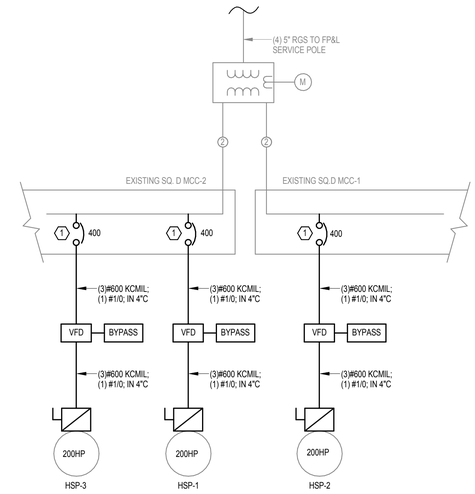


NEW VFD 1, 2, 3





② EXISTING ELECTRICAL ONE-LINE DIAGRAM
N.T.S



① NEW ELECTRICAL ONE-LINE DIAGRAM
N.T.S

874 Dixon Boulevard
Cocoa, FL 32922
Phone: 321-636-0274
Fax: 321-639-8986
ENGINEERING FOR ARCHITECTURE www.tlc-engineers.com

COA #15 TLC NO: 516059

No.	BY	REVISIONS	DATE	No.	BY	REVISIONS	DATE

QUENTIN L. HAMPTON ASSOCIATES, INC. CONSULTING ENGINEERS
FLORIDA CERTIFICATE-of-AUTHORIZATION No. 626
PHONE: (386) 761-6810 FAX: (386) 761-3977
P.O. DRAWER 290247, PORT ORANGE, FL. 32129-0247

CITY of EDGEWATER
VOLUSIA COUNTY, FLORIDA

WATER TREATMENT PLANT HIGH SERVICE PUMP VFD UPGRADES

PROJECT No. EW115

ELECTRICAL ONE-LINE DIAGRAMS

DRAWN BY: DRS

M. MONCEF HADIJI, P.E.
Florida License #48022

10/14/2016

SHEET No.
E-4
OF 5