



LEE COUNTY

SOUTHWEST FLORIDA

LEE COUNTY UTILITIES

CN-11-09, CIP-7333
Fiesta Village WWTP
Switchgear and
Generator Replacement

ISSUED FOR BIDDING
JUNE 2013

In Association With

**RKS CONSULTING
ENGINEERS**

Electrical, Instrumentation & Control Design

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LEE COUNTY UTILITIES

FIESTA VILLAGE WWTP

SWITCHGEAR AND GENERATOR REPLACEMENT PROJECT

DIVISION 1 – GENERAL REQUIREMENTS

GENERAL REQUIREMENTS

| | |
|-------|--|
| 01010 | Summary of Work |
| 01026 | Measurement and Payment |
| 01035 | Change Order and Directive Change Procedures |
| 01040 | Project Meetings |
| 01041 | Project Coordination |
| 01090 | Reference Standards |
| 01092 | Abbreviations |
| 01300 | Submittals |
| 01310 | Progress Schedule (Simple) |
| 01400 | Quality Control |
| 01500 | Construction Facilities and Temporary Controls |
| 01600 | Material and Equipment |
| 01710 | Cleaning |
| 01720 | Contract Close Out |
| 01740 | Warranties and Bonds |

DIVISION 2 – SITEWORK

SITEWORK

| | |
|-------|---|
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| 02110 | Site Clearing |
| 02276 | Temporary Erosion and Sedimentation Control |
| 02400 | Lawn Restoration |
| 02485 | Seeding and Sodding |
| 02999 | Miscellaneous Work and Cleanup |

DIVISION 23 – HVAC TECHNICAL SPECIFICATIONS INDEX

BASIC MATERIALS AND METHODS

| | |
|----------|--|
| 23 01 30 | HVAC Basic Materials and Methods |
| 23 01 31 | Housekeeping Pads, Concrete |
| 23 05 48 | HVAC Vibration Isolation Equipment |
| 23 07 19 | Insulation, HVAC |
| 23 21 13 | Piping: Condensate Drain |
| 23 23 00 | Refrigerant Pipe, Valves And Specialties |

EQUIPMENT & SYSTEMS

| | |
|----------|---------------------------------------|
| 23 31 13 | HVAC Ductwork |
| 23 37 19 | Air Distribution Devices |
| 23 81 25 | Condensing Units: Air Cooled Hermetic |
| 23 81 26 | Air Handling Units: Split System |

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| | |
|----------|---------------------------------------|
| 23 08 00 | Performance Verification, Preliminary |
| 23 08 01 | Performance Verification, Final |

DIVISION 26 – ELECTRICAL TECHNICAL SPECIFICATIONS INDEX

BASIC MATERIALS AND METHODS

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|----------|--|
| 26 05 00 | Basic Materials and Methods |
| 26 05 11 | Special Requirements for Electrical Installations. |
| 26 05 19 | Low-Voltage Wires and Cables |
| 26 05 26 | Grounding and Bonding for Electrical Systems |
| 26 05 29 | Hangers and Supports for Electrical Systems |
| 26 05 43 | Underground Ducts and Raceways for Electrical Systems |
| 26 05 51 | Conduit Systems |
| 26 05 53 | Identification of Electrical Systems |
| 26 05 70 | Wiring Devices |
| 26 05 73 | Short Circuit & Coordination Study & Arc Fault Hazard Analysis |
| 26 08 00 | Acceptance Testing & Performance Verification |

ELECTRICAL SERVICE AND DISTRIBUTION

| | |
|----------|--|
| 26 22 00 | Low-Voltage Transformers |
| 26 23 00 | Low-Voltage Draw-out Switchgear |
| 26 24 14 | Portable Generator Quick Connect Switchboard |
| 26 24 16 | Panelboards |
| 26 27 13 | Electric Service |
| 26 28 11 | Circuit Breakers & Fused Switches |
| 26 32 13 | Diesel-Engine-Driven Generator Sets |
| 26 36 13 | Safety Switches |

SPECIAL SYSTEMS

| | |
|----------|------------------------------|
| 26 41 00 | Lightning Protection Systems |
| 26 43 00 | Surge Suppression |
| 26 50 00 | Lighting |

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of Work
- B. Constraints
- C. Work by Others
- D. CONTRACTOR's Use of Site
- E. Work Sequence
- F. Owner Occupancy

1.2 DESCRIPTION OF WORK

- A. General: The Work to be done under this Contract consists of the complete demolition of existing electrical service, switchgear and generator along with construction of new electrical service, switchgear and generator. In general of the following and as specified in Contract Documents:

- 1. Site clearing, filling, grading, paving and patching
- 2. Building modifications to existing operations facility
- 3. Selective site, building and equipment Demolition
- 4. Furnish and Install HVAC systems
- 5. Construct new equipment room including switchgear trench and cut in new door.
- 6. Furnish and Install new class 1 reliable service entrance switchgear and electrical service.
- 7. Demolition of existing switchgear and electrical service.
- 8. Furnish and install stand-by power generator set in walk-in enclosure with sub-base fuel tank.
- 9. Furnish and install Concrete encased ductbank and conduit racking system for power distribution.
- 10. Construct manholes and furnish and install precast handholes. Furnish and install manhole and handhole frames and covers.
- 11. Provide Concrete work for pad mounted equipment.

12. Coordinate with other construction contractors that maybe concurrently working at the WWTP on other projects.

Refer to individual Divisions Contract Documents for additional and more specific requirements.

B. The Work includes:

1. Furnishing of all labor, material, superintendence, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the Work.
2. Sole responsibility for adequacy of overall project and equipment.
3. Maintaining the Work area and site in a clean and acceptable manner.
4. Use only designated staging areas for storage, on-site office trailers and parking.
5. Maintaining existing facilities in service at all times except where specifically provided for otherwise herein.
6. Protection of finished and unfinished Work.
7. Repair and restoration of Work damaged during construction.
8. Furnishing as necessary proper equipment and machinery, of a sufficient capacity, to facilitate the Work and to handle all emergencies normally encountered in Work of this character.
9. Furnishing, installing, and protecting all necessary guides, track rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

C. Implied and Normally Required Work: It is the intent of these Specifications to provide the OWNER with complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

D. Quality of Work: Regard the apparent silence of the Contract Documents as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished as meaning that only the best general practice is to prevail and that only materials and workmanship of the best quality are to be used. Interpretation of these specifications will be made upon this basis.

1.3 CONTRACTOR'S USE OF SITE

A. In addition to the requirements of the General Conditions, limit use of site and premises for work and storage to the staging area shown on the contract documents and to allow for the following:

1. Coordination of the Work under this CONTRACT with the work of the other contractors where Work under this CONTRACT encroaches on the Work of other contractors.
2. OWNER occupancy and access to operate existing facilities.
3. Coordination of site use with ENGINEER.
4. Responsibility for protection and safekeeping of products under this CONTRACT.
5. Providing additional off site storage at no additional cost to OWNER as needed.

1.4 WORK SEQUENCE

A. Construct Work in stages to accommodate OWNER's use of premises during construction period and in accordance with the limitations on the sequence of construction specified. Coordinate construction schedules and operations with OWNER, PLANT MANAGER and ENGINEER and using work sequence detailed on Contract Documents and in general as follows:

Construction sequence will be at the determination of the OWNER, but will likely be sequenced as follows:

1. Clearing and excavation of site as necessary for concrete encased ductbank and generator installation.
2. Construct manholes.
3. Construct switchgear trench, electrical equipment room and building modifications.
4. Install HVAC systems, switchgear and generator. Perform full functional testing and start-up.
5. Demolish existing Switchgear and electrical service
6. Fill, and grade site as necessary. Patch asphalt as necessary

B. Coordinate Work of all subcontractors.

C. Coordinate with other construction contractors that maybe concurrently working at the WWTP on other projects.

D. The work shown in the Bid Schedule, Section 01026 Measurement and Payment section, and Section 01010 Summary of Work may or may not be performed at the discretion of the OWNER or ENGINEER.

1.5 OWNER OCCUPANCY

- A. OWNER will occupy premises during entire period of construction in order to maintain normal operations. Cooperate with OWNER's representative in all construction operations to minimize conflict, and to facilitate OWNER usage.
- B. Conduct operations so as to inconvenience the general public in the least.

1.6 LIST OF DRAWINGS

The drawings listed below, are a part of this Specification.

SHEET # TITLE

GENERAL

- G1 DRAWING INDEX & PROJECT PHASING NOTES
- G2 SITE LOCATION MAP
- G3 OVERALL EXISTING SITE PLAN
- G4 PARTIAL LANDSCAPE REMOVAL SITE PLAN
- G5 PARTIAL PROPOSED SITE PLAN & UTILITY IDENTIFICATION AND RELOCATION
- G6 EXISTING SWITCHGEAR ROOM GENERAL DEMOLITION PLAN
- G7 PROPOSED DUCTBANK & EXISTING UNDERGROUND PIPING COORDINATION SECTIONS

CIVIL-DIV 2

- C1 PARTIAL SITE EXISTING CONDITIONS & UNDERGROUND LOCATES SURVEY

STRUCTURAL - DIV 3,4 & 8

- S1 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - GENERAL NOTES
- S2 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - FOUNDATION PLAN
- S3 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - FLOOR PLAN
- S4 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - FOUNDATION DETAILS
- S5 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - WALL DETAILS
- S6 OPERATIONS BUILDING SWITCHGEAR & ELECTRICAL ROOM - SITE DETAILS

HVAC-DIV 23

- H1 SWITCHGEAR ROOM HVAC DRAWING INDEX, LEGEND, SCHEDULES, DIAGRAMS AND NOTES
- H2 SWITCHGEAR ROOM FIRST FLOOR PLAN-HVAC

ELECTRICAL-DIV 26

- E1 ELECTRICAL SYMBOLS LEGEND & DRAWING INDEX
- E2 ELECTRICAL GENERAL NOTES & LIGHT FIXTURE SCHEDULE
- E3 OVERALL EXISTING ELECTRICAL SITE PLAN
- E4 PARTIAL ELECTRICAL SITE DEMOLITION PLAN
- E5 PARTIAL ELECTRICAL SITE PLAN
- E6 EXISTING SWITCHGEAR ROOM ELECTRICAL DEMOLITION PLAN
- E7 PROPOSED SWITCHGEAR ROOM POWER PLAN
- E8 PROPOSED SWITCHGEAR ROOM LIGHTING PLAN
- E9 OPERATIONS BUILDING BONDING & GROUNDING PLAN
- ED1 ELECTRICAL SERVICE SINGLE LINE DRAWING & SWITCHGEAR ELEVATION
- ED2 MCC MODIFICATION & CONDUIT ROUTING DETAILS
- ED3 MODIFICATIONS TO MCC-1 SINGLE LINE DRAWING & ELEVATION
- ED4 MODIFICATIONS TO MCC-1 SINGLE LINE DRAWING & ELEVATION
- ED5 GENERATOR LAYOUT & DETAILS
- ED6 ELECTRICAL DETAILS
- ED7 ELECTRICAL DETAILS
- ED8 ELECTRICAL & STRUCTURAL COORDINATION DETAILS
- ED9 DUCTBANK DETAILS AND SECTIONS
- ED10 PANELBOARD SCHEDULES
- ED11 SWITCHGEAR NETWORK COMMUNICATIONS BLOCK DIAGRAM

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

- A. Starting Work: Start Work within 10 days following the date stated in the Notice to Proceed and execute with such progress as may be required to prevent delay to other contractors or to the general completion of the project. Execute Work at such items and in or on such parts of the project, and with such forces, material and equipment, as to complete the Work in the time established by the Contract. At all times, schedule and direct the Work so that it provides an orderly progression to completion within the specified time for completion. The work shall reach final completion within 395 calendar days after the notice to proceed. The work shall be substantially complete within 365 calendar days after the notice to proceed.

END OF SECTION

SECTION 01026
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Explanation and Definitions
- B. Measurement
- C. Payment
- D. Schedule of Values
- E. Application for Payment

1.2 EXPLANATION AND DEFINITIONS

- A. The following explanation of the Measurement and Payment for the bid form items is made for information and guidance. The omission of reference to any item in this description shall not, however, alter the intent of the bid form or relieve the CONTRACTOR of the necessity of furnishing such as a part of the Contract.

1.3 MEASUREMENT

- A. The quantities set forth in the bid form are approximate and are given to establish a uniform basis for the comparison of bids. The OWNER reserves the right to increase or decrease the quantity of any class or portion of the work during the progress of construction in accord with the terms of the Contract.
- B. All measurements for payment shall be measured/verified by an authorized LCU representative.

1.4 PAYMENT

- A. Payment shall be made for the items listed on the Bid Form on the basis of the work actually performed and completed, such work including but not limited to, the furnishing and mobilization of all necessary labor, materials, equipment, transportation, clean up, restoration of disturbed areas, and all other appurtenances to complete the construction and installation of the work as shown on the drawings and described in the specifications.

- B. Payment shall fully reimburse the Contractor for cooperating with and meeting all the requirements of the State of Florida Trench Safety Act (90-96).
- C. Unit prices are used as a means of computing the final figures for bid and Contract purposes, for periodic payments for work performed, for determining value of additions or deletions and wherever else reasonable.

1.5 SCHEDULE OF VALUES

- A. Approval of Schedule: Submit for approval a preliminary schedule of values, in duplicate, for all of the Work. Prepare preliminary schedule in accordance with the General Conditions. Submit preliminary schedule of values within 10 calendar days after the Effective Date of the Agreement. Submit final schedule of values in accordance with the General Conditions.
- B. Refer to Article 14 of the General Conditions (Part F) and Supplementary General Conditions (Part G) of these Contract Documents for additional requirements.

1.6 APPLICATION FOR PAYMENT

- A. Required Copies: Submit three (3) copies of each application on the "Estimate and Requisition for Payment" form CMO:013. Present required information in typewritten form or on electronic media printout.
- B. Prepare the Application for Payment in accordance with Article 14 of the General Conditions (Part F) and Supplementary Conditions (Part G) of these Contract Documents. Execute certification by signature of authorized officer, with original signature on each copy of application for payment.
- C. Use data from approved Schedule of Values.
- D. Stored Materials: When payment for materials stored is permitted, submit a separate Schedule for Materials Stored showing line item, description, previous value received, value incorporated into the Work and present value.
- E. Change Orders: List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of work.
- F. Final Payment: Prepare Application for Final Payment as required in the General Conditions (Part F) of these Contract Documents.
- G. Submit an updated construction schedule for each Application for Payment.

PART 2 EXECUTION

2.1 MEASUREMENT AND PAYMENT

- A. Payment shall be made on the basis of work actually performed or completing each item in the Bid, such work including, but not limited to Section 01010 Summary of Work and as shown on the contract documents.
- B. Retainage will be withheld from the final payment until written acceptance by the Owners Representative for all final clean up, restoration and Record Drawings / As-Builts.
- C. PAYMENT ITEMS:

Refer to bid schedule for list of payment items. Payment items are considered work in progress payment items unless specifically noted otherwise. See 1.2 Description of Work, Section 01010 Summary of Work for further clarification.

END OF SECTION

SECTION 01035

CHANGE ORDER AND FIELD DIRECTIVE CHANGE PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Definitions
- B. Change Orders
- C. Field Directive Change

1.2 DEFINITIONS

- A. Change Order: Refer to the Change Order definition in Article 2 of the General Conditions.
- B. Field Directive Change: Field Directive Change is a written directive to the CONTRACTOR issued on or after the effective date of the agreement; signed by the OWNER, recommended by the ENGINEER ordering an addition, deletion, or revision in the Work. A Field Directive Change will subsequently be followed by the issuance of a Change Order.
- C. Overhead: Overhead is defined as the cost of administration, field office and home office costs, general superintendence, office engineering and estimating costs, other required insurance, materials used in temporary structures (not including form work), additional premiums on the performance bond of the CONTRACTOR, the use of small tools, scheduling costs, and all other costs incidental to the performance of the change or the cost of doing business.

1.3 CHANGE ORDERS

- A. Initiation of Proposals:
 - 1. From time to time, the OWNER or the ENGINEER may issue a Request for a Change Order Proposal. The Request will contain a description of the intended change with supplementary or revised Drawings and Specifications as applicable, and the projected time for accomplishing the change.
 - 2. The CONTRACTOR may propose a change in the Work by submittal of a Change Order Request to the ENGINEER describing the proposed change with a statement of the reason for the change and the effect on the Contract time and price, along with supporting documentation.

B. Execution of Change Order Proposal:

1. When a Proposal is requested for changed work, submit proposal within 15 days following receipt of the Request from OWNER or ENGINEER. State the increase or decrease, if any, in Contract Completion time and Contract Price.
2. Explain proposal in sufficient detail to permit review by OWNER.
3. For Omitted Work the decrease in the Contract Price will be determined by the ENGINEER and will include appropriate amounts for profit and overhead.
4. The OWNER and ENGINEER will review the Proposal and may request additional information and documentation. Provide these items upon request.
5. If the OWNER decides to proceed with the change, the OWNER will issue a Change Order for signature first by the CONTRACTOR and then by the OWNER.
6. The CONTRACTOR will promptly complete the approved change in the Work on receipt of the executed Change Order.
 - a. Failure to sign the Change Order does not relieve the CONTRACTOR from performing the Work if the Change Order is signed by the OWNER.

C. Compute the cost of both additive and deductive changes in the Work in accordance with Article 11 of the General Conditions and as follows:

1. Include, the costs of labor, crew foreman and general foreman performing or directly supervising the changed Work on the site. Include travel and subsistence, but only to the extent incurred.
2. To the labor cost add all net premium for Workman's Compensation, taxes pursuant to the Federal Social Security Act, and payments required under State and Federal unemployment laws.
3. Add necessary extra materials, delivered at the site.
4. Include rent for plant and equipment at unit rental costs for similar rentals from an independent firm (i.e. a firm which is not owned in whole or in part by the CONTRACTOR). If equipment is owned by CONTRACTOR or rented from a firm in which the CONTRACTOR has an interest, calculate the rent in accordance with the applicable provisions and terms of the current "Cost Reference Guide for Construction Equipment" published by Dataquest.

5. Include Subcontractor's costs, determined by items 1 through 4 in the preceding subparagraphs, including a maximum of 10 percent overhead and 10 percent profit for the first \$20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next \$30,000; and 5 percent overhead and 5 percent profit on balance over \$50,000.
6. For all subcontract work add 5 percent overhead and 5 percent profit to the subcontractor's costs as determined in paragraph 5. For work performed by the CONTRACTOR's own forces add a maximum of 10 percent overhead and 10 percent profit for the first \$20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next \$30,000; and 5 percent overhead and 5 percent profit on balance over \$50,000.

1.4 FIELD DIRECTIVE CHANGE

- A. Initiation by OWNER: OWNER may issue a Field Directive Change with a Notice to Proceed without a prior Request for a Change Order Proposal or the CONTRACTOR's signature.
- B. Payment Determination: The OWNER will designate the method of determining the amount of compensation or credit, if any, based on one of the methods contained in Article 11 of the General Conditions.
- C. Timing: Proceed with the change in the Work immediately upon receipt of the Field Directive Change.
- D. Addition to Contract: The Field Directive Change will be incorporated into the Contract Documents via a Change Order at a later date.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01040
PROJECT MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Coordination
- B. Preconstruction Conference
- C. Progress Meetings

1.2 COORDINATION

- A. General: Coordinate scheduling, submittals, and Contract work to assure efficient and orderly sequence of installation of interdependent construction elements.
- B. Accessory Placement: Place conduits, saddles, boxes, cabinets, sleeves, inserts, foundation bolts, anchors and other like work in floors, roofs or walls of buildings and structures in conformity with the construction program.

1.3 PRECONSTRUCTION CONFERENCE

- A. General: Prior to commencement of the Work, in accordance with the General Conditions, the OWNER will conduct a preconstruction conference to be held at a predetermined time and place.
- B. Delineation of Responsibilities: The purpose of the conference is to designate responsible personnel, to establish a working relationship among the parties and to identify the responsibilities of the OWNER, plant personnel and the CONTRACTOR/VENDOR. Matters requiring coordination will be discussed and procedures for handling such matters, established. The agenda will include:
 - 1. Submittal procedures
 - 2. Partial Payment procedures
 - 3. Maintenance of Records
 - 4. Schedules, sequences and maintenance of facility operations
 - 5. Safety and First Aid responsibilities
 - 6. Change Orders and Field Directive Changes
 - 7. Use of site
 - 8. Housekeeping
 - 9. Equipment delivery

- C. Attendees: The preconstruction conference is to be attended by the representatives of the CONTRACTOR/VENDOR, the OWNER and plant personnel that will be associated with the project. Representatives of regulatory agencies, subcontractors, and principal suppliers may also attend when appropriate.
- D. Chair and Minutes: The preconstruction conference will be chaired by the OWNER or ENGINEER who will also arrange for the keeping and distribution of minutes to all attendees.

1.4 PROGRESS MEETINGS

- A. Meeting Frequency and Format: Schedule progress meetings on at least a weekly basis, more frequently as warranted by the complexity of the Project or as requested by the ENGINEER, to review the Work, discuss changes in schedules, maintain coordination and resolve potential problems. Invite OWNER, ENGINEER and all SUs Bb CONTRACTOR/VENDORS. Suppliers may be invited as appropriate. Minutes of the meeting will be maintained by CONTRACTOR/VENDOR and reviewed by ENGINEER prior to distribution by the CONTRACTOR/VENDOR. Distribute reviewed minutes to attendees within 2 calendar days after each meeting.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01041
PROJECT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Work Progress
- B. Private Land
- C. Work Locations
- D. Open Excavations
- E. Test Pits
- F. Maintenance of Traffic
- G. Maintenance of Flow

1.2 WORK PROGRESS

- A. Furnish personnel and equipment which will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress which will allow the completion of the work within the time stipulated in the Bid of these Specifications. If at any time such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work required or for producing the rate of progress aforesaid, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the CONTRACTOR shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR of his obligations to secure the quality of the work and rate of progress.

1.3 PRIVATE LAND

- A. Do not enter or occupy private land outside of easements, except by permission of OWNER. Construction operations shall be conducted in accordance with Section 01500.

1.4 WORK LOCATIONS

- A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the ENGINEER reserves the right to make such modifications in locations as may

be found desirable to avoid interference noted on the Drawings, such notation is for the CONTRACTOR's convenience and does not relieve him from laying and jointing different or additional items where required.

1.5 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by the public and workmen.

1.6 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the ENGINEER. The costs for such test pits shall be borne by the CONTRACTOR.

1.7 MAINTENANCE OF TRAFFIC

- A. All projects and work on highways, roads, and streets, shall have a traffic control plan, (TCP), as required by Florida Statute and Federal regulations. All work shall be executed under the established plan and Department approved procedures. The TCP is the result of considerations and investigations made in the development of a comprehensive plan for accommodating vehicular and pedestrian traffic through the construction zone.
- B. The complexity of the TCP varies with the complexity of the traffic problems associated with a project. Many situations can be covered adequately with reference to specific sections from the Manual on Uniform Traffic Control Devices (MUTCD), the Traffic Control Devices Handbook (TCDH), or Roadway and Traffic Design Standard Series 600.

1.8 MAINTENANCE OF FLOW

- A. Provide for the flow of sewers, drains, courses interrupted during the progress of the work, and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the ENGINEER well in advance of the interruption of any flow.

PART 2 PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the CONTRACTOR at his own expense.
- B. All structures shall be protected in a manner approved by the ENGINEER. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. Special attention is directed to substructure bracing requirements, described in Section 02151. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. The CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.
- C. Take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

PART 3 EXECUTION

3.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. Sequence and schedule work in a manner to preclude delays and conflicts between the work of various trades and contractors. Each trade shall keep informed as to the work of other trades on the project and shall execute their work in a manner that will not interfere with the work of other trades.

3.2 DIAGRAMMATIC NATURE OF DRAWINGS

- A. Where layout is diagrammatic, such as pipelines, conduits, ductwork, etc., it shall be followed as closely as other work will permit. Changes from diagrams shall be made as required to conform to the construction requirements.
- B. Before running lines, carefully verify locations, depths and sizes and confirm that lines can be run as contemplated without interfering with other construction. Any deviation shall be referred to the ENGINEER for approval before lines are run. Minor changes in location of the equipment, fixtures, piping, etc., from those shown on the Drawings, shall be made without extra charge if so directed by the ENGINEER before installation.

- C. Determine the locations and sizes of equipment, fixtures, conduit, ducts, openings, etc., in order that there will be no interference in the installation of the work or delay in the progress of other work. In the event that interferences develop, the ENGINEER's decision regarding relocation of work will be final.
- D. Any changes made necessary through failure to make proper arrangements to avoid interference shall not be considered as extras. Cooperate with those performing other work in preparation of interference drawings, to the extent that the location of piping, ductwork, etc., with respect to the installations of other trades shall be mutually agreed upon by those performing the work.

3.3 PROVISIONS FOR LATER INSTALLATION

- A. Where any work cannot be installed as the construction is progressing, provide for boxes, sleeves, inserts, fixtures or devices as necessary to permit installation of the omitted work during later phases of construction. Arrange for chases, holes, and other openings in the masonry, concrete or other work and provide for subsequent closure after placing equipment. Arrangement for and closure of openings shall be subject to the approval of the ENGINEER and all costs therefor shall be included in the contract price for the work.

3.4 COORDINATION

- A. The CONTRACTOR shall be fully responsible for the coordination of his work and the work of his employees, subcontractors, and suppliers with the OWNER, and regulatory agencies, and assure compliance with schedules.

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations and Symbols
- B. Reference Standards
- C. Definitions

1.2 RELATED SECTIONS

- A. Information provided in this section is used where applicable in individual Specification Sections, Divisions 2 through 26.

1.3 REFERENCE ABBREVIATIONS

- A. Reference to a technical society, trade association or standards setting organization, may be made in the Specifications by abbreviations in accordance with the following list:

| | |
|--------|---|
| AABC | Associated Air Balance Council |
| AAMA | Architectural Aluminum Manufacturers Association |
| AASHTO | American Association of State Highway and Transportation Officials |
| AATCC | American Association of Textile Chemists and Colorists |
| ACI | American Concrete Institute |
| ADC | Air Diffusion Council |
| AFBMA | Anti-friction Bearing Manufacturers Association |
| AGA | American Gas Association |
| AGMA | American Gear Manufacturers Association |
| AHA | Association of Home Appliance Manufacturers |
| AISC | American Institute of Steel Construction |
| AISI | American Iron and Steel Institute |
| AMCA | Air Movement and Control Association, Inc. |
| ANSI | American National Standards Institute |
| APA | American Plywood Association |
| ARI | American Refrigeration Institute |
| ASCE | American Society of Civil Engineers |
| ASHRAE | American Society of Heating, Refrigerating and Air Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASSE | American Society of Sanitary Engineers |

| | |
|------------|--|
| ASTM | American Society for Testing and Materials |
| AWI | Architectural Woodwork Institute |
| AWPA | American Wood Preservers Association |
| AWS | American Welding Society |
| AWWA | American Water Works Association |
| BHMA | Builders' Hardware Manufacturers Association |
| BIA | Brick Institute of American |
| CABO | Council of American Building Officials |
| CAGI | Compressed Air and Gas Institute |
| CISPI | Cast Iron Soil Pipe Institute |
| CMAA | Crane Manufacturers Association of America |
| CRD | U.S. Corps of Engineers Specifications |
| CRSI | Concrete Reinforcing Steel Institute |
| CTI | Cooling Tower Institute |
| DHI | Door and Hardware Institute |
| DOH | Department of Health |
| DOT | Department of Transportation |
| Fed. Spec. | Federal Specifications |
| FGMA | Flat Glass Marketing Association |
| FM | Factory Mutual |
| HMI | Hoist Manufacturing Institute |
| HPMA | See HPVA |
| HPVA | Hardwood Plywood Veneer Association |
| ICEA | Insulated Cable Engineers Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| IFI | Industrial Fasteners Institute |
| MIL | Military Specifications |
| MSS | Manufacturer's Standardization Society |
| NAAMM | National Association of Architectural Metal Manufacturers |
| NACM | National Association of Chain Manufacturers |
| NBS | National Bureau of Standards, See NIST |
| NEBB | National Environmental Balancing Bureau |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| NETA | National Electrical Testing Association |
| NFPA | National Fire Protection Association |
| NFPA | National Forest Products Association |
| NFPA | National Fluid Power Association |
| NIST | National Institute of Standards and Technology |
| NLMA | National Lumber Manufacturers Association |
| NSF | National Sanitation Foundation |
| OSHA | Occupational Safety and Health Act |
| PCI | Prestressed Concrete Institute |
| PDI | Plumbing and Drainage Institute |
| SAE | Society of Automotive Engineers |
| SCPRF | Structural Clay Products Research Foundation |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association |
| SPI | Society of the Plastics Industry |

| | |
|------|---|
| SSPC | Steel Structures Painting Council |
| STI | Steel Tank Institute |
| TCA | Tile Council of American |
| TIMA | Thermal Insulation Manufacturers' Association |
| UL | Underwriters' Laboratories, Inc. |
| USBR | U. S. Bureau of Reclamation |
| USBS | U. S. Bureau of Standards, See NIST |

1.4 REFERENCE STANDARDS

- A. Latest Edition: Construe references to furnishing materials or testing, which conform to the standards of a particular technical society, organization, or body, to mean the latest standard, code, or specification of that body, adopted and published as of the date of bidding this Contract. Standards referred to herein are made a part of these Specifications to the extent which is indicated or intended.
- B. Precedence: The duties and responsibilities of the OWNER, CONTRACTOR or ENGINEER, or any of their consultants, agents or employees are set forth in the Contract Documents, and are not changed or altered by any provision of any referenced standard specifications, manuals or code, whether such standard manual or code is or is not specifically incorporated by reference in the Contract Documents. Any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority, to undertake responsibility contrary to the powers of the ENGINEER as set forth in the Contract Documents cannot be assigned to the ENGINEER or any of the ENGINEER's consultants, agents or employees.

1.5 DEFINITIONS

- A. In these Contract Documents the words furnish, install and provide are defined as follows:
 1. Furnish (Materials): to supply and deliver to the project ready for installation and in operable condition.
 2. Install (services or labor): to place in final position, complete, anchored, connected in operable condition.
 3. Provide: to furnish and install complete. Includes the supply of specified services. When neither furnish, install or provide is stated, provided is implied.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01092

ABBREVIATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Abbreviations
- B. Standards for Abbreviations

1.2 RELATED SECTIONS

- A. Abbreviations provided in this section are used where applicable in individual Specification Sections, Divisions 2 through 16.

1.3 ABBREVIATIONS

- A. Abbreviations which may be used in Divisions 1 through 16 for units of measure are as follows:

| | | | |
|---|----------------|---|-------|
| alternating current..... | ac | cubic | cu |
| American wire gauge | AWG | cubic centimeter(s)..... | cc |
| ampere(s) | amp | cubic feet per day | cfm |
| ampere-hour(s) | AH | cubic feet per hour | cfh |
| annual..... | ann | cubic feet per minute..... | cfm |
| Ampere Interrupting Capacity..... | AIC | cubic feet per minute, standard conditions | scfm |
| atmosphere(s) | atm | cubic feet per second | cfs |
| average | avg | cubic foot (feet) | cu ft |
| biochemical oxygen demand | BOD | cubic inch(es) | cu in |
| Board Foot..... | FBM | cubic yard(s) | cu yd |
| brake horsepower | bhp | decibels..... | dB |
| Brinell Hardness | BH | decibels (A scale)..... | dBa |
| British thermal unit(s)..... | Btu | degree(s)..... | deg |
| calorie (s)..... | cal | dewpoint temperature | dpt |
| carbonaceous biochemical oxygen demand | CBOD | diameter | dia |
| Celsius (centigrade)..... | C | direct current | dc |
| Center to Center | C to C | dissolved oxygen..... | DO |
| centimeter(s)..... | cm | dissolved solids | DS |
| chemical oxygen demand | COD | dry-bulb temperature..... | dbt |
| coefficient, valve flow | C _v | efficiency | eff |
| | | elevation..... | el |

entering water temperature.....ewt
 entering air temperature eat
 equivalent direct radiation.....edr

 face area fa
 face to face f to f
 Fahrenheit F
 feet per day..... fpd
 feet per hour fph
 feet per minute..... fpm
 feet per second fps
 foot (feet) ft
 foot-candle..... fc
 foot-pound ft-lb
 foot-pounds per minute ft-lb/min
 foot-pounds per secondft-lb/sec
 formazin turbidity unit(s) FTU
 frequency..... freq

 gallon(s)..... gal
 gallons per day gpd
 gallons per day per
 cubic foot gpd/cu ft
 gallons per day per
 square foot..... gpd/sq ft
 gallons per hour gph
 gallons per minute gpm
 gallons per second gps
 gas chromatography and
 mass spectrometry GC-MS
 gauge ga
 grain(s) gr
 gram(s) g
 grams per cubic centimetergm/cc

 Heat Transfer CoefficientU
 height..... hgt
 Hertz Hz
 horsepower..... hp
 horsepower-hour hp-hr
 hour(s) hr
 humidity, relative..... rh
 hydrogen ion concentrationpH

 inch(es)..... in
 inches per secondips
 inside diameterID

Jackson turbidity unit(s) JTU

 kelvin..... K
 kiloamperes..... kA
 kilogram(s) kg
 kilometer(s) km
 kilovar (kilovolt-amperes
 reactive) kvar
 kilovolt(s)..... kV
 kilovolt-ampere(s)..... kVA
 kilowatt(s).....kW
 kilowatt-hour(s)kWh

 linear foot (feet)..... lin ft
 liter(s)..... L

 megavolt-ampere(s) MVA
 meter(s).....m
 micrograms per liter ug/L
 miles per hourmph
 milliamperes(s) mA
 milligram(s) mg
 milligrams per liter mg/L
 milliliter(s) mL
 millimeter(s) mm
 million gallons MG
 million gallons per day..... mgd
 millisecond(s) ms
 millivolt(s) mV
 minute(s) min

 mixed liquor suspended
 solids..... MLSS

 nephelometric turbidity
 unit NTU
 net positive suction head.....NPSH
 noise criteria..... nc
 noise reduction coefficient..... NRC
 number.....no

 ounce(s) oz
 outside airoa
 outside diameter OD

 parts per billion..... ppb
 parts per million..... ppm
 percent..... pct

phase (electrical) ph
 pound(s) lb
 pounds per cubic foot pcf
 pounds per cubic foot
 per hour pcf/hr
 pounds per day lbs/day
 pounds per day per
 cubic foot lbs/day/cu ft
 pounds per day per
 square foot lbs/day/sq ft
 pounds per square foot psf
 pounds per square foot
 per hour psf/hr
 pounds per square inch psi
 pounds per square inch
 absolute psia
 pounds per square inch
 gauge psig
 power factor PF
 pressure drop or
 difference dp
 pressure, dynamic
 (velocity) vp
 pressure, vapor vap pr

 quart(s) qt

 Rankine R
 relative humidity rh
 resistance res
 return air ra
 revolution(s) rev
 revolutions per minute rpm
 revolutions per second rps
 root mean squared rms

 safety factor sf
 second(s) sec
 shading coefficient SC
 sludge density index SDI

 Sound Transmission
 Coefficient STC
 specific gravity sp gr
 specific volume Sp Vol
 sp ht at constant pressure Cp
 square sq
 square centimeter(s) sq cm

square foot (feet) sq ft
 square inch (es) sq in
 square meter(s) sq m
 square yard(s) sq yd
 standard std
 static pressure st pr
 supply air sa
 suspended solids SS

 temperature temp
 temperature difference TD
 temperature entering TE
 temperature leaving TL
 thousand Btu per hour Mbh
 thousand circular mils kcmil
 thousand cubic feet Mcf
 threshold limit value TLV
 tons of refrigeration tons
 torque TRQ
 total dissolved solids TDS
 total dynamic head TDH
 total kjeldahl nitrogen TKN
 total oxygen demand TOD
 total pressure TP
 total solids TS
 total suspended solids TSS
 total volatile solids TVS

 vacuum vac
 viscosity visc
 volatile organic chemical VOC
 volatile solids VS
 volatile suspended solids VSS
 volt(s) V
 volts-ampere(s) VA
 volume vol

 watt(s) W
 watthour(s) Wh
 watt-hour demand WHD
 watt-hour demand meter WHDM
 week(s) wk
 weight wt
 wet-bulb WB
 wet bulb temperature WBT

 yard(s) yd
 year(s) yr

1.4 STANDARD FOR ABBREVIATIONS

- A. Use ASME Y1.1-1989, "Abbreviations for use on Drawings and in Text" for abbreviations for units of measure not included in Paragraph 1.3.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description of Requirements
- B. Submittal Procedures
- C. Specific Submittal Requirements
- D. Action on Submittals
- E. Repetitive Review

1.2 DESCRIPTION OF REQUIREMENTS

- A. This section specifies procedural requirements for Shop Drawings, product data, samples, and other miscellaneous Work-related submittals.
- B. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.
- C. Work-Related Submittals:
 - 1. Substitution or "Or Equal" Items:
 - a. Includes material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.
 - 2. Shop Drawings:
 - a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.

- b. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.
- 3. Product Data:
 - a. Includes standard printed information on manufactured products, and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
- 4. Samples:
 - a. Includes both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
 - b. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.
- 5. Working Drawings:
 - a. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR'S plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities control systems, forming and falsework for underpinning; temporary by-pass pumping and for such other work as may be required for construction but does not become an integral part of the project.
 - b. Copies of working drawings shall be submitted to the ENGINEER at least fourteen (14) calendar days (unless otherwise specified by the ENGINEER) in advance of the required work.
 - c. Working drawings shall be signed by a registered Professional Engineer currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use.
- 6. Miscellaneous Submittals:
 - a. Work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds,

survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

1.3 SUBMITTAL PROCEDURES

A. Scheduling:

1. Submit for approval, a preliminary schedule of shop drawings and samples submittals, in duplicate, and in accordance with the General Conditions.
2. Prepare and transmit each submittal to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
2. Coordinate submission of different units of interrelated work so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of products, field measurement, field construction criteria, coordination of information within submittal with requirements of the Work and the Contract Documents, coordination with all trades, and verification that product will fit in space provided.
2. Transmittal Form: In the transmittal form forwarding each specific submittal to the ENGINEER include the following information as a minimum.
 - a. Date of submittal and dates of previous submittals containing the same material.
 - b. Project title and number.
 - c. Submittal and transmittal number.
 - d. Contract identification.

- e. Names of:
 - (1) Contractor
 - (2) Supplier
 - (3) Manufacturer
- f. Identification of equipment and material with equipment identification numbers, model numbers, and Specification section number.
- g. Variations from Contract Documents and any limitations which may impact the Work.
- h. Drawing sheet and detail number as appropriate.

D. Resubmittal Preparation:

- 1. Comply with the requirements described in Submittal Preparation. In addition:
 - a. Identify on transmittal form that submittal is a resubmission.
 - b. Make any corrections or changes in submittals required by ENGINEER's notations on returned submittal.
 - c. Respond to ENGINEER's notations:
 - (1) On the transmittal or on a separate page attached to CONTRACTOR's resubmission transmittal, answer or acknowledge in writing all notations or questions indicated by ENGINEER on ENGINEER's transmittal form returning review submission to CONTRACTOR.
 - (2) Identify each response by question or notation number established by ENGINEER.
 - (3) If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by ENGINEER until CONTRACTOR provides a written response to all ENGINEER's notations or questions.
 - d. CONTRACTOR initiated revisions or variations:
 - (1) On transmittal form identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.
 - (2) ENGINEER's responsibility for variations or revisions is established in the General Conditions.

1.4 SPECIFIC SUBMITTAL REQUIREMENTS

- A. Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, comply with requirements specified herein for each indicated type of submittal.
- B. Requests for Substitution or "Or Equal"
 - 1. Collect data for items to be submitted for review as substitution into one submittal for each item of material or equipment in accordance with the General Conditions.
 - 2. Submit with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted.
 - 3. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, schedule substitution submittal request in Submittal schedule and submit as scheduled.
- C. Shop Drawings:
 - 1. Check all drawings, data and samples before submitting to the ENGINEER for review. Each and every copy of the drawings and data shall bear CONTRACTOR's stamp showing that they have been so checked. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR for conformance with this requirement. All shop drawings shall be submitted through the CONTRACTOR, including those from any subcontractors.
 - 2. Submit newly prepared information, with graphic information at accurate scale. Indicate name of manufacturer or supplier (firm name). Show dimensions and clearly note which are based on field measurement; identify materials and products which are included in the Work; identify revisions. Indicate compliance with standards and notation of coordination requirements with other work. Highlight, encircle or otherwise indicate variations from Contract Documents or previous submittals.
 - 3. Include on each drawing or page:
 - a. Submittal date and revision dates.
 - b. Project name, division number and descriptions.
 - c. Detailed specifications section number and page number.

- d. Identification of equipment, product or material.
 - e. Name of CONTRACTOR and Subcontractor.
 - f. Name of Supplier and Manufacturer.
 - g. Relation to adjacent structure or material.
 - h. Field dimensions, clearly identified.
 - i. Standards or Industry Specification references.
 - j. Identification of deviations from the Contract Documents.
 - k. CONTRACTOR's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
 - l. Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
4. Provide 8-inch by 3-inch blank space for CONTRACTOR and ENGINEER stamps.
5. Submittals:
- a. Submit 3 blue line or black line prints, or 2 reverse sepia reproducible and 1 blue or black line print. One reproducible or one print will be returned.
6. Distribution:
- a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approved information is in possession of installer.
 - b. Maintain one set of product data (for each submittal) at Project site.
 - c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER's records.
- D. Product Data:
1. Preparation:
- a. Collect required data into single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on

Project or are not included in submittal, mark copies to clearly show such information is not applicable.

- b. Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, submit data as a Shop Drawing and not as product data.

2. Submittals:

- a. Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
- b. Submit 3 copies.

3. Distribution:

- a. Do not proceed with installation of materials, products or systems until copy of applicable product data showing only approval information is in possession of installer.
- b. Maintain one set of product data (for each submittal) at Project site, available for reference by ENGINEER and others.
- c. Mark 5 additional copies with the date of approval and forward to the ENGINEER for use in field and for OWNER records.

E. Samples:

1. Preparation:

- a. Where possible, provide samples that are physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3 units) showing approximate limits of variations.
- b. Provide full set of optional samples where ENGINEER's selection required. Prepare samples to match ENGINEER's selection where so indicated.
- c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.

- d. Submit samples for ENGINEER's visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of work.

2. Submittals:

- a. At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.
- b. A preliminary submittal, consisting of a single set of samples, is required where specifications indicate ENGINEER's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with ENGINEER's "Action" marking.
- c. Final Submittals: Submit 3 sets of samples in final submittal, 1 set will be returned.

3. Distribution:

- a. Maintain returned final set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.
- b. Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections, and shall be in undamaged condition at time of use.

F. Mock-Ups:

- 1. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible. Process transmittal forms to provide record of activity.

G. Miscellaneous Submittals:

- 1. Inspection and Test Reports:
 - a. Classify each inspection and test report as being either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Process inspection and test reports accordingly.
- 2. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:

- a. Refer to Specification sections for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".
 - b. In addition to copies desired for CONTRACTOR's use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.
3. Survey Data:
- a. Refer to Specification sections for specific requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data required by Specification sections. Copies will not be returned.
 - (1) Survey Copies: Furnish 2 copies. Provide 10 copies of final property survey (if any).
 - (2) Condition Surveys: Furnish 2 copies.
4. Certifications:
- a. Refer to Specification sections for specific requirement on submittal of certifications. Submit 7 copies. Certifications are submitted for review of conformance with specified requirements and information. Submittal is final when returned by ENGINEER marked "Approved".
5. Closeout Submittals:
- a. Refer to Specification Section 01720 for specific requirements on submittal of closeout information, materials, tools, and similar items.
 - (1) Record Documents: Section 01720.
 - (2) Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.
 - (3) Operating and maintenance data.
- H. Operation and Maintenance Manuals:
- 1. Submit Operation and Maintenance Manuals in accordance with Section 01730.
- I. General Distribution:

1. Unless required elsewhere, provide distribution of submittals to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

1.5 ACTION ON SUBMITTALS

A. ENGINEER's Action:

1. General:

- a. Except for submittals for record and similar purposes, where action and return on submittals are required or requested, ENGINEER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, ENGINEER will also advise CONTRACTOR without delay.
- b. ENGINEER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.

B. Action Stamp:

1. Approved:

- a. Final Unrestricted Release: Where submittals are marked "Approved", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS. Acceptance of Work will depend upon that compliance.

2. Approved As Noted:

- a. When submittals are marked "Approved as Noted", Work covered by submittal may proceed PROVIDED IT COMPLIES WITH BOTH ENGINEER'S NOTATIONS OR CORRECTIONS ON SUBMITTAL AND WITH Contract Documents. Acceptance of Work will depend on that compliance. Re-submittal is not required.

3. Comments Attached - Confirm or Resubmit:

- a. When submittals are marked "Examined and Returned for Correction", do not proceed with Work covered by submittal. Do not permit Work covered by submittal to be used at Project site or elsewhere where Work is in progress.
- b. Revise submittal or prepare new submittal in accordance with ENGINEER's notations in accordance with Paragraph 1.3D of this section. Resubmit submittal without delay. Repeat if necessary to obtain different action marking.

1.6 RE-SUBMITTAL REVIEW

- A. Cost of Subsequent Reviews: Shop Drawings and Operation and Maintenance Manuals submitted for each item will be reviewed no more than twice at the OWNER's expense. All subsequent reviews will be performed at times convenient to the ENGINEER and at the CONTRACTOR's expense based on the ENGINEER's then prevailing rates including all direct and indirect costs and fees. Reimburse the OWNER for all such fees invoiced to the OWNER by the ENGINEER.
- B. Time Extension: Any need for more than one resubmission, or any other delay in ENGINEER's review of submittals, will not entitle CONTRACTOR to extension of the Contract Time.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01310
PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Form of Schedules: Schedules shall be submitted in electronic PDF format, electronic Microsoft Project format, and hardcopy format
- B. Content of Schedules: Submit for approval, a preliminary progress schedule in accordance with the General Conditions.
- C. Schedule Revisions
- D. Submittal Requirements

1.2 FORM OF SCHEDULES

- A. Prepare schedules in form of a horizontal bar chart.
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Utilize a horizontal time scale and identify first work day of each week.
 - 3. Utilize scale and spacings to allow space for notations and future revisions.
- B. Utilize a listing format which chronologically indicates the order of start of each item of work.
- C. Identify each listing by major specification section numbers.

1.3 CONTENT OF SCHEDULES

- A. Completion Dates: Show the beginning and ending contract dates stated in documents. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against the OWNER by the CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.

- B. Show complete sequence of construction by activity.
- C. Show dates for beginning and completion of each major element of construction and installation dates for major items of equipment. Elements shall include, but not be limited to, the following:
 - 1. Shop drawing receipt from supplier/manufacturer submitted to ENGINEER, review and return to supplier/manufacturer
 - 2. Material and equipment order, manufacturer, delivery, installation, and checkouts
 - 3. Performance tests and supervisory services activity
 - 4. Construction of various facilities
 - 5. Demolition
 - 6. Excavation, sheeting, shoring, dewatering
 - 7. Concrete placement sequence
 - 8. Wall and roof construction
 - 9. Piping and equipment installation
 - 10. Electrical work activity
 - 11. Heating, ventilating, and air conditioning work activity
 - 12. Miscellaneous concrete placement
 - 13. Subcontractor's items of work
 - 14. Backfilling, grading, seeding, sodding, landscaping, fence construction, and paving
 - 15. Final cleanup
 - 16. Allowance for inclement weather
 - 17. Coordination with concurrent Work on site
- D. Show projected percentage of completion for each item as of first day of each month.

1.4 SCHEDULE REVISIONS

- A. As a minimum, revise construction schedule every 14 calendar days to reflect changes in progress of Work for duration of Contract.
- B. Indicate progress of each activity at date of submittal.
- C. Show changes occurring since previous submittal of schedule.
 - 1. Major change in scope
 - 2. Activities modified since previous submittal
 - 3. Revised projections of progress and completion
 - 4. Other identifiable changes
- D. Provide a written report as needed to define:
 - 1. Problem areas, anticipated delays, and impact on schedule
 - 2. Corrective action recommended and its effect
 - 3. Effect of changes on schedules of other Contractors

1.5 SUBMITTAL REQUIREMENTS

- A. Schedule: Submit final progress schedule in accordance with the General Conditions.
- B. For preliminary and final submittal of construction progress schedule and subsequent revisions thereof furnish three copies to ENGINEER.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS SECTION)

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittals
- B. Inspection Services
- C. Inspection of Materials
- D. Quality Control
- E. Costs of Inspection
- F. Acceptance Tests
- G. Failure to Comply with Contract

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals: Specific Submittal Requirements

1.3 SUBMITTALS

- A. General: Provide all submittals, including the following, as specified in Division 1.
- B. Certificate Submittals: Furnish the ENGINEER authoritative evidence in the form of Certificates of Manufacture that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

1.4 INSPECTION SERVICES

- A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford the OWNER and ENGINEER every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory

work at no additional cost to the OWNER. Replace as directed, finished or unfinished work found not to be in strict accordance with the Contract, even though such work may have been previously approved and payment made therefor.

- B. Rejection: The OWNER and the OWNER's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected work and materials from the site.
- C. Inferior Work Discoveries: Failure or neglect on the part of the OWNER or the OWNER's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the OWNER or the OWNER's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.
- D. Removal for Examination: Should it be considered necessary or advisable by the OWNER or the OWNER's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.
- E. Operation Responsibility: Assume full responsibility for the proper operation of equipment during tests and instruction periods. Make no claim for damage which may occur to equipment prior to the time when the OWNER accepts the Work.
- F. Rejection Prior to Warranty Expiration: If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the OWNER, repay to the OWNER all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices, and upon the receipt of the sum of money, OWNER will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. Do not remove the equipment from the premises of the OWNER until the OWNER obtains from other sources, equipment to take the place of that rejected. The OWNER hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the OWNER may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.5 INSPECTION OF MATERIALS

- A. Premanufacture Notification: Give notice in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice to include a request for inspection, the date of commencement, and

the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. Comply with these provisions before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

- B. Testing Standards: Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized, applicable test codes except as may otherwise be stated herein.

1.6 QUALITY CONTROL

A. Testing

1. Field and Laboratory

- a. Provide personnel to assist the ENGINEER in performing the following periodic observation and associated services.
 - (1) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.
 - (2) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.
 - (3) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.
- b. When specified in Divisions 2 through 26 of the Contract Documents, provide an independent laboratory testing facility to perform required testing. Qualify the laboratory as having performed previous satisfactory work. Prior to use, submit to the ENGINEER for approval.
- c. Cooperate with the ENGINEER and laboratory testing representatives. Provide at least 24 hours notice prior to when specified testing is required. Provide labor and materials, and necessary facilities at the site as required by the ENGINEER and the testing laboratory.
- d. Provide an independent testing agency, a member of the National Electrical Testing Association, to perform inspections and tests specified in Division 26 of these Specifications.

2. Equipment: Coordinate and demonstrate test procedures as specified in the Contract Documents or as otherwise required during the formal tests.
3. Pipeline and Other Testing: Conform to test procedures and requirements specified in the appropriate Specification Section.

B. Reports

1. Certified Test Reports: Where transcripts or certified test reports are required by the Contract Documents, meet the following requirements:
 - a. Before delivery of materials or equipment submit and obtain approval of the ENGINEER for all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents. Perform all testing in an approved independent laboratory or the manufacturer's laboratory. Submit for approval reports of shop equipment tests within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.
2. Certificate of Compliance: At the option of the ENGINEER, or where not otherwise specified, submit for approval a notarized Certificate of Compliance. The Certificates may be in the form of a letter stating the following:
 - a. Manufacturer has performed all required tests
 - b. Materials to be supplied meet all test requirements
 - c. Tests were performed not more than one year prior to submittal of the certificate
 - d. Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified
 - e. Identification of the materials

1.7 COSTS OF INSPECTION

- A. OWNER's Obligation: Initial inspection and testing of materials furnished under this Contract will be performed by the OWNER or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or

because of rejection for noncompliance, reimburse the OWNER for expenditures incurred in making such tests.

- B. CONTRACTOR's Obligation: Include in the Contract Price, the cost of all shop and field tests of equipment and other tests specifically called for in the Contract Documents.
- C. Reimbursements to OWNER:
 - 1. Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the OWNER for compliance. Reimburse the OWNER for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.
 - 2. Reimburse OWNER for the costs of any jobsite inspection between the hours of 7:00 p.m. and 6:00 a.m.
 - 3. Reimburse OWNER for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.8 ACCEPTANCE TESTS

- A. Preliminary Field Tests: As soon as conditions permit, furnish all labor and materials and services to perform preliminary field tests of all equipment provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, make all changes, adjustments and replacements required prior to the acceptance tests.
- B. Final Field Tests: Upon completion of the Work and prior to final payment, subject all equipment, piping and appliances installed under this Contract to specified acceptance tests to demonstrate compliance with the Contract Documents.
 - 1. Furnish all labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests.
 - 2. Conduct field tests in the presence of the ENGINEER. Perform the field tests to demonstrate that under all conditions of operation each equipment item:
 - a. Has not been damaged by transportation or installation
 - b. Has been properly installed
 - c. Has been properly lubricated
 - d. Has no electrical or mechanical defects
 - e. Is in proper alignment
 - f. Has been properly connected
 - g. Is free of overheating of any parts
 - h. Is free of all objectionable vibration

- i. Is free of overloading of any parts
 - j. Operates as intended
- 3. Operate work or portions of work for a minimum of 100 hours or 14 days continuous service, whichever comes first. For those items of equipment which would normally operate on wastewater or sludge, plant effluent may be used if available when authorized by ENGINEER. If water can not properly exercise equipment, conduct 100-hour test after plant startup. Conduct test on those systems which require load produced by weather (heating or cooling) exercise only when weather will produce proper load.
- C. Failure of Tests: If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, then promptly correct such deficiencies. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the OWNER, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.

1.9 FAILURE TO COMPLY WITH CONTRACT

- A. Unacceptable Materials: If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, do not deliver said material or equipment, or if delivered remove it promptly from the site or from the Work and replace it with acceptable material without additional cost to the OWNER. Fulfill all obligations under the terms and conditions of the Contract even though the OWNER or the OWNER's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General Requirements
- B. Temporary Utilities
- C. Temporary Construction
- D. Barricades and Enclosures
- E. Fences
- F. Security
- G. Temporary Controls
- H. Traffic Regulation
- I. Field Offices and Sheds

1.2 GENERAL REQUIREMENTS

- A. Plant and Facilities: Furnish, install, maintain and remove all false work, scaffolding, ladders, hoistways, braces, pumping plants, shields, trestles, roadways, sheeting, centering forms, barricades, drains, flumes, and the like, any of which may be needed in the construction of any part of the Work and which are not herein described or specified in detail. The CONTRACTOR shall accept responsibility for the safety and efficiency of such works and for any damage that may result from their failure or from their improper construction, maintenance or operation.
- B. First Aid: Maintain a readily accessible, completely equipped first aid kit at each location where work is in progress.
- C. Safety Responsibility: Accept sole responsibility for safety and security at the site. Indemnify and hold harmless the OWNER and the OWNER's Authorized Representatives, including the ENGINEER, for any safety violation, or noncompliance with governing bodies and their regulations, and for accidents, deaths, injuries, or damage at the site during occupancy or partial occupancy of the site by CONTRACTOR's forces while performing any part of the Work.

- D. Hazard Communication: Furnish two copies of the CONTRACTOR's Hazard Communication Program required under OSHA regulations before beginning on site activities. Furnish two copies of amendments to Hazard Communications Program as they are prepared.

1.3 TEMPORARY UTILITIES

- A. Water: Provide all necessary and required water without additional cost, unless otherwise specified. If necessary, provide and lay water lines to the place of use; secure all necessary permits; pay for all taps to water mains and hydrants and for all water used at the established rates.
- B. Light and Power: Provide without additional cost to the OWNER temporary lighting and power facilities required for the proper construction and inspection of the Work. If, in the ENGINEER's opinion, these facilities are inadequate, do NOT proceed with any portion of the Work affected thereby. Maintain temporary lighting and power until the Work is accepted.
- C. Heat: Provide temporary heat, whenever required, for work being performed during cold weather to prevent freezing of concrete, water pipes, and other damage to the Work or existing facilities.
- D. Sanitary Facilities: Provide sufficient sanitary facilities for construction personnel. Prohibit and prevent nuisances on the site of the Work or on adjoining property. Discharge any employee who violates this rule. Abide by all environmental regulations or laws applicable to the Work.
- E. Connections to Existing Utilities:
 - 1. Unless otherwise specified or indicated, make all necessary connections to existing facilities including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electricity. In each case, obtain permission from the OWNER or the owning utility prior to undertaking connections. Protect facilities against deleterious substances and damage.
 - 2. Thoroughly plan in advance all connections to existing facilities. Have on hand at the time of undertaking the connections, all material, labor and required equipment. Proceed continuously to complete connections in minimum time. Arrange for the operation of valves or other appurtenances on existing utilities, under the direct supervision of the owning utility.

1.4 TEMPORARY CONSTRUCTION

- A. Bridges: Design and place suitable temporary bridges where necessary for the maintenance of vehicular and pedestrian traffic. Assume responsibility for the sufficiency and safety of all such temporary work or bridges and for any damage which may result from their failure or their improper construction, maintenance, or

operation. Indemnify and save harmless the OWNER and the OWNER's representatives from all claims, suits or actions, and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.5 BARRICADES AND ENCLOSURES

- A. Protection of Workmen and Public: Effect and maintain at all times during the prosecution of the Work, barriers and lights necessary for the protection of Workmen and the Public. Provide suitable barricades, lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the Work causes obstructions to normal traffic, excavation sites, or constitutes in any way a hazard to the public.
- B. Barricades and Lights:
 - 1. Protect all streets, roads, highways, excavations and other public thoroughfares which are closed to traffic; use effective barricades which display acceptable warning signs. Locate barricades at the nearest public highway or street on each side of the blocked section.
 - 2. Statutory Requirements: Install and maintain all barricades, signs, lights, and other protective devices within highway rights-of-way in strict conformity with applicable statutory requirements by the authority having jurisdiction.

1.6 FENCES

- A. Existing Fences: Obtain written permission from the OWNER prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.
- B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work.

1.7 SECURITY

- A. Preservation of Property:
 - 1. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by the CONTRACTOR are not considered as damage. Whenever damages occur to such property, immediately restore to its original condition. Costs for such repairs are incidental to the Contract.

2. In case of failure on the part of the CONTRACTOR to restore property or make good on damage or injury, the OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract. If removal, repair or replacement of public or private property is made necessary by alteration of grade or alignment authorized by the OWNER and not contemplated by the Contract Documents, the CONTRACTOR will be compensated, in accordance with the General Conditions, provided that such property has not been damaged through fault of the CONTRACTOR or the CONTRACTOR's employees.

B. Public Utility Installations and Structures:

1. Public utility installations and structures include all poles, tracks, pipes, wires, conduits, vaults, manholes, and other appurtenances and facilities, whether owned or controlled by public bodies or privately owned individuals, firms or corporations, used to serve the public with transportation, gas, electricity, telephone, storm and sanitary sewers, water, or other public or private utility services. Facilities appurtenant to public or private property which may be affected by the Work are deemed included hereunder.
2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. Existing public utility installations and structures are indicated on the Drawings only to the extent such information was made available to, or found by, the ENGINEER in preparing the Drawings. These data are not guaranteed for completeness or accuracy, and the CONTRACTOR is responsible for making necessary investigations to become fully informed as to the character, condition, and extent of all public utility installations and structures that may be encountered and that may affect the construction operations.
3. Contact utility locating service sufficiently in advance of the start of construction to avoid damage to the utilities and delays to the completion date.
4. Remove, replace, relocate, repair, rebuild, and secure any public utility installations and structures damaged as a direct or indirect result of the Work under this Contract. Costs for such work are incidental to the Contract. Be responsible and liable for any consequential damages done to or suffered by any public utility installations or structures. Assume and accept responsibility for any injury, damage, or loss which may result from or be consequent to interference with, or interruption or discontinuance of, any public utility service.
5. Repair or replace any water, electric, sewer, gas, or other service connection damaged during the Work with no addition to the Contract price.

6. At all times in performance of the Work, employ proven methods and exercise reasonable care and skill to avoid unnecessary delay, injury, damage, or destruction to public utility installations and structures. Avoid unnecessary interference with, or interruption of, public utility services. Cooperate fully with the owners thereof to that end.
 7. Give written notice to the owners of all public utility installations and structures affected by proposed construction operations, sufficiently in advance of breaking ground in any area or on any unit of the Work, to obtain their permission before disrupting the lines and to allow them to take measures necessary to protect their interests. Advise the Chiefs of Police, Fire and Rescue Services of any excavation in public streets or the temporary shut-off of any water main. Provide at least 24 hours notice to all affected property owners whenever service connections are taken out of service.
- C. Miscellaneous Structures: Assume and accept responsibility for all injuries or damage to culverts, building foundations and walls, retaining walls, or other structures of any kind met with during the prosecution of the Work. Assume and accept liability for damages to public or private property resulting therefrom. Adequately protect against freezing all pipes carrying liquid.
- D. Protection of Trees and Lawn Areas:
1. Protect with boxes, trees and shrubs, except those ordered to be removed. Do not place excavated material so as to cause injury to such trees or shrubs. Replace trees or shrubs destroyed by accident or negligence of the CONTRACTOR or CONTRACTOR's employees with new stock of similar size and age, at the proper season, at no additional cost to the OWNER.
 2. Leave lawn areas in as good condition as before the start of the Work. Restore areas where sod has been removed by seeding or sodding.

1.8 TEMPORARY CONTROLS

- A. During Construction:
1. Keep the site of the Work and adjacent premises free from construction materials, debris, and rubbish. Remove this material from any portion of the site if such material, debris, or rubbish constitutes a nuisance or is objectionable.
 2. Remove from the site all surplus materials and temporary structures when they are no longer needed.
 3. Neatly stack construction materials such as concrete forms and scaffolding when not in use. Promptly remove splattered concrete, asphalt, oil, paint,

corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

4. Properly store volatile wastes in covered metal containers and remove from the site daily.
5. Do not bury or burn on the site or dispose of into storm drains, sanitary sewers, streams, or waterways, any waste material. Remove all wastes from the site and dispose of in a manner complying with applicable ordinances and laws.

B. Smoke Prevention:

1. Strictly observe all air pollution control regulations.
2. Open fires will be allowed only if permitted under current ordinances.

C. Noises:

1. Maintain acceptable noise levels in the vicinity of the Work. Limit noise production to acceptable levels by using special mufflers, barriers, enclosures, equipment positioning, and other approved methods.
2. Supply written notification to the OWNER sufficiently in advance of the start of any work which violates this provision. Proceed only when all applicable authorizations and variances have been obtained in writing.

D. Hours of Operation:

1. Operation of construction equipment between the hours of 7:00 p.m. and 7:00 a.m. the following day is prohibited. For operation of this equipment during this period obtain written consent from the OWNER and ENGINEER.
2. Do not carry out nonemergency work, including equipment moves, on Saturdays and Sundays without prior written authorization by the OWNER and ENGINEER.

E. Dust Control:

1. Take measures to prevent unnecessary dust. Keep earth surfaces exposed to dusting moist with water or a chemical dust suppressant. Cover materials in piles or while in transit to prevent blowing or spreading dust.
2. Adequately protect buildings or operating facilities which may be affected adversely by dust. Protect machinery, motors, instrument panels, or similar

equipment by suitable dust screens. Include proper ventilation with dust screens.

F. Temporary Drainage Provisions:

1. Provide for the drainage of stormwater and any water applied or discharged on the site in performance of the Work. Provide adequate drainage facilities to prevent damage to the Work, the site, and adjacent property.
2. Supplement existing drainage channels and conduits as necessary to carry all increased runoff from construction operations. Construct dikes as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect the OWNER's facilities and the Work, and to direct water to drainage channels or conduits. Provide ponding as necessary to prevent downstream flooding.
3. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- G. Pollution: Prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. Do not permit sanitary wastes to enter any drain or watercourse other than sanitary sewers. Do not permit sediment, debris, or other substances to enter sanitary sewers. Take reasonable measures to prevent such materials from entering any drain or watercourse.

1.9 TRAFFIC REGULATION

- A. Parking: Provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the Contract, to avoid any need for parking personal vehicles where they may interfere with public traffic or construction activities.
- B. Access: Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when the CONTRACTOR has obtained permission from the owner or tenant of private property, or from the authority having jurisdiction over the public property involved, to obstruct traffic at the designated point.

1.10 FIELD OFFICES AND SHEDS

- A. CONTRACTOR's Office: The CONTRACTOR, at his discretion may, erect, furnish, and maintain a field office with a telephone. The CONTRACTOR will have an

authorized agent present at the site at all times while the Work is in progress. The CONTRACTOR shall keep readily accessible copies of the Contract Documents, required record documents, and the latest approved shop drawings on the project site at all times, regardless of the use of a field office.

- B. Material Sheds and Temporary Structures: Provide material sheds and other temporary structures of sturdy construction and neat appearance as needed and required to properly store and secure materials and equipment.
- C. Location: Coordinate location of field offices, material sheds and temporary structures with ENGINEER and OWNER and as indicated on the contract documents.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Description
- B. Substitutions
- C. Manufacturer's Written Instructions
- D. Transportation and Handling
- E. Storage, Protection and Maintenance
- F. Manufacturer's Field Quality Control Services
- G. Post Startup Services
- H. Special Tools and Lubricating Equipment
- I. Lubrication

1.2 DESCRIPTION

- A. Proposed Manufacturers List: Within 15 calendar days of the date of the Notice to Proceed, submit to the ENGINEER a list of the names of proposed manufacturers, materialmen, suppliers and subcontractors, obtain approval of this list by OWNER prior to submission of any working drawings. Upon request submit evidence to ENGINEER that each proposed manufacturer has manufactured a similar product to the one specified and that it has previously been used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.
- B. Furnish and install Material and Equipment which meets the following:
 - 1. Conforms to applicable specifications and standards.
 - 2. Complies with size, make, type, and quality specified or as specifically approved, in writing, by ENGINEER.
 - 3. Will fit into the space provided with sufficient room for operation and maintenance access and for properly connecting piping, ducts and services, as applicable. Make the clear spaces that will be available for operation and

maintenance access and connections equal to or greater than those shown and meeting all the manufacturers' requirements. Make all provisions for installing equipment furnished at no increase in Contract Price.

4. Manufactured and fabricated in accordance with the following:
 - a. Design, fabricate, and assemble in accordance with best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Provide two or more items of same kind identical, by same manufacturer.
 - d. Provide materials and equipment suitable for service conditions.
 - e. Adhere to equipment capabilities, sizes, and dimensions shown or specified unless variations are specifically approved, in writing, in accordance with the Contract Documents.
 - f. Adapt equipment to best economy in power consumption and maintenance. Proportion parts and components for stresses that may occur during continuous or intermittent operation, and for any additional stresses that may occur during fabrication or installation.
 - g. Working parts are readily accessible for inspection and repair, easily duplicated and replaced.
5. Use material or equipment only for the purpose for which it is designed or specified.

1.3 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR's requests for changes in equipment and materials from those required by the Contract Documents are considered requests for substitutions and are subject to CONTRACTOR's representations and review provisions of the Contract Documents when one of following conditions are satisfied:
 - a. Where request is directly related to an "or equal" clause or other language of same effect in Specifications.
 - b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR's failure to pursue Work promptly or to coordinate various activities properly.

- c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.
- 2. CONTRACTOR'S Options:
 - a. Where more than one choice is available as options for CONTRACTOR's selection of equipment or material, select option compatible with other equipment and materials already selected (which may have been from among options for other equipment and materials).
 - b. Where compliance with specified standard, code or regulation is required, select from among products which comply with requirements of those standards, codes, and regulations.
 - c. "Or Equal": For equipment or materials specified by naming one or more equipment manufacturer and "or equal", submit request for substitution for any equipment or manufacturer not specifically named.
- B. Conditions Which are Not Substitution:
 - 1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in the Specifications.
 - 2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions".
 - 3. CONTRACTOR's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions and do not constitute basis for a Change Order, except as provided for in Contract Documents.

1.4 MANUFACTURER'S WRITTEN INSTRUCTIONS

- A. Instruction Distribution: When the Contract Documents require that installation, storage, maintenance and handling of equipment and materials comply with manufacturer's written instruction's, obtain and distribute printed copies of such instructions to parties involved in installation, including six copies to ENGINEER.
 - 1. Maintain one set of complete instructions at jobsite during storage and installation, and until completion of work.
- B. Manufacturer's Requirements: Store, maintain, handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.
 2. Do not proceed with work without written instructions.
- C. Performance Procedures: Perform work in accordance with manufacturer's written instructions. Do not omit preparatory steps or installation procedures, unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

- A. Coordination with Schedule: Arrange deliveries of materials and equipment in accordance with Construction Progress Schedules. Coordinate to avoid conflict with work and conditions at site.
1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 2. Protect bright machined surfaces, such as shafts and valve faces, with a heavy coat of grease prior to shipment.
 3. Immediately upon delivery, inspect shipments to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.
- B. Handling: Provide equipment and personnel to handle material and equipment by methods recommended by manufacturer to prevent soiling or damage to materials and equipment or packaging.

1.6 STORAGE, PROTECTION, AND MAINTENANCE

- A. On-site storage areas and buildings:
1. Conform storage buildings to requirements of Section 01500.
 2. Coordinate location of storage areas with ENGINEER and OWNER.
 3. Arrange on site storage areas for proper protection and segregation of stored materials and equipment with proper drainage. Provide for safe travel around storage areas and safe access to stored materials and equipment.
 4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 5. Store materials such as pipe, reinforcing and structural steel, and equipment on pallets, blocks or racks, off ground.

6. PVC Pipe may be damaged by prolonged exposure to direct sunlight and the CONTRACTOR shall take necessary precautions during storage and installation to avoid this damage. Pipe shall be stored under cover, and installed with sufficient backfill to shield it from the sun.
 7. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- B. Interior Storage:
1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.
 2. Store materials and equipment, subject to damage by elements, in weathertight enclosures.
 3. Maintain temperature and humidity within ranges required by manufacturer's instructions.
- C. Accessible Storage: Arrange storage in a manner to provide easy access for inspection and inventory. Make periodic inspections of stored materials or equipment to assure that materials or equipment are maintained under specified conditions and free from damage or deterioration.
1. Perform maintenance on stored materials or equipment in accordance with manufacturer's instructions, in presence of OWNER or ENGINEER.
 2. Submit a report of completed maintenance to ENGINEER with each Application for Payment.
 3. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.
- D. OWNER's Responsibility: OWNER assumes no responsibility for materials or equipment stored in buildings or on-site. CONTRACTOR assumes full responsibility for damage due to storage of materials or equipment.
- E. CONTRACTOR's Responsibility: CONTRACTOR assumes full responsibility for protection of completed construction. Repair and restore damage to completed Work equal to its original condition.
- F. Special Equipment: Use only rubber tired wheelbarrows, buggies, trucks, or dollies to wheel loads over finished floors, regardless if the floor has been protected or not.

This applies to finished floors and to exposed concrete floors as well as those covered with composition tile or other applied surfacing.

- G. Surface Damage: Where structural concrete is also the finished surface, take care to avoid marking or damaging surface.

1.7 MANUFACTURER'S FIELD QUALITY CONTROL SERVICES

A. General:

1. Provide manufacturer's field services in accordance with this subsection for those tasks specified in other sections.
2. Provide training as specified in Section 01670.
3. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

- B. Installation Instruction: Provide instruction by competent and experienced technical representatives of equipment manufacturers or system suppliers as necessary to resolve assembly or installation procedures which are attributable to, or associated with, the equipment furnished.

C. Installation Inspection, Adjustments and Startup Participation:

1. Provide competent and experienced technical representatives of equipment manufacturers or system suppliers to inspect the completed installation as follows.
 - a. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.
 - b. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - c. Verify that wiring and support components for equipment are complete.
 - d. Verify that equipment or system is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
 - e. Verify that nothing in the installation voids any warranty.
2. Provide manufacturer's representatives to perform initial equipment and system adjustment and calibration conforming to the manufacturer's recommendations and instructions, approved shop drawings and the Contract Documents.

3. Obtain ENGINEER's approval before start-up of equipment. Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' instructions.
4. Furnish ENGINEER with three copies of the following. When training is specified, furnish the copies at least 24 hours prior to training.
 - a. "Certificate of Installation, Inspection and Start-up Services" by manufacturers' representatives for each piece of equipment and each system specified, certifying:
 - (1) That equipment is installed in accordance with the manufacturers' recommendations, approved shop drawings and the Contract Documents.
 - (2) That nothing in the installation voids any warranty.
 - (3) That equipment has been operated in the presence of the manufacturer's representative.
 - (4) That equipment, as installed, is ready to be operated by others.
 - b. Detailed report by manufacturers' representatives, for review by ENGINEER of the installation, inspection and start-up services performed, including:
 - (1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.
 - (2) Description of any parts replaced and why replaced.
 - (3) Type, brand name, and quantity of lubrication used, if any.
 - (4) General condition of equipment.
 - (5) Description of problems encountered, and corrective action taken.
 - (6) Any special instructions left with CONTRACTOR or ENGINEER.
- D. Field Test Participation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to participate in field testing of the equipment specified in Section 01400.
- E. Trouble-Free Operation: Provide competent and experienced technical representatives of all equipment manufacturers and system suppliers as necessary to

place the equipment in trouble-free operation after completion of start-up and field tests.

1.8 POST START-UP SERVICES

- A. General: Provide Post Start-up Services in accordance with this subsection for equipment specified in other sections.
- B. Site Visit: Provide the services of an authorized service representative for each equipment manufacturer or system supplier to make a final site visit after the equipment or system has been in operation for at least 6 months, but no longer than 11 months. Furnish assistance to OWNER's operating personnel in making adjustments and calibrations required to determine that the equipment and system is operating in conformance with design, manufacturer's, and specification requirements. Instruct the personnel in a review of proper operation and maintenance procedures.
- C. Certificate: Furnish "Certificate of Post Start-up Services" cosigned by ENGINEER and the manufacturer's representative, certifying that this service has been performed. Use form provided in this section, and furnish OWNER with three copies.

1.9 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

- A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
- B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.
- C. Quality: Provide tools and lubricating equipment of a quality meeting equipment manufacturer's requirements.

1.10 LUBRICATION

- A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and proper provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.
- B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

CERTIFICATE OF INSTALLATION, INSPECTION AND START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify that the named equipment has been inspected, adjusted and operated by the Manufacturers' Representative and further certify:

1. That the equipment is installed in accordance with the manufacturer's recommendations, approved shop drawings and the Contract Documents.
2. That nothing in the installation voids any warranty.
3. That equipment has been operated in the presence of the manufacturer's representative.
4. That equipment, as installed, is ready to be operated by others.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

Attach the detailed report called for by Specification Section 01600.

Complete and submit three copies of this form with the detailed report to ENGINEER as specified.

CERTIFICATE OF POST START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby certify the Manufacturers' Representative has inspected this equipment, made adjustments and calibrations, and that it is operating in conformance with the design, specifications, and manufacturer's requirements. Detailed notation of improper operation with corresponding recommendations, if any, are made and attached to this form.

MANUFACTURERS' REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

_____ Complete and submit three copies of this form to OWNER upon completion of 6 to 11 months reinspection as required by Specification Section 01600.

(NO TEXT FOR THIS PAGE)

SECTION 01710

CLEANING

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. General Requirements
- B. Disposal Requirements

1.2 GENERAL REQUIREMENTS

- A. Execute cleaning during progress of the work and at completion of the work.

1.3 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 DURING CONSTRUCTION

- A. Execute daily cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.2 FINAL CLEANING

- A. Requirements: At the completion of work and immediately prior to final inspection, clean the entire project as follows:
 - 1. Thoroughly clean, sweep, wash, and polish all work and equipment provided under the Contract, including finishes. Leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.
 - 2. Direct all subcontractors to similarly perform, at the same time, an equivalent thorough cleaning of all work and equipment provided under their contracts.
 - 3. Remove all temporary structures and all debris, including dirt, sand, gravel, rubbish and waste material.
 - 4. Should the CONTRACTOR not remove rubbish or debris or not clean the buildings and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
- B. Employ experienced workers, or professional cleaners, for final cleaning.
- C. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- D. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
- E. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated to shine finish.
- F. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.
- G. Replace air-handling filters if units were operated during construction.
- H. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.
- I. Vacuum clean all interior spaces, including inside cabinets.
- J. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.

- K. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly-painted surfaces.
- L. Clean interior of all panel cabinets, pull boxes, and other equipment enclosures.
- M. Wash and wipe clean all lighting fixtures, lamps, and other electrical equipment which may have become soiled during installation.
- N. Perform touch-up painting.
- O. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- P. Remove erection plant, tools, temporary structures and other materials.
- Q. Remove and dispose of all water, dirt, rubbish or any other foreign substances.

3.3 FINAL INSPECTION

- A. After cleaning is complete the final inspection may be scheduled. The inspection will be done with the OWNER and ENGINEER.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 01720

CONTRACT CLOSE OUT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Warranties and Bonds
- B. Record Drawings
- C. Special Tools

1.2 WARRANTIES AND BONDS

Prior to final payment deliver to the OWNER the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period. Show OWNER as beneficiary of these documents.

1.3 RECORD DRAWINGS

At the site keep and maintain one record copy of all Contract Documents, reference documents and all technical documents submitted in good order. As the work progresses the CONTRACTOR or his designated representative shall record on one set of reproducible drawings all changes and deviations from the original Plans. He shall record the exact location of all changes in vertical and horizontal alignment by offsets and ties at each; sewer, water, electric, gas, communication and other services by off-set distance to permanent improvements such as building and curbs or survey control points.

Prior to acceptance of the project and before final payment is made, the CONTRACTOR shall submit one (1) set of reproducible drawings, two (2) sets of blueline or blackline prints, all marked "Drawings of Record". These Record Drawings must be certified by a Professional Land Surveyor, licensed in the State of Florida and submit AutoCAD compatible diskette copy of the drawings, and other applicable related records to the Department of Lee County Utilities.

These Record Drawings must be certified by a Professional Land Surveyor, licensed in the State of Florida. The Record Drawings shall include vertical and horizontal alignment of all water, sewer, and effluent reuse lines, valves, tees, bends, reducers, hydrants, pump stations, service connections, meter boxes and/or pads, water wells, concrete pads, fill and other pertinent structures. Pipeline runs in excess of 152.4m, (500'), without fittings shall include vertical alignment information at 152.4m, (500') intervals. Said alignment shall be tied to permanent improvements, such as roadway

and/or railroad centerlines and rights-of-way, building and property corners, and shall be certified by a Professional Land Surveyor, licensed in the State of Florida. The Professional Land Surveyor can coordinate with the Contractor to install the necessary appurtenances on buried utilities to facilitate the survey after construction is completed. In addition, property strap numbers and street names shall be shown on the plan.

On a case by case basis, Lee County Utilities may waive the requirement for certification by a Professional Land Surveyor, licensed in the State of Florida. However, prior consent must first be obtained from Lee County Utilities. The County shall withhold final acceptance of the project until the requirement for record drawings and related records has been met. Record Drawings without detailed field verified horizontal and vertical locations of all facilities shown will be rejected.

1.4 SPECIAL TOOLS

Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

For each type of equipment provided under this CONTRACT, furnish a complete set of all special tools including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Furnish only tools of high grade, smooth forged alloy tool steel. Manufacture grease guns of the lever type.

Furnish and erect one or more neat and substantial steel wall cases or cabinets with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Compile specified warranties and bonds, as in Articles 6 and 13 of the General Conditions.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit to the ENGINEER for review and transmittal to OWNER.

1.2 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Two original signed copies are required.
- C. Table of Contents. Neatly typed in orderly sequence. Provide complete information for each items.
 - 1. Product or work item.
 - 2. Firm, with name of principal, address and telephone number.
 - 3. Scope.
 - 4. Date of beginning warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond or service maintenance contract.
 - 6. Provide information for OWNER's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity of warranty or bond.
 - 7. CONTRACTOR, name of responsible principal, address and telephone number.

1.3 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2" x 11", punch sheets for standard 3-post binder.
 - a. Fold larger sheets to fit into binders.

- 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS" list:
 - a. Title of Project
 - b. Name of CONTRACTOR

- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.4 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR's for one (1) year, unless otherwise specified, commencing at the time of substantial completion.

- B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Division 11, 23, 25, and 26 and which has a 1 HP motor or which lists for more than \$1,000. The ENGINEER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be "major" in the CONTRACTOR's one-year warranty period even though certificates of warranty may not be required.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: All work necessary for the removal and disposal of buildings, structures, foundations, piping, equipment and roadways, or any part thereof including masonry, steel, reinforced concrete, plain concrete, electrical facilities, and any other material or equipment shown or specified to be removed.
- B. Basic Procedures and Schedule: Carry out demolition so that adjacent structures, which are to remain, are not endangered. Schedule the work so as not to interfere with the day to day operation of the existing facilities. Do not block doorways or passageways in existing facilities.
- C. Additional Requirements: Provide dust control and make provisions for safety.

1.2 SUBMITTALS

- A. Provide all submittals, including the following, as specified in Division 1.
- B. Site Inspection: Visit the site and inspect all existing structures. Observe and record any defects which may exist in buildings or structures adjacent to but not directly affected by the demolition work. Provide the OWNER with a copy of this inspection record and obtain the (ENGINEER's) (OWNER's) approval prior to commencing the demolition.

1.3 QUALITY ASSURANCE

- A. Limits: Exercise care to break concrete well for removal in reasonably small masses. Where only parts of a structure are to be removed, cut the concrete along limiting lines with a suitable saw so that damage to the remaining structure is held to a minimum.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION OF EXISTING DRAWINGS

- A. Drawings of existing structures and equipment will be available for inspection at the office of the (ENGINEER) (OWNER).

3.2 PROTECTION

- A. General Safety: Provide warning signs, protective barriers, and warning lights as necessary adjacent to the work as approved or required. Maintain these items during the demolition period.
- B. Existing Services: Undertake no demolition work until all mechanical and electrical services affected by the work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily in a manner that will not interfere with the operation of the remaining facilities.
- C. Hazards: Perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.

3.3 DEMOLITION REQUIREMENTS

- A. Explosives: The use of explosives will not be permitted.
- B. Protection: Carefully protect all mechanical and electrical equipment against dust and debris.
- C. Removal: Remove all debris from the structures during demolition and do not allow debris to accumulate in piles.
- D. Access: Provide safe access to and egress from all working areas at all times with adequate protection from falling material.
- E. Protection: Provide adequate scaffolding, shoring, bracing railings, toe boards and protective covering during demolition to protect personnel and equipment against injury or damage. Cover floor openings not used for material drops with material substantial enough to support any loads placed on it. Properly secure the covers to prevent accidental movement.
- F. Lighting: Provide adequate lighting at all times during demolition.
- G. Closed Areas: Close areas below demolition work to anyone while removal is in progress.

- H. Material Drops: Do not drop any material to any point lying outside the exterior walls of the structure unless the area is effectively protected.

3.4 DISPOSAL OF MATERIALS

- A. Final Removal: Remove all debris, rubbish, scrap pieces, equipment, and materials resulting from the demolition unless otherwise indicated. Take title to all demolished materials and remove such items from the site.
- B. OWNER's Property: In addition to any items which may be shown, the following items remain the property of the OWNER. Remove carefully, without damage, all items listed or shown, and stockpile as directed.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for clearing of all areas within the Contract limits and other areas shown, including work designated in permits and other agreements, in accordance with the requirements of Division 1.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 02050 - Demolition
 - 2. Section 02400 – Lawn Restoration

1.2 DEFINITIONS

- A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish and debris as well as the removal of fences.
- B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 1-1/2 inches, matted roots and organic materials.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TREE REMOVAL

- A. Tree Removal Within Property Limits: Remove trees and shrubs within the (limits of the right-of-way) (property limits) unless otherwise indicated.
 - 1. Remove trees and shrubs to avoid damage to trees and shrubs designated to remain.
 - 2. Grub and remove tree stumps and shrubs felled within the (property limits) (right-of-way) to an authorized disposal site. Fill depressions created by such removal with material suitable for backfill as specified in Section 02223.

- B. Tree Removal Outside Property Limits: Do not cut or damage trees outside the (right-of-way) (property limits) unless shown to be removed or unless written permission has been obtained from the property owner. Furnish three copies of the written permission before removal operations commence.
- C. If the land owner desires the timber or small trees, the CONTRACTOR shall cut and neatly pile it in 4 ft. lengths for removal by the OWNER; otherwise, the CONTRACTOR shall dispose of it by hauling it away from the project site.

3.2 TREES AND SHRUBS TO BE SAVED

- A. Protection: Protect trees and shrubs within the (construction site) (right-of-way) (construction strip) that are so delineated or are marked in the field to be saved from defacement, injury and destruction.
 - 1. Work within the limits of the tree drip line with extreme care using either hand tools or equipment that will not cause damage to trees.
 - a. Do not disturb or cut roots unnecessarily. Do not cut roots 1-1/2 inches and larger unless approved.
 - b. Immediately backfill around tree roots after completion of construction in the vicinity of trees.
 - c. Do not operate any wheeled or tracked equipment within drip line.
 - 2. Protect vegetation from damage caused by emissions from engine-powered equipment.
 - 3. During working operations, protect the trunk, foliage and root system of all trees to be saved with boards or other guards placed as shown and as required to prevent damage, injury and defacement.
 - a. Do not pile excavated materials within the drip line or adjacent to the trunk of trees.
 - b. Do not allow runoff to accumulate around trunk of trees.
 - c. Do not fasten or attach ropes, cables, or guy wires to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.
 - d. The use of axes or climbing spurs for trimming will not be permitted.
 - e. Provide climbing ropes during trimming.

4. Remove shrubs to be saved, taking a sufficient earth ball with the roots to maintain the shrub.
 - a. Temporarily replant if required, and replace at the completion of construction in a condition equaling that which existed prior to removal.
 - b. Replace in kind if the transplant fails.
5. Have any tree and shrub repair performed by a tree surgeon properly licensed by the State of Florida and within 24 hours after damage occurred.

3.3 CLEARING AND GRUBBING

- A. Clearing: Clear all items specified to the limits shown and remove cleared and grubbed materials from the site.
 1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.
 2. Comply with erosion, sediment control and storm management measures as specified in Division 1.
- B. Grubbing: Clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.
 1. Remove stumps and root mats in these areas to a depth of not less than 18 inches below the subgrade of sloped surfaces.
 2. Fill all depressions made by the removal of stumps or roots with material suitable for backfill as specified in Section 02223.
- C. Limited Clearing: Clear areas receiving more than 3 feet of fill by cutting trees and shrubs as close as practical to the existing ground. Grubbing will not be required.
- D. Dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved dump. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.4 TOPSOIL

- A. Stripping: Strip existing topsoil from areas that will be excavated or graded prior to commencement of excavating or grading and place in well-drained stockpiles in approved locations.

3.5 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The CONTRACTOR shall exercise extreme care to avoid unnecessary disturbance of developed private property along the route of the construction. Trees, shrubbery, gardens, lawns, and other landscaping, which in the opinion of the ENGINEER must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.
- D. Clean up the construction site across developed private property directly after construction is completed upon approval of the ENGINEER.
- E. Any commercial signs, disturbed or removed, shall be restored to their original condition within 24 hours.

3.6 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Articles 3.5 and 3.6 of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements, and all other damaged areas.

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering, and reseeding onsite surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the OWNER.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the OWNER.
- D. CONTRACTOR is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.2 REFERENCE DOCUMENTS

- A. South Florida Building Code and Standard Building Code.

PART 2 PRODUCTS

2.1 EROSION CONTROL

- A. Seeding and Sodding is specified in Section 02400.
- B. Netting - fabricated of material acceptable to the OWNER.

2.2 SEDIMENTATION CONTROL

- A. Bales - clean, seed free cereal hay type.
- B. Netting - fabricated of material acceptable to the OWNER.
- C. Filter Stone - crushed stone conforming to Florida Department of Transportation specifications.

- D. Concrete Block - hollow, non-load-bearing type.
- E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.1 EROSION CONTROL

- A. Minimum procedures for grassing are:
 1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
 2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
 3. Apply mulch loosely and to a thickness of between 3/4 inch and 1-1/2 inches.
 4. Apply netting over mulched areas on sloped surfaces.
 5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.2 SEDIMENTATION CONTROL

- A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings, hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.3 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the CONTRACTOR fail to produce results which comply with the requirements of the State of Florida, CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02400
LAWN RESTORATION

PART 1 GENERAL

1.1 DESCRIPTION OF REQUIREMENTS

- A. The work in this section consists of furnishing all labor, material and equipment to replace and maintain all areas disturbed during construction by establishing a stand of grass, within the areas called for by the furnishing and placing grass sod, or seeding, or seeding and mulching.

1.2 REFERENCE DOCUMENTS

- A. The materials used in this work shall conform to the requirements of Florida Department of Transportation Standard Specifications for Road and Bridge Construction as follows:
 - 1. Sod - Section 981-2
 - 2. Fertilizer - Section 982
 - 3. Water - Section 983

1.3 SUBMITTALS

- A. Submit certifications and identification labels for all sodding supplied as specified in Section 01300.

PART 2 PRODUCTS

2.1 SODDING

- A. Types: Sod may be of either St. Augustine or Argentine Bahia grass or as that disturbed, as established prior to construction. It shall be well matted with roots. When replacing sod in areas that are already sodded, the sod shall be the same type as the existing sod.
- B. Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The CONTRACTOR shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.
- C. The sod shall be taken up in commercial-size rectangles, preferably 12-inch by 24-inch or larger, except where 6-inch strip sodding is called for.

- D. The sod shall be sufficiently thick to secure a dense stand of live grass. The sod shall be live, fresh and uninjured at the time of planting. It shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. It shall be reasonably free of weeds and other grasses. It shall be planted as soon as possible after being dug and shall be shaded and kept moist from the time it is dug until it is planted.
- E. Sod should be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling during delivery, storage or installation will be rejected.

2.2 FERTILIZER

- A. Chemical fertilizer shall be supplied in suitable bags with the net weight certification of the shipment. Fertilizer shall be 12-8-8 and comply with Section 982 of the FDOT Standard Specification for Road and Bridge Construction.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water soluble potash, contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 12-8-8, with at least 50 percent of the nitrogen from a nonwater-soluble organic source. The nitrogen source may be a unreaformaldehyde source provided it is not derived from a waste product of the plastic industry.

2.3 EQUIPMENT

- A. The device for spreading fertilizer shall be capable of uniformly distributing the material at the specified rate.

2.4 NETTING

- A. Netting is fabricated of material similar to Geoscope Landscape Fabric or approved equal.

2.5 GRASSING

- A. The CONTRACTOR shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.
- B. Grass seed shall be Argentine Bahia, 60 #/acre March 1 to November 1, 50 #/acre with 20 #/acre of rye grass seed November 1 to March 1. Argentine Bahia seed shall be a scarified seed having a minimum active germination of 40% and total of 85%.

- C. Mulch material shall be free of weeds and shall be oat straw or rye, Pangola, peanut, Coastal Bermuda, or Bahia grass hay.

2.6 TOPSOIL

- A. Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the OWNER. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

2.7 MULCH

- A. Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1-inch or more than 3-inches according to texture and moisture content of mulch material.

2.8 WATER

- A. It is the CONTRACTOR'S responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The CONTRACTOR shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.1 SOD BED PREPARATION

- A. Areas to be sodded and/or seeded shall be cleared of all rough grass, weeds, and debris, and brought to an even grade.
- B. The soil shall then be thoroughly tilled to a minimum 8-inch depth.
- C. The areas shall then be brought to proper grade, free of sticks, stones, or other foreign matter over 1-inch in diameter or dimension. The surface shall conform to finish grade, less the thickness of sod, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 INSPECTION

- A. Verify that soil preparation and related preceding work has been completed.
- B. Do not start work until conditions are satisfactory.

3.3 SOD HANDLING AND INSTALLATION

- A. During delivery, prior to planting, and during the planting of sod areas, the sod panels shall at all times be protected from excessive drying and unnecessary exposure of the roots to the sun. All sod shall be stacked during construction and planting so as not to be damaged by sweating or excessive heat and moisture.
- B. After completion of soil conditioning as specified above, sod panels shall be laid tightly together so as to make a solid sodded lawn area. On mounds and other slopes, the long dimension of the sod shall be laid perpendicular to the slope. Immediately following sod laying the lawn areas shall be rolled with a lawn roller customarily used for such purposes, and then thoroughly watered.
- C. Sod shall be placed at all areas where sod existed prior to construction, on slopes of 3 horizontal on 1 vertical (3:1) or greater, in areas where erosion of soils will occur, and as directed by the ENGINEER. On areas where the sod may slide, due to height and slope, the ENGINEER may direct that the sod be pegged, with pegs driven through the sod blocks into firm earth, at suitable intervals.

3.4 USE OF SOD ON ROADWAY PROJECTS

- A. In accordance with the FDOT District One Standard Practice, permanent green grass shall be established at the completion of roadway construction and maintenance work. The following shall apply to all restoration involving State or County roadways:
 - 1. Sod in lieu of seed and mulch shall be used on all roadways with urban (raised curb) typical sections.
 - 2. One inch water per week shall be required for a minimum of four (4) consecutive weeks for the purpose of establishing sod. This can be waived during construction, if and only if there is a minimum of one inch of rain per week on all sod on the project.
 - 3. Sod shall be placed on slopes 1:3 or greater. Staked sod shall be placed on slopes 1:2 or greater.
 - 4. On all curves with superelevation, sod shall be placed from the edge of pavement to the toe of slope on the downhill side(s) for the entire length of the superelevated roadway. On multi-lane divided rural facilities, sod shall be placed in the median and on the inside of the curve in the superelevated areas. This does not apply to reverse crowns.
 - 5. For all projects with less than 10,000 square yards grass area, sod shall be used.
 - 6. On tangent sections and on outside of curves, sod shall be used between the edge of pavement and a point 4 feet beyond the shoulder break point.
 - 7. The entire width of sod should not exceed 15 feet from the edge of pavement.
 - 8. Sod is to be used to eliminate narrow seed and mulch areas. Areas less than 6 feet in width shall be sodded.
 - 9. Sod shall be placed around drainage structures as per the standard Indexes and extended to the edge of pavement.

3.5 SOD MAINTENANCE

- A. The sod shall produce a dense, well established growth. The CONTRACTOR shall be responsible for the repair and re-sodding of all eroded or bare spots until project acceptance. Repair to sodding shall be accomplished as in the original work.
- B. Sufficient watering shall be done by the CONTRACTOR to maintain adequate moisture for optimum development of the seeded and sodded areas. Sodded areas shall receive no less than 1.5 inches of water per week for at least 2 weeks. Thereafter, the CONTRACTOR shall apply water for a minimum of 60 days as needed until the sod takes root and starts to grow or until final acceptance, whichever is latest.

3.6 CLEANING

- A. Remove debris and excess materials from the project site.

END OF SECTION

(NO TEXT FOR THIS PAGE)

SECTION 02485

SEEDING AND SODDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment necessary to satisfactorily return all construction areas to their original conditions or better.
- B. Work includes furnishing and placing seed or sod, fertilizer, planting, watering, and maintenance until acceptance by the Owner.

1.02 QUALITY ASSURANCE

A. Requirements

It is the intent of this specification that the Contractor is obliged to deliver a satisfactory strand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering, and seeding or sodding at no additional cost to the owner until a satisfactory strand is obtained.

B. Satisfactory Strand

For purposes of grassing, a satisfactory strand of grass is herein defined as a full lawn cover over areas to be seeded or sodded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 sq. yd. within a radius of 10 ft.

PART 2 - PRODUCTS

2.01 Materials

A. Fertilizer

Fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 3 percent phosphorus, 6 percent potassium; 40 percent other available materials derived from organic sources. Fertilizer

shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Grassing

The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications.

C. Sodding

Sod shall be provided as required in accordance with Florida Department of Transportation Specifications 575 and 981. The Contractor shall furnish sod equal to and similar in type as that disturbed. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575.

D. Topsoil

Topsoil stockpiled during excavation may be used. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the Owner. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants, and grassing specified herein.

E. Mulch

Mulch shall be fresh cypress mulch. Rate of application specified herein shall correspond to depth not less than 1" or more than 3" according to texture and moisture content of much material.

F. Water

It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments, and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Time of Seeding and Sodding

When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as required.

B. Finish Grading

Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated; the Engineer shall approve the finish grade of all areas to be seeded or sodded prior to application of seed or sod.

C. Protection

Seeded and sodded areas shall be protected against the traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to actual acceptance by the Owner shall be repaired by the Contractor as directed by the Engineer.

3.01 CLEANUP

- A. Soil, mulch, seed, or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones, and debris remaining shall be removed from the construction areas.

3.02 LANDSCAPE MAINTENANCE

- A. Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.
- B. Maintain landscape work for a period of 90 days immediately following complete installation of work or until Owner accepts project. Watering, seeding, cultivating, restoration of grade, mowing and trimming grass, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be the responsibility of the Contractor and at no additional cost to the Owner.

3.03 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATIONS

- A. Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing, and reseeding or sodding, in accordance with these Specifications.

END OF SECTION

SECTION 02999

MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This Section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent of work involved. Furnish all labor, materials, equipment and incidentals to complete the work under this Section.
- B. The work of this Section includes, but is not limited to, the following:
 - 1. Restoring of sidewalks, driveways, curbing and gutters.
 - 2. Crossing utilities.
 - 3. Relocation of existing water lines, low pressure, gas lines, telephone lines, electric lines, cable TV lines and storm drains as necessary, all as shown on the drawings.
 - 4. Restoring easements and rights-of-ways.
 - 5. Cleaning up.
 - 6. Incidental work.

1.2 WORK SPECIFIED UNDER OTHER SECTIONS

- A. All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of these Specifications.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials required for this Section shall be of at least the same type and quality as materials that are to be restored. Where possible, reuse existing materials that are removed and then replaced, with the exception of paving.

PART 3 EXECUTION

3.1 RESTORING OF CURBING, FENCES, AND GUARD RAILS

- A. Existing curbing shall be protected. If necessary, curbing shall be removed from joint to joint and replaced after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension.

3.2 CROSSING UTILITIES

- A. This item shall include any extra work required in crossing culverts, water courses, drains, water mains, and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required for the crossing, whether or not shown on the drawings.

3.3 RELOCATIONS OF EXISTING GAS LINES, TELEPHONE LINES, ELECTRIC LINES, AND CABLE TV LINES

- A. Notify the proper authority of the utility involved when relocation of these lines is required. Coordinate all work by the utility so that the progress of construction will not be hampered.

3.4 PROTECTION AND RESTORATION OF PROPERTY

- A. Protection and Restoration of Property: During the course of construction, take special care and provide adequate protection in order to minimize damage to vegetation, surfaced areas, and structures within the construction right-of-way, easement or site, and take full responsibility for the replacement or repair thereof. Immediately repair any damage to private property created by encroachment thereon. Should the removal or trimming of valuable trees, shrubs, or grass be required to facilitate the installation within the designated construction area, this work shall be done in cooperation with the County and/or local communities which the work takes place. Said valuable vegetation, removed or damaged, shall be replanted, if possible, or replaced by items of equal quality, and maintained until growth is re-established. Top soil damaged in the course of work shall be replaced in kind with suitable material, graded to match existing grade. Following construction completion, the work area along the route of the installation shall be finish grade to elevations compatible with the adjacent surface, with grassing or hand raking required within developed areas.
- B. Existing lawn surfaces damaged by construction shall be re-graded and re-sodded or re-seeded. These areas shall be maintained until all work under this Contract has been completed and accepted.

3.5 CLEANING UP

- A. Remove all construction material, excess excavation, buildings, equipment and other debris remaining on the job as a result of construction operations and shall render the site of the work in a neat and orderly condition.
- B. Work site clean-up shall follow construction operations without delay and in accordance with Section 01710.

3.6 INCIDENTAL WORK

- A. Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the Contract as specified and as shown on the drawings.

END OF SECTION

(NO TEXT FOR THIS PAGE)

PART F
LEE COUNTY CONSTRUCTION CONTRACT GENERAL CONDITIONS

ARTICLE 1. PRELIMINARY MATTERS

Titles, Article Headings, Section Headings, Indexes and Table of Contents are given for the sake of clarity, ease of reading and as a guide for ease of reference to specific topics within the General Conditions.

Administration

1.1 The Consultant is the initial interpreter of the Contract Documents but is not the Judge between the COUNTY and the CONTRACTOR. The COUNTY reserves the right to make final decisions considering the Consultant's recommendations or interpretations of the Contract Documents. The Consultant does not have authority to obligate or commit the COUNTY to fund additional expenditures or approve extensions of time over the approved Contract time or price. However, the CONSULTANT'S interpretation as to the intent of his design shall be final and not subject to interpretation by the COUNTY'S staff.

Copies of Documents

1.2 The COUNTY shall furnish to the CONTRACTOR the number of copies specified in the Supplementary Conditions of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction which shall be paid by the CONTRACTOR.

Before Starting Construction

1.3 1.3 Before undertaking each phase of the Work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. The CONTRACTOR shall promptly report in writing to the OWNER'S REPRESENTATIVE any conflict, error or discrepancy which the CONTRACTOR may discover or other information known to the CONTRACTOR and shall obtain a written interpretation or clarification from the OWNER'S REPRESENTATIVE before proceeding with any Work affected thereby. If the CONTRACTOR performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the OWNER'S REPRESENTATIVE, the CONTRACTOR shall assume responsibility for such performance and shall share in costs associated with correction; however, the CONTRACTOR shall not be liable to the COUNTY for failure to report any conflict, error or discrepancy in the Contract Documents, unless the CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

1.4 Within ten (10) calendar days after the Effective Date of the Agreement (unless otherwise specified in the Contract Documents), the CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE for review:

1.4.1 an estimated progress schedule indicating the starting and completion dates of the various stages of the Work:

1.4.1.1 Long lead item shall be identified and scheduled accordingly.

1.4.2 a preliminary schedule of Shop Drawing submission; and

ARTICLE 1. PRELIMINARY MATTERS (Continued)
Before Starting Construction (Continued)

1.4.3 a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction on form No. CMO:013. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work which will be confirmed in writing by the CONTRACTOR at the time of submission; and specify times for Application for Payment.

1.4.4 a plan of work for maintenance of traffic, when the Contract Documents require maintenance of traffic.

1.4.5 for informational purposes, a proposed listing of subcontractors to be used for the project,

Pre-Construction Conference

1.5 Within fifteen (15) calendar days after the Effective Date of the Agreement, but before the CONTRACTOR starts the Work at the site, a conference attended by the CONTRACTOR, the OWNER'S REPRESENTATIVE, the COUNTY, and Others as appropriate, will be held to discuss the items referred to in paragraph 1.4, to discuss procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish an understanding among the parties as to the Work.

Finalizing Schedules

1.6 At least ten (10) calendar days before submission of the first Application for payment, a conference attended by the CONTRACTOR, the OWNER'S REPRESENTATIVE, the COUNTY, and Others as appropriate, will be held to finalize the schedules submitted in accordance with paragraph 1.4. The finalized progress schedule will be acceptable to the OWNER'S REPRESENTATIVE and the COUNTY as providing an orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on the OWNER'S REPRESENTATIVE or the COUNTY responsibility for the progress or scheduling of the Work nor relieve the CONTRACTOR from full responsibility therefor. The finalized schedule of Shop Drawing submissions will be acceptable to the OWNER'S REPRESENTATIVE as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to the OWNER'S REPRESENTATIVE and the COUNTY as to form and substance.

ARTICLE 2. DEFINITIONS

The following definition of terms associated with this Contract is provided to establish a common understanding between both parties to this Contract as to the intended usage, application and interpretation of such terms pertaining to this Contract.

ADDENDUM means any additional Contract provisions in writing signed and sealed by the CONSULTANT, if applicable, issued by the COUNTY prior to the receipt of Bid which clarify, correct, change or interpret the Bidding Documents or the Contract Documents.

AGREEMENT means the written agreement between the COUNTY and the CONTRACTOR covering the Work to be performed; the Agreement is a part of the Contract Documents.

BIDDER is any individual, firm, partnership, joint venture, or corporation submitting a bid for this project, acting directly or through an authorized representative.

ARTICLE 2. DEFINITIONS (Continued)

BID is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents.

BID BOND is a security in the form and amount required by the COUNTY pledging that the BIDDER will enter into a Contract with the COUNTY on the terms stated in his Bid.

BIDDING DOCUMENTS are the Request for Bids, the Notice to Bidders, the Instructions to Bidders, sample forms, the Bid Proposal Form and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

CHANGE ORDERS are written order to the CONTRACTOR signed by the COUNTY, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract price or the Contract Time. The Contract Price and the Contract Time may be changed only by a Change Order. A Change Order signed by the CONTRACTOR indicates his agreement therewith, including the adjustment in the Contract Price or the Contract Time.

COMPLETION (FINAL) means acceptance of the Project by the COUNTY as evidenced by its signature upon a final payment Certification form CMO:016 and approval thereof by the Board of County Commissioners or their designee. The final payment Certification shall be signed only after the COUNTY has assured itself by tests, inspections, or otherwise that all of the provisions of the Contract have been carried out as required.

COMPLETION (SUBSTANTIAL) shall mean an acceptance of the Work by the COUNTY when construction is sufficiently complete in accordance with the Contract Documents so the COUNTY can occupy or utilize the Work or designated portion thereof for the use applicable, issued by the Building Official is required concurrent with or prior to issuance of the Certificate of Substantial Completion.

CONSTRUCTION is the erection, fabrication, assembly, remodeling, renovation, addition, modification, repair or demolition of any building or structure or any appurtenances connected or attached to such buildings or structures. The term applies but is not limited to the repair, replacement modification or construction of roads, bridges, sidewalks, traffic devices, parking lots, drainage, underground and overhead utilities.

CONSULTANT is the person lawfully licensed to practice Architecture or Engineering and registered in the State of Florida, or an entity lawfully practicing Architecture or Engineering, identified as such in the Construction Contract, and is referred to throughout the Contract Documents as if singular in number and masculine in genre. The term CONSULTANT means the Architect or Engineer or his authorized representative. The CONSULTANT is specified by name in Part B, paragraph 4 of this Contract Document.

CONTRACT DOCUMENTS consist of the Construction Contract, Conditions of the Contract, the Plans, the Project Manual, Addenda issued prior to execution of the Contract, all written modifications issued after execution of the Contract, all provisions required by law to be inserted in this Contract whether actually inserted or not, and a Purchase Order issued by the COUNTY.

A Modification is:

- (1) A written Amendment to the Contract.
- (2) A Change Order.
- (3) A written interpretation necessary for the proper execution or progress of the Work issued by the OWNER'S Representative.
- (4) A Field Change Order.
- (5) A Field Directive Change.

ARTICLE 2. DEFINITIONS (Continued)

CONTRACT PRICE means the total monies payable to the CONTRACTOR under the Contract Documents.

CONTRACT TIME means the number of Calendar days stated in the Agreement for the purpose of establishing Substantial Completion and Final Completion dates.

CONTRACTOR is the person, firm, joint venture, or corporation with whom the COUNTY has contracted and who has the primary responsibility for performance of the work.

COUNTY means the Board of County Commissioners of Lee County, Florida, a political subdivision of the State of Florida, its successors and assigns. Also hereinafter referred to as OWNER.

DAYS - The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically designated. A calendar day constitutes twenty four (24) hours measured from midnight to the next midnight.

DEFECTIVE - An adjective which when modifying the word "Work" refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to the OWNER'S REPRESENTATIVE recommendation of final payment (unless responsibility for the protection thereof has been assumed by the COUNTY at Substantial Completion in accordance with paragraph 14.5 or 14.6).

EFFECTIVE DATE OF THE AGREEMENT means the date on which the agreement is signed and delivered by the latter of the two parties.

FIELD CHANGE ORDER is a written change order requested by the OWNER'S Representative, accepted by the CONTRACTOR, and approved by the PROJECT MANAGER for minor changes in the Work, not involving adjustments in the Contract Sum or an extension of Time, and not inconsistent with the overall intent of the Contract Documents.

FIELD DIRECTIVE CHANGE - A written directive to the CONTRACT, issued on or after the effective date of the Agreement ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed as provided in paragraph 5.2 or 5.3, or to emergencies under paragraph 7.20. A Field Directive Change may not change the Contract Price or the Contract Time, but is evidence that the parties expect that the change directed or documented by a Field Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or the Contract Time as provided in Articles 11 and 12.

FINAL ACCEPTANCE means acceptance of the Work by the COUNTY upon the expiration of the warranty period as stated in the Contract Documents.

MATERIALS - Anything used in the process of, but not limited to, constructing, demolishing, renovating or remodeling of any building, structure, road, bridge, recreational facility, transportation element and utility or any addition thereto utilized for this project.

NOTICE means written notice. Notice shall be served upon the CONTRACTOR either personally or by leaving the said Notice at his residence or with his agency in charge of the Work, or addressed to the CONTRACTOR at the residence or place of business stated in the Bid Proposal and deposited in a postpaid wrapper in any United States Mailbox.

ARTICLE 2. DEFINITIONS (Continued)

NOTICE TO PROCEED is a written instrument issued by the COUNTY to the CONTRACTOR, authorizing the CONTRACTOR to commence Work on the Project. The NOTICE TO PROCEED shall include the effective date of Commencement.

NOTICE OF AWARD means the written Notice given by the COUNTY to the successful Bidder.

NOTICE OF TERMINATION is a written instrument issued in accordance with the Contract Documents as stated in Section 15.2 by the COUNTY to the CONTRACTOR or by the CONTRACTOR to the COUNTY notifying the receiving party that the Contract is being terminated. The NOTICE shall clearly identify the effective date the Contract is to be terminated.

OWNER'S REPRESENTATIVE is the CONSULTANT contracted by the COUNTY for Professional Services during the construction phase of this project or a qualified person authorized as his official representative, or in the absence of such a contract, the project Manager will be considered the OWNER'S REPRESENTATIVE for the purpose of this Contract Document. The OWNER'S REPRESENTATIVE is not authorized to issue change orders to the contract sum, contract time or scope of work without express approval of the Board of County Commissioners. The OWNER'S REPRESENTATIVE is specified by name in Part B, paragraph 4 of this Contract Document.

PLANS AND/OR DRAWINGS are a graphic representation of the arrangement of the materials or parts of the construction of the project and are a portion of the Contract Documents.

PROJECT shall mean the entire improvement of which this contract forms a part.

PROJECT MANAGER is an employee of the Department or the COUNTY which requested the Contract and is a designee authorized by or for that Department who is the representative of the Board of County Commissioners in matters concerning the contractor of this project. The project manager will act as the OWNER'S REPRESENTATIVE in the absence of a contract with a CONSULTANT. The PROJECT MANAGER is not authorized to issue changes to the Contract Sum, Contract Time, or Scope of Work without express approval by the Department Director, County Manager, or Board of County Commissioners. The Project Manager is specified by name in Part B, paragraph 4 of this Contract Document.

The PROJECT MANAGER, within the authority conferred by the Board of County Commissioners, acting as the COUNTY'S designated representative shall initiate written Change Orders, and notification to the CONTRACTOR of any and all changes approved by the COUNTY in the CONTRACTOR'S (1) compensation (2) time and/or schedule of service delivery; (3) any Amendment (s) or other change(s) relative to the WORK and ADDITIONAL SERVICES pursuant to this Contract, or AMENDMENTS, or CHANGE ORDERS pertaining thereto. Following COUNTY approval, the Project Manager shall coordinate assurance of any such documents. The PROJECT MANAGER or his designee shall be responsible for acting on the COUNTY'S behalf to administer, coordinate, interpret and otherwise manage the contractual provisions and requirements set forth in this Contract, or any AMENDMENT(S), or CHANGE ORDER(S) issued thereunder.

PROJECT MANUAL means the General Conditions, Supplementary General Conditions, Specifications, and the Bidding Documents.

PUBLIC WORKS DIRECTOR means the person employed by the Board to serve and act on the COUNTY'S behalf as the DIRECTOR of the COUNTY'S Public Works Office. The PUBLIC WORKS DIRECTOR (or designee), within the authority conferred by the Board of County Commissioners, acting as the COUNTY'S designated representative shall issue written Addenda and notify all interested Bidders.

ARTICLE 2. DEFINITIONS (Continued)

SPECIFICATIONS are written documents organized into divisions, sections, and articles which provide detailed instructions to the CONTRACTOR pertaining, but not limited to, materials, style, workmanship, fabrication, dimensions, colors, warranties, finishes, quality, manufacturer, grade and operational data of all components to be provided by the CONTRACTOR and incorporated into the Project.

SUBCONTRACTOR is a person, firm, partnership, corporation, or entity who has a direct contract with the CONTRACTOR to perform any of the Work at the site. The term Subcontractor does not include whose sole purpose is that of a supplier of materials. A supplier of materials shall be classified as a Subcontractor if it enters into any agreement, whether written or verbal, for the installation of said materials. The term Subcontractor means a Subcontractor or it's authorized representative.

SUB-Subcontractor is a person, firm, partnership, corporation, or entity who has a direct or indirect Contract with a Subcontractor to perform any of the Work at the site. The term Sub-Subcontractor means a Sub-Subcontractor or it's authorized representative.

SUPPLIER - A manufacturer, fabricator, distributor, materialmen or vendor.

SURETY is the surety company or individual that is bound by Contract bond with and for the CONTRACTOR who is primarily liable, and is responsible for CONTRACTOR'S acceptable performance of the Project and payment of all debts pertaining to the Contract Documents in accordance with Section 255.05, Florida Statutes.

UNDERGROUND FACILITIES - All pipeline, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

WORK is the construction required by the Contract Documents and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.

ARTICLE 3. - STARTING THE WORK

3.1 Written Notice to Proceed is contingent upon and will be done subsequent to the CONTRACTOR fully satisfying the COUNTY'S stated insurance and Bond submittal requirements. Until the CONTRACTOR receives the COUNTY'S written Notice to Proceed, the CONTRACTOR is advised that the COUNTY will not be liable for any expenses which the CONTRACTOR may incur relative to this Contract before the written Notice to Proceed is issued.

3.2 The Contract time shall commence to run from the date specified in the "Notice to Proceed".

3.3 The CONTRACTOR is required, before commencing the Work, to deliver to the COUNTY the Public Payment and Performance Bond issued by a surety insurer authorized to do business in the State of Florida as Surety. The Bond must state the name and principal business address of both the principal and the Surety and must contain a description of the project sufficient to identify it and post in conspicuous place at the project site.

3.4 The COUNTY will forward to the CONTRACTOR a Notice of Commencement along with a copy of the recorded Public Payment and Performance Bond with instructions to post in a conspicuous spot on the project site.

ARTICLE 4. - INTERPRETATION INTENT, AMENDING AND REUSE OF CONTRACT DOCUMENTS.

4.1 It is the intent of the Specifications and Plans to describe a complete Project to be constructed in accordance with the Contract Documents.

4.2 The Contract Documents are complementary; what is called for by one is as binding as if called for by all. If the CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, he shall immediately call it to the attention of the OWNER'S REPRESENTATIVE in writing before proceeding with the Work affected thereby.

4.3 Any Work that may be reasonably inferred from the specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for.

4.4 Work, materials or equipment described in words which have a well-known technical or trade meaning, shall be deemed to refer to such recognized standards.

4.5 In resolving conflicts, errors, and discrepancies, the order of precedence of the Contract Document is as follows:

1. Change Order
2. Standard Form of Agreement
3. Addenda
4. Supplementary Conditions
5. General Conditions
6. Specifications
7. Drawings
8. Figure Dimensions
9. Scale Dimensions (Large Scale Drawings supersede Small Scale Drawings)

AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS:

4.6 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

- 4.6.1 a formal Written Amendment,
- 4.6.2 a Change Order (pursuant to Article 10).
- 4.6.3 a Field Directive Change (pursuant to Article 10).

As indicated in paragraphs 11.2 and 12.1, the Contract Price and the Contract Time may only be changed by a Change Order or Written Amendment.

4.7 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations of the Work may be authorized, in one or more of the following ways:

- 4.7.1 a field Change Order (pursuant to paragraph 9.3),
- 4.7.2 The OWNER'S REPRESENTATIVE approval of a Shop Drawing or sample (pursuant to paragraphs 7.23 and 7.30), or
- 4.7.3 The OWNER'S REPRESENTATIVE written interpretation or clarification (pursuant to paragraph 9.2).

ARTICLE 4. - INTERPRETATION INTENT, AMENDING AND REUSE OF CONTRACT DOCUMENTS
(Continued)

REUSE OF DOCUMENTS:

4.8 Neither the CONTRACTOR nor any SUBCONTRACTOR or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the COUNTY shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of the CONSULTANT; and they shall not reuse any of them on extensions of the Project or any other project without written consent of the COUNTY or their CONSULTANT and the specific written verification or adaptation by the CONSULTANT.

ARTICLE 5. - AVAILABILITY OF LANDS: PHYSICAL CONDITION: REFERENCE POINTS

Availability of Lands

5.1 The COUNTY will furnish, as indicated in the Contract Documents and not later than the date when needed by the CONTRACTOR, the lands upon which the Work is to be done, Work is to be done, rights-of-way for access thereto, and such other lands which are designated for the use of the CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained by the COUNTY unless otherwise specified in the Contract Documents. If the CONTRACTOR believes that any delay in the COUNTY'S furnishing these lands or easements entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Article 10. The CONTRACTOR will provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment unless designated otherwise. The OWNER'S REPRESENTATIVE will, upon request, furnish to the CONTRACTOR copies of all available boundary and topographic surveys as required and sub-surface tests.

Physical Conditions

5.2 Explorations and Reports: Reference is made to the Supplementary Conditions for identification of those reports of explorations and tests of subsurface conditions at the site that have been utilized by the CONSULTANT and/or the COUNTY in preparation of the Contract Documents. These reports are not part of the contract Documents. The CONTRACTOR may rely upon the accuracy of the technical data contained in such reports but not upon the non-technical data, interpretations or opinions contained therein for the completeness or accuracy thereof for the CONTRACTOR'S purposes of preparing or submitting a bid. Except as indicated in the immediately preceding sentence and in paragraph 5.7, the CONTRACTOR shall have full responsibility with respect to subsurface conditions at the site. The technical data which will be made available only at the CONTRACTOR'S request may not be sufficient for construction purposes. Additional investigations may be necessary for the purposes of carrying out the construction project.

5.3 Existing Structures: Reference is made to the Supplementary Conditions for identification of those drawings of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities referred to in paragraph 5.9) which are at or contiguous to the site that have been utilized by the CONSULTANT and/or the COUNTY in preparation of the Contract Documents. The CONTRACTOR may rely upon the accuracy of the technical data contained in such drawings but not for the completeness thereof for the purposes of preparing or submitting a bid. Except as indicated in the immediately preceding sentence and paragraph 5.7, the CONTRACTOR shall have full responsibility with respect to physical conditions in or relating to such structures.

ARTICLE 5. - AVAILABILITY OF LANDS: PHYSICAL CONDITION: REFERENCE POINTS

(Continued)

Physical Conditions (Continued)

5.4 Unless otherwise stated, the CONTRACTOR shall be fully responsible for the removal of any materials, debris, garbage, vehicles or other such items which would interfere with the undertaking and completion of the project. By submission of a bid, the CONTRACTOR assumes full responsibility for the expenses associated with such removal. There shall not be an increase in time or price associated with such removal.

5.5 Report of Differing Conditions: If the CONTRACTOR believes that

5.5.1 any technical data on which the CONTRACTOR is entitled to rely as provided in paragraph 5.2 and 5.3 is inaccurate, or

5.5.2 any physical condition uncovered or revealed at the site differs materially from that indicated, reflected or referred to in the Contract Documents.

The CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work in connection therewith (except in an emergency as permitted by paragraph 7.20) notify the OWNER'S REPRESENTATIVE in writing about the inaccuracy or difference.

5.6 OWNER'S REPRESENTATIVE Review: The OWNER'S REPRESENTATIVE will promptly review the pertinent conditions, determine the necessity or obtaining additional explorations or tests with respect thereto and advise the COUNTY in writing (with a copy to the CONTRACTOR) of the OWNER'S REPRESENTATIVE'S findings and conclusions.

5.7 Possible Document Change: If the OWNER'S REPRESENTATIVE and the COUNTY conclude that there is a material error in the Contract Documents and a change in the Contract Documents is required, a Field Directive Change, a Field Change or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of the inaccuracy or difference.

5.8 Possible Price and Time Adjustments: In each case of a material error in the Contract Documents, an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, or any combination thereof, will be allowable to the extent that they are attributable to any such inaccuracy or difference.

Physical Conditions - Underground Facilities

5.9 Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to the COUNTY or the CONSULTANT by the owners of such Underground facilities or by Others. Unless it is otherwise expressly provided in the Supplementary Conditions:

5.9.1 The CONTRACTOR shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof as provided in paragraph 7.17 and for repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

ARTICLE 5. - AVAILABILITY OF LANDS: PHYSICAL CONDITION: REFERENCE POINTS

(Continued)

Physical Conditions –Underground Facilities (Continued)

5.10 Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which the CONTRACTOR could not reasonably have been expected to be aware of, the CONTRACTOR shall, promptly after becoming aware thereof and before performing any Work affected thereby (except in an emergency as permitted by paragraph 7.20) identify the owner of such Underground Facility and give written notice thereof to that owner and to the OWNER'S REPRESENTATIVE. The OWNER'S REPRESENTATIVE will promptly review the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the Underground Facility, and with the COUNTY'S approval, the Contract Documents will be amended or supplemented to the extent necessary. During such time, the CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in paragraph 7.17. The CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility that was not shown or indicated in the Contract Documents and which the CONTRACTOR could not reasonably have been expected to be aware of.

Reference Points

5.11 The COUNTY shall provide engineering surveys to establish reference points, as specified in the Supplementary Conditions, for construction which in the judgment of the COUNTY and the CONSULTANT are necessary to enable CONTRACTOR to proceed with the Work. The CONTRACTOR shall be responsible for laying out the Work (unless otherwise specified in the Technical Specifications), shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of the COUNTY. The CONTRACTOR shall report to the OWNER'S REPRESENTATIVE whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

ARTICLE 6. - BONDS AND INSURANCE

Public Payment and Performance Bond

6.1 The CONTRACTOR will execute the Public Payment and Performance Bonds included herein as security for the faithful performance and payment of all his obligations under the Contract Documents. This Bond shall be in amounts at least equal to the Contract Price and in such form and with such securities as are acceptable to the COUNTY. Prior to execution of the Contract Documents, the COUNTY may require the CONTRACTOR to furnish such other bonds, in such form and with such sureties as it may require. If such bonds are required by written instructions given prior to opening of Bids, the Premiums shall be paid by the CONTRACTOR. If the Contract is increased by a Change Order, it shall be the CONTRACTOR'S responsibility to insure that the Public Payment and Performance Bond be amended accordingly and a copy of the amendment forwarded to the CONTRACTS MANAGEMENT.

6.2 If the surety on any bond furnished by the CONTRACTOR is declared bankrupt or becomes insolvent or 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 acceptable to the COUNTY.

ARTICLE 6. - BONDS AND INSURANCE (Continued)
Public Payment and Performance Bond (Continued)

6.2.1 If the CONTRACTOR cannot obtain another bond and surety within (5) calendar days the COUNTY will accept and the CONTRACTOR shall submit an irrevocable letter of credit drawn on a Lee County, Florida bank until the bond and surety can be obtained.

Qualifications of Surety Companies

6.3 In order to be acceptable to the COUNTY, a surety company issuing Bid Guaranty Bonds or 100% Public Payment and Performance Bonds, called for in these specifications, shall meet and comply with the following minimum standards:

6.3.1 General

6.3.1.1 All Sureties for Lee County projects must be admitted to do business in the State of Florida and shall comply with the provisions of Florida Statute 255.05.

6.3.1.2 Attorneys-in-Fact who sign bid bonds or Public Payment and Performance Bonds for Lee County projects must file with such bond a certified copy of their Power of Attorney to sign such bond.

6.3.1.3 Agents of surety companies must list their name, address, and telephone number on all bonds.

6.3.1.4 The life of all bonds provided to Lee County shall extend twelve (12) months beyond the date of final payment and shall contain a waiver of alternation to the terms of the Contract, extensions of time and/or forbearance on the part of the COUNTY.

6.3.1.4.1 the amount of the bond shall automatically be reduced from 100% of the contract price to 100% upon final completion and acceptance by the COUNTY.

6.3.2 To be acceptable to the OWNER AS Surety on projects not in excess of \$500,000.00, Surety shall comply with these minimum provisions of State Statute 287.0935 as follows:

6.3.2.1 Surety must have twice the minimum surplus and capital required by Florida Insurance Code at the time of bid solicitation.

6.3.2.2 Surety must be in compliance with all provisions of the Florida Insurance Code and hold a currently valid certificate of authority issued by the United States Department of the Treasury under SS.31 U.S.C. 9404-9308.

6.3.3 Sureties on projects in excess of \$500,000.00 shall comply with the above minimum provisions as well as being rated thru A.M. best shall comply with the following provisions:

6.3.3.1 The Surety shall be rated as "A-" or better as to General Policyholders Rating and Class VII or better as to financial category by the most current Best's Key Rating Guide, published by A.M. best Company.

6.3.3.2 Surety must have fulfilled all of its obligations on all other bonds previously given to the COUNTY.

6.3.3.3 Surety must have a minimum underwriting limitation of \$5,000,000 published in the latest edition of the Federal Register for Federal Bonds (U.S. Dept. of Treasury).

ARTICLE 6. - BONDS AND INSURANCE (Continued)
Public Payment and Performance Bond (Continued)

Letter of Credit

6.4 At any time during the life of the letter of credit, should the rating of financial institution fall below both of the minimum ratings as indicated in the Contract Documents, or should the financial institution become insolvent, the CONTRACTOR must, within five (5) calendar days after notification by the COUNTY:

6.4.1 replace the existing letter of credit with a replacement letter of credit from a financial institution with either of the minimum ratings as specified in the Contract Documents, or

6.4.2 have the existing letter of credit confirmed by a financial institution with either of the minimum ratings as specified in the Contract Documents.

6.5 At the COUNTY'S option, the letter of credit may be replaced by a Public Payment and Performance Bond in accordance with the COUNTY'S existing bond policies.

6.6 Failure to comply with this provision may result in any or all of the following actions by the COUNTY:

6.6.1 suspension of the CONTRACTOR'S right to pull building permits and schedule inspections;

6.6.2 a stop work order; and/or

6.6.3 revocation of the Land Development Permit.

Financial Institutions/Letters of Credit

6.7 In order to be acceptable to the COUNTY, a financial institution issuing 100% Letters of Credit, called for in these specifications, shall meet and comply with the following minimum standards:

6.7.1 General

6.7.1.1 The face of the letter of credit must be in a format utilizing Lee County Standard Form CMO:008 and indicate the following:

6.7.1.1.1 the letter of credit is "clean" and "irrevocable";

6.7.1.1.2 an exact expiration date. The life of all letters of credit provided to Lee County shall extend twelve (12) months beyond the date of final payment;

6.7.1.1.3 statement of the purpose or project for which the letter of credit is issued;

6.7.1.1.4 a specific amount of the letter of credit, in U.S. dollars;

6.7.1.1.5 the method of disbursement of draws against the letter of credit;

6.7.1.1.6 the street address where draws against the letter of credit may be made; and

6.7.1.1.7 venue in Lee County.

ARTICLE 6. - BONDS AND INSURANCE (Continued)
Financial Institutions/Letters of Credit (Continued)

6.7.1.2 Verification of the status or certification of any financial institution may be made with:

Department of Insurance and Treasurer
Bureau of Collateral Securities
200 East Gaines Street
Tallahassee, FL 32377-0345
Phone (850) 922-3167

or

Contracts Management
1500 Monroe Street, 4th Floor
Fort Myers, FL 33901
Phone (239) 335-2183

or

Lee County Risk Management
2115 Second Street
Fort Myers, FL 33901
Phone (239) 335-2897

6.7.2 At the time of issuance of the letter of credit, the financial institution must have a minimum "peer group" rating of 50 in the latest Sheshunoff Quarterly Listing or a minimum rating of 125 in the latest IDC Bank Financial Quarterly Listing.

6.7.3 Letters of Credit from financial institutions which do not meet either of the minimum ratings indicated in 20.2.1.3 above must be confirmed by a financial institution with either of the minimum ratings indicated in 20.2.1.3 above.

6.7.4 All financial institutions which issue or confirm any Letter of Credit must be authorized by the Secretary of State to do business in the State of Florida, shall show proof of same upon request by COUNTY staff, and agree to venue in Lee County.

6.7.5 In addition to the institutions meeting the aforementioned requirements, the Federal Home Loan Bank of Atlanta is authorized to issue and confirm letters of credit which are in accordance with the provisions of paragraph 20.2.1.1 above and all subsequent sub-paragraphs, with the exception of 20.1.1.1.7.

6.8 These actions shall be in effect until a satisfactory replacement bond or letter of credit is accepted by the COUNTY. The CONTRACTOR agreement shall so provide for replacement or confirmation in accordance with this policy.

Contractor's Liability Insurance

6.9 The CONTRACTOR will purchase and maintain such insurance as will protect him from claims under Worker's Compensation laws, disability benefit laws or other similar employee benefit laws; from claims for damages because of bodily injury, occupational sickness or disease, or death of his employees including claims insured by usual personal injury, sickness and disease, or death of any person other than his employees including claims insured by usual personal injury liability coverage; and from claims for injury to or destruction of tangible property including loss of use resulting therefrom any or all of which may arise out of or result from the CONTRACTOR'S operations under

ARTICLE 6. - BONDS AND INSURANCE (Continued)
Contractor's Liability Insurance (Continued)

the Contract Documents, whether such operations be by himself or any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be legally liable. This insurance shall be written for no less than the limits of liability specified in the Contract Documents or required by law, whichever is greater, and shall include contractual liability insurance. As a prerequisite to the COUNTY signing the Contract, the CONTRACTOR will file with the COUNTY certificates of such insurance, acceptable to the COUNTY; these certificates shall contain a provision for cancellation as found in Paragraph 6.14.

Insurance Requirements

6.10 Before final execution of the Agreement and until acceptance of the Work by the COUNTY, the CONTRACTOR shall procure and maintain insurance of the types and the limits specified below.

6.11 All CONTRACTOR'S Certificates of Insurance must be approved by the Lee County Risk Manager (or designee) before the final execution of the agreement by the COUNTY.

6.12 An Insurance Certificate (provided in Part E) shall be required from the successful BIDDER. Such form must be properly executed and submitted by an authorized representative of the insurance company and successful BIDDER within seven (7) calendar days after notification by Lee County of the Board of County Commissioners' approval to award the contract. Such certificate of insurance must have a 30 days notice of cancellation, state that the coverage is primary, and shall be in the types and amounts stated in the Contract Documents. Certificate should include producers phone number and reference the name of the project.

Certificate of Insurance

6.13 Lee County Board of County Commissioners, its officers and employees is to be specifically included as an Additional Insured on the Commercial General Liability coverage.

6.14 In the event the insurance coverage expires prior to the completion of the project, a written renewal certificate shall be issued thirty (30) calendar days prior to said expiration date. The policy shall provide a thirty (30) calendar day written notification clause in the event cancellation or modification to the policy.

6.15 It shall be the responsibility of the CONTRACTOR to ensure that all Subcontractors comply with the insurance requirements specified below.

6.16 The Certificate of Insurance must contain the following limits:

6.16.1 WORKER'S COMPENSATION

Coverage to apply for all employees for Statutory Limits in compliance with the applicable state and federal laws. The policy must include Employers' Liability with a minimum limit of **\$1,000,000** each accident and shall include a waiver of subrogation from the carrier.

6.16.2 COMMERCIAL GENERAL LIABILITY

Shall have minimum limits of **\$3,000,000** Per occurrence. Combined Single Limit for Bodily Injury Liability and Property Damage Liability. This shall include Premises and/or Operations, Independent Contractors and Products and/or Completed Operations, Broad Form Property damage, XCU Coverage, and a Contractual Liability Endorsement. Said coverage must be on an occurrence basis. Lee County Board of County Commissioners, its officers and employees shall be included as an Additional Insured.

ARTICLE 6. - BONDS AND INSURANCE (Continued)
Certificate of Insurance (Continued)

6.16.3 BUSINESS AUTOMOBILE POLICY

Shall have minimum limits of **\$3,000,000** Per occurrence. Combined Single Limit for Bodily Injury Liability and Property Damage liability. This shall include Owned Vehicles, and Employees Non-Ownership and be based on occurrence basis.

6.16.4 ALL RISK BUILDERS RISK OR INSTALLATION FLOATER (If Applicable)

All Risk coverage, with the limits of insurance to equal 100% of the completed contract amount of such addition(s), buildings(s), or structure(s). Any deductible is the responsibility of the CONTRACTOR. The COUNTY shall be named as an additional insured only with respect to losses in connection with this contract.

6.16.5 SUBCONTRACTORS

It shall be the responsibility of the CONTRACTOR to ensure that all subcontractors carry Automobile Liability, General Liability and Workers' Compensation in compliance with statutory limits.

6.17 The CONTRACTOR agrees that the requested insurance coverages are not intended to and shall not, in any manner, limit or reduce the liabilities and obligations assumed by the CONTRACTOR, it's agents, employees, subcontractors, etc.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence

7.1 The CONTRACTOR will supervise and direct the Work efficiently. He will be solely responsible for the means, methods, techniques, sequences, safety, and procedure of construction, unless otherwise specified. The CONTRACTOR will be responsible to see that the finished Work complies with the Contract Documents.

7.2 The CONTRACTOR will keep on the site at all times when work is being performed, a competent, resident superintendent who shall not be replaced without prior written notice to the OWNER'S REPRESENTATIVE. The superintendent will be the CONTRACTOR'S representative at the site and shall have authority to act on behalf of the CONTRACTOR. All communications given to the superintendent shall be binding as if given to the CONTRACTOR.

Labor Material and Equipment

7.3 The CONTRACTOR will provide competent, suitable, qualified personnel to lay out the Work and perform construction as required by the Contract Documents. He will at all times maintain good discipline and order at the site.

7.4 The CONTRACTOR will furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, heat, light, telephone, water and sanitary facilities and incidentals necessary for the execution, testing, initial operation and completion of the Work unless otherwise specified.

7.5 All materials and equipment will be new except as otherwise provided in the Contract Documents. If required by the OWNER'S REPRESENTATIVE, the CONTRACTOR will furnish satisfactory evidence as to the kind and quality of materials and equipment furnished.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)

Labor Material and Equipment (Continued)

7.6 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricator or processors except as otherwise provided in the Contract Documents.

7.7 In instances where the act is applicable due to the nature of the bid matter with which this bid package is concerned, all material, equipment, etc., as proposed and offered by CONTRACTOR must meet and conform to all O.S.H.A. requirements; the CONTRACTOR'S signature upon the bid proposal form (Part D) being by this reference considered a certification of such fact.

Adjusting the Progress Schedule

7.8 The CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE for acceptance of adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the Contract Documents applicable thereto. The COUNTY reserves the right to reject the progress schedule from the CONTRACTOR which in its judgment does not appear to devote sufficient resources of manpower to enable the timely completion of the project. If the COUNTY requests the progress schedule to be adjusted, the CONTRACTOR shall do so and perform the work according to the adjusted schedule at no additional cost to the COUNTY.

Substitute Materials or Equipment

7.9 If it is indicated in the specifications that the CONTRACTOR may furnish or use a substitute that is equal to any material or equipment specified, and if the CONTRACTOR wishes to furnish or use a proposed substitute, he will, within thirty (30) calendar days after the award of the Contract, make written application to the OWNER'S REPRESENTATIVE for approval of such a substitute, certifying in writing that the proposed substitute will perform adequately the duties imposed by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified. No substitute shall be ordered or installed without the written approval of the COUNTY who shall be the judge of quality. Whether or not the COUNTY accepts a proposed substitute, the CONTRACTOR shall reimburse the COUNTY for any charges or cost for evaluating any proposed substitute.

Concerning Subcontractors

7.10 The CONTRACTOR will be fully responsible for all acts and omissions of his SUBCONTRACTORS and of persons directly or indirectly employed by them and of persons for whose acts they may be liable to the same extent that they are employed by him. Nothing in the Contract Documents shall create any contractual relationship between any SUBCONTRACTOR and the COUNTY. The COUNTY may, upon request, furnish to any SUBCONTRACTOR, to the extent practicable, evidence of amounts paid to the CONTRACTOR on account of specific Work done.

7.10.1 The divisions and sections of the specifications and the identifications of any Drawings shall not control the CONTRACTOR in dividing the Work among SUBCONTRACTORS or delineating the Work to be performed by any specific trade.

7.10.2 The CONTRACTOR agrees to bind specifically every SUBCONTRACTOR to the applicable terms and conditions of these Contract Documents for the benefit of the COUNTY.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)
Concerning Subcontractors (Continued)

7.10.3 All Work performed for the CONTRACTOR by a SUBCONTRACTOR shall be pursuant to an appropriate agreement between the CONTRACTOR and the SUBCONTRACTOR which shall contain provisions that waive all rights the contracting parties may have against one another for damages caused by fire or perils covered by insurance, except such rights as they may have to the proceeds of such insurance held by the COUNTY as trustee.

Patent Fees and Royalties

7.11 The costs involved in fees, royalties, or claims for any patented invention, article, process or method that may be used upon, or in a manner connected with the work under this contract, shall be paid by the CONTRACTOR. The CONTRACTOR and his sureties, together with his officers, agents, and employees, shall protect and hold the COUNTY harmless against any and all demands made for such fees or claims brought or made by holder of any invention or patent. Before final payment is made on the account of this Contract, the CONTRACTOR shall, if requested by the COUNTY, furnish acceptable proof of a proper release from all such fees or claims.

7.11.1 Should the CONTRACTOR, his agent, employee, or any of them be enjoined from furnishing or using any invention, article, material or plans supplied or required to be supplied or used under this contract, the CONTRACTOR shall promptly pay such royalties and secure the requisite licenses; or, subject to acceptance by the COUNTY, substitute other articles, materials or appliances in lieu thereof which are of equal efficiency, quality, finish, suitability and market value to those planned or required under the contract. Descriptive information of these substitutions shall be submitted to the OWNER'S REPRESENTATIVE for determination of general conformance to the design concept and the construction contract. Should the COUNTY elect to use the substitution, the CONTRACTOR agrees to pay such royalties and secure such valid licenses as may be requisite for the COUNTY, his officers, agents, and employees, or any of them, to use such invention, article, material, or appliance without being disturbed or in any way interfered with by any proceeding in law or equity on account thereof.

Permits

7.12 Unless otherwise specified herein, the CONTRACTOR will secure and pay for all permits, impact fees, and licenses and will pay all governmental charges and inspections' fees necessary for the prosecution of the Work which are applicable at the time of his bid. The CONTRACTOR will also pay all public utility charges and connection fees except as provided for in the Contract Documents. Permits and licenses of regulatory agencies which are necessary to be maintained after completion of the guarantee period shall be secured and paid for by the COUNTY.

7.12.1 Pursuant to the requirements of F.S. 218.80, the following County permits and fees are required to be obtained and paid for by the contractor.

| <u>Permit or Fee</u> | <u>Dollar Amount/Percentage Method/ Unit Method of Computation</u> |
|----------------------|--|
| LDOT ROW Permit | \$200.00 |

This is a disclosure of permits and fees required by Lee County for this project and does not relieve the contractor of its responsibility to obtain and pay for permits required by other governmental entities as specified elsewhere in this document.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)

Laws and Regulations

7.13 The CONTRACTOR will give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If the CONTRACTOR observes that the Specifications or Drawings are at a variance therewith, he will give the OWNER'S REPRESENTATIVE prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If the CONTRACTOR performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the OWNER'S REPRESENTATIVE, he will bear all cost arising therefrom; however, it shall not be his primary responsibility to make certain that the Drawings and Specifications are in accordance with such laws, ordinances, rules and regulations.

Licenses

7.14 The CONTRACTOR must be properly licensed, within the jurisdiction where the project is to be constructed, to perform the work specified in the Scope of Work at the time of bid submittal.

Use of Premises

7.15 The CONTRACTOR will confine his equipment, the storage of materials and equipment, and the operations of his workmen to the areas permitted by law, ordinances, permits or the requirements of the Contract Documents and shall not unreasonably encumber the premises with materials or equipment.

Record Drawings

7.16 The CONTRACTOR will keep one record copy of all Specifications, Drawings, Addenda, Modifications and Shop Drawings at the site in good order, and annotated to show all changes made during the construction process or addition and exact location of underground or otherwise concealed components such as, but not limited to, plumbing, air conditioning, electric, and conduit which were not installed exactly as shown on the contract drawings. These shall be available to the OWNER'S REPRESENTATIVE and shall be verified by the OWNER'S REPRESENTATIVE at 30%, 60%, and 100% completion of the Project. The CONTRACTOR shall submit to the OWNER'S REPRESENTATIVE one (1) complete set of all recorded changes made during Construction entitled "Record Drawings", and dated. Submittals shall be made in accordance with the above and shall be submitted at the time of substantial completion.

Safety and Protection

7.17 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of and will provide the necessary protection to prevent damage, injury or loss to:

7.17.1 All employees on the Project and other persons who may be affected thereby;

7.17.2 All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site; and

7.17.3 Other property at the site or adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)
Safety and Protection (Continued)

7.18 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection and, in addition, he will comply with all applicable recommendations of the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc.; "Roadway and Traffic Design Standards" latest edition published by the Florida Department of Transportation, specifically Index 600-650; and Occupational Safety and Health Administration published by the United States Department of Labor. He will notify owners of adjacent utilities when prosecution of the Work may affect them. All damage, injury or loss to any property referred to in 7.17.2 and 7.17.3 caused directly or indirectly, in whole or in part by the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable will be remedied by the CONTRACTOR; except any damage or loss attributable to the fault of the Drawings or the Specifications or to the acts or omissions of the COUNTY, and not attributable, directly or indirectly, in whole or in part, to the fault of negligence of the CONTRACTOR.

7.19 The CONTRACTOR will designate a member of his organization whose responsibility will be to plan for the prevention of accidents at the site. This person shall be the CONTRACTOR'S Superintendent unless otherwise designated in writing by the CONTRACTOR to the OWNER'S REPRESENTATIVE.

Emergencies

7.20 In emergencies affecting the safety of persons, the Work or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the COUNTY, is obligated to act at his discretion to prevent threatened damage, injury or loss. He will give the OWNER'S REPRESENTATIVE prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby. If the COUNTY and the OWNER'S REPRESENTATIVE determine that a change to the Contract Documents is required because of the action taken in response to an emergency, a Field Directive Change or Change Order shall thereupon be issued covering the changes and deviations involved.

Shop Drawings and Samples

7.21 After checking and verifying all field measurements, the CONTRACTOR will submit to the OWNER'S REPRESENTATIVE for approval, in accordance with the acceptable schedule of Shop Drawing submission, five copies (or at the option of the OWNER'S REPRESENTATIVE, one reproducible copy) of all Shop Drawings, which shall have been checked by and stamped with the approval of the CONTRACTOR and identified as the OWNER'S REPRESENTATIVE may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and the like to enable the OWNER'S REPRESENTATIVE to review the information as required.

7.22 The CONTRACTOR will also submit to the OWNER'S REPRESENTATIVE for approval with such promptness as to cause no delay in the Work, all samples required by the Contract Documents. All samples will have been checked by and stamped with the approval of the CONTRACTOR, identified clearly as to material, manufacturer, any pertinent numbers and the use for which intended.

7.22.1 At the time of each submission, the CONTRACTOR will in writing call the OWNER'S REPRESENTATIVE'S attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents and, in addition, shall cause a specific notation to be made on each shop drawing submitted for review and approval of each such variation.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)
Shop Drawings and Samples (Continued)

7.23 The OWNER'S REPRESENTATIVE will review and approve with reasonable promptness Shop Drawings and Samples, but its review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a separate item as such will not indicate approval of the assembly in which the item functions. The CONTRACTOR will make any corrections required by the OWNER'S REPRESENTATIVE and will return the required number of corrected copies of Shop Drawings and re-submit new samples until approved. All cost incurred by the COUNTY for the review of a shop drawing in excess of two (2) reviews shall be the CONTRACTORS responsibility. The CONTRACTOR'S stamp of approval on any Shop Drawing or sample shall constitute a representation to the OWNER'S REPRESENTATIVE that the CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Document.

7.24 No work requiring a Shop Drawing or sample submissions shall be commenced until the submission has been approved by the OWNER'S REPRESENTATIVE. Any related Work performed prior to review and approval by the COUNTY of the pertinent submission will be the sole expense and responsibility of the CONTRACTOR. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the OWNER'S REPRESENTATIVE.

7.25 The OWNER'S REPRESENTATIVE approval of Shop Drawings or samples shall not relieve the CONTRACTOR from his responsibility for any deviations from the requirements of the Contract Documents, unless the CONTRACTOR has in writing called the OWNER'S REPRESENTATIVE attention to such deviation at the time of submission and the COUNTY and the OWNER'S REPRESENTATIVE have given written approval to the specific deviation; nor shall any approval by the OWNER'S REPRESENTATIVE relieve the CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.

Indemnification

7.26 The CONTRACTOR shall indemnify, save harmless and defend the COUNTY and all of it's officers, agents, consultants and employees from and against all losses, claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recoverable against it or them by reason of any act or omission of the CONTRACTOR, his agent, consultants, employees, subcontractors etc., in the execution of the work or in consequence of any negligence or carelessness in guarding the same and agrees to assume any related cost.

7.27 The CONTRACTOR shall assume all risk and bear any loss or injury to property or persons occasioned by neglect or accident during the progress of work until the same shall have been completed and accepted. The CONTRACTOR agrees to repair, restore or rebuild any damages he causes to any property of the COUNTY. He shall also assume all blame or loss by reason of neglect or violation of any state or federal law or municipal rule, regulation or order. The CONTRACTOR shall give to the proper authorities all required notices relating to the work, obtain all official permits and licenses and pay all proper fees. He shall repair any damage that may have occurred to any adjoining building, structure, utility or private property in the course of this work.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)

Cleaning Up

7.28 The CONTRACTOR will keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work; at the completion of the Work he will remove all waste materials, rubbish and debris from and about the premises as well as all tools, construction equipment and machinery, and surplus materials, and will leave the site clean and ready for occupancy by the COUNTY. The CONTRACTOR will restore to their original condition those portions of the site not designated for alteration by the Contract Documents.

7.28.1 If the CONTRACTOR fails to clean up as provided in the Contract Documents, the COUNTY may do so and the cost thereof shall be deducted from the final retainage due the CONTRACTOR.

Continuing the Work

7.29 The CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes and disagreements with the COUNTY. No work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 13.7 (The COUNTY May Stop Work) or as the CONTRACTOR and the COUNTY may otherwise agree in writing.

Anti-Discrimination

7.30 The CONTRACTOR for itself, its successors in interest, and assignees, as part of the consideration thereof covenant and agree that:

7.30.1 In the furnishing of services to the COUNTY hereunder, no person on the grounds of race, religion, color, age, sex, national origin, handicap or marital status shall be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination.

7.30.2 The CONTRACTOR will not discriminate against any employee or applicant for employment because of race, religion, color, age, sex, national origin, handicap or marital status. The CONTRACTOR will make affirmative efforts to insure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, age, sex, national origin, handicap or marital status. Such action shall include, but not be limited to, acts of employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination, rates of pay or other forms of compensation and selection for training, including apprenticeships.

7.30.3 CONTRACTOR agrees to post in a conspicuous place, available to employees and applicants for employment, notices setting forth the provisions of this anti-discrimination clause.

7.30.4 CONTRACTOR will provide all information and reports required by relevant regulations and/or applicable directives. In addition, the CONTRACTOR shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the COUNTY to be pertinent to ascertain compliance. The CONTRACTOR shall maintain and make available relevant data showing the extent to which members of minority groups are beneficiaries under these contracts.

Where any information required of the CONTRACTOR is in the exclusive possession of another who fails or refuses to furnish this information, the CONTRACTOR shall so certify to the COUNTY its efforts made toward obtaining said information. The CONTRACTOR shall remain obligated under this paragraph until the expiration of three (3) years after the termination of this CONTRACT.

7.30.5 In the event of breach of any of the above anti-discrimination covenants, the COUNTY shall have the right to impose sanctions as it may determine to be appropriate, including withholding payment to the CONTRACTOR or canceling, terminating or suspending this CONTRACT, in whole or in part.

ARTICLE 7. - CONTRACTOR'S RESPONSIBILITIES (Continued)
Anti-Discrimination (Continued)

Additionally, the CONTRACTOR may be declared ineligible for further COUNTY contracts by rule, regulation or order of the Board of County Commissioners of Lee County, or as otherwise provided by law.

7.30.6 The CONTRACTOR will send to each labor union, or representative of workers with which the CONTRACTOR has a collective bargaining agreement or other contract of understanding, a notice informing the labor union or worker's representative of the CONTRACTOR'S commitments under this assurance, and shall post copies of the notice in conspicuous places available to the employees and the applicants for employment.

7.30.7 The CONTRACTOR will include the provisions of paragraphs 7.30.1 through 7.30.6 in every sub-contract under this contract to insure its provisions will be binding upon each Subcontractor. The CONTRACTOR will take such action with respect to any Subcontractor, as the contracting agency may direct, as a means of enforcing such provisions, including sanctions for non-compliance.

ARTICLE 8. - WORK BY OTHERS

8.1 The COUNTY may perform additional Work related to the Project by itself, or it may let other direct contracts which shall contain General Conditions similar to these.

8.2 The CONTRACTOR will afford the other Contractors who are parties to such direct contracts (or the COUNTY, if it is performing the additional Work itself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of the Work, and shall properly connect and coordinate his work with theirs. Should the Contract entail relocation of facilities not a part of this Contract, the CONTRACTOR will coordinate and cooperate with the applicable entity responsible for this portion of the Work.

8.3 Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners at their expense, unless otherwise provided in the Contract. It is understood and agreed that the CONTRACTOR has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and that no additional compensation will be allowed for any delays, inconveniences, or damage sustained to him due to any interference from the said utility appurtenances or the operation of moving them. If any part of the CONTRACTOR'S work depends (for proper execution) upon the Work of any such other Contractor (or the COUNTY), the CONTRACTOR will inspect and promptly report to the OWNER'S REPRESENTATIVE in writing, any defects, deficiencies or delays in such Work that render it unsuitable for such proper execution and results. His failure to report shall constitute an acceptance of the Work, except as to defects, deficiencies and delays which may appear in the other Work after the execution of his Work.

8.4 The CONTRACTOR will do all cutting, fitting and patching of his Work, which is consistent with the Contract Documents that may be required to make its several parts come together properly and fit it to receive or be received by such other Work. The CONTRACTOR will not endanger any Work of others by cutting, excavating or otherwise altering such other Work and will only cut or alter such other work with the written consent of the OWNER'S REPRESENTATIVE.

8.5 If the performance of additional Work by other Contractors or the COUNTY is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional Work.

ARTICLE 9. - OWNER'S REPRESENTATIVE STATUS DURING CONSTRUCTION

County's Representatives

9.1 The COUNTY shall issue all communications to the CONTRACTOR through the OWNER'S REPRESENTATIVE.

Clarifications and Interpretations

9.2 The OWNER'S REPRESENTATIVE will issue with reasonable promptness, through the COUNTY, such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as the COUNTY may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If the CONTRACTOR believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree to the amount or extent thereof, the CONTRACTOR may make a claim therefore as provided in Article 11 or Article 12.

Authorized Variations in Work

9.3 The OWNER'S REPRESENTATIVE may authorize, with prior approval from the COUNTY minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Time and are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Change Order on form CMO:010 and the CONTRACTOR shall perform the Work involved promptly. If the CONTRACTOR believes that a Field Change Order justifies an increase in the Contract Price or an extension of the Contract Time and the parties are unable to agree as to the amount or extent thereof, the CONTRACTOR may make a claim therefore as provided in Article 11 or Article 12.

ARTICLE 10. - CHANGES IN WORK

10.1 Without invalidating the Agreement, the COUNTY may unilaterally and at any time or from time to time order additions, deletions or revisions in the Work; these will be authorized by Change Orders or Field Directive Change. Upon receipt of a Change Order on form CMO:011 or Field Directive Change on form CMO:012, the CONTRACTOR will proceed with the Work involved.

10.1.1 All such Work shall be executed under the applicable conditions of the Contract Documents.

10.1.2 If any Change Order or Field Directive Change causes an increase or decrease in the Contract Price or any extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 11 or Article 12.

10.2 Additional Work performed by the CONTRACTOR without written authorization of a change in the form of an approved Change Order will not entitle him to an increase in the Contract Price or any extension of the Contract Time, except in the case of an emergency as provided in Article 7.20.

10.3 It is the CONTRACTOR'S responsibility to notify the Surety of any changes affecting the general scope of the Work or change of the Contract Price and the amount of the applicable Bonds shall be adjusted accordingly. The Surety's Acceptance must be submitted to the OWNER'S REPRESENTATIVE, by the CONTRACTOR, within ten (10) calendar days of the initiation of the change.

ARTICLE 11. - CHANGE OF CONTRACT PRICE

11.1 The Contract Price constitutes the total compensation payable to the CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by the CONTRACTOR shall be at his expense without change in the Contract Price.

11.2 The Contract Price may only be changed by a Change Order on form CMO:011. Any claim for an increase or decrease in the Contract Price shall be in writing and delivered to the OWNER'S REPRESENTATIVE within fifteen (15) calendar days of the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within fifty (50) calendar days after such occurrence (unless COUNTY allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR'S written statement that the amount claimed covers all known amounts (direct, indirect, and consequential) to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with paragraph 11.2. All claims for adjustment in the Contract Price shall be reviewed by the OWNER'S REPRESENTATIVE. Any change in the Contract Price shall be incorporated in a Change Order and approved by the COUNTY. No claim by the CONTRACTOR for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

11.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

11.3.1 Where the Work involved is covered by unit prices contained in the Contract Documents or subsequently agreed upon, by application of unit prices to the quantities of the items involved.

11.3.2 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.

11.3.3 By cost of the Work and mutually acceptable fixed amount for overhead and profit agreed upon by the parties.

11.3.4 If none of the above methods is agreed upon, the value shall be determined by the COUNTY on the basis of cost of the Work and a percentage for overhead and profit. Cost shall only include labor (payroll, payroll taxes, fringe benefits, worker's compensation, etc.), materials, equipment, and other incidentals directly related to the Work involved.

In such cases the CONTRACTOR will submit in the form prescribed by the COUNTY an itemized cost breakdown together with supporting data. The amount of credit to be allowed by the CONTRACTOR to the COUNTY for any such change which results in a net decrease in cost, will be the amount of the actual net decrease as determined by the COUNTY. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net decrease, if any.

Cash Allowances

11.4 It is understood that the CONTRACTOR has included in the Contract Price any allowances so named in the Contract Documents and shall cause the Work so covered to be done by such materialmen, suppliers, or SUBCONTRACTORS and for such sums within the limit of the allowances as the COUNTY may approve. Upon final payment, the Contract Price shall be adjusted as required and an appropriate Change Order issued. The CONTRACTOR agrees that the original Contract Price includes such sums as he deems proper for cost and profit on account of cash allowances. No demand for an additional sum for overhead or profit in connection therewith will be allowed.

ARTICLE 11. - CHANGE OF CONTRACT PRICE(Continued)

Unit Price Work

11.5 Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit prices for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price.

11.6 Each unit price will be deemed to include an amount considered by the CONTRACTOR to be adequate to cover the CONTRACTOR'S overhead and profit for each separately identified item.

11.7 The unit price of an item of Unit Price Work shall be subject to revaluation and adjustment under the following conditions:

11.7.1 if the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by the CONTRACTOR differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and

11.7.2 if there is no corresponding adjustment with respect to any other item of Work; and

11.7.3 if the CONTRACTOR believes that it has incurred additional expense as a result thereof; or

11.7.4 if the COUNTY believes that the quantity variation entitles it to an adjustment in the unit price, either the COUNTY or the CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

ARTICLE 12. - CHANGE OF CONTRACT TIME

12.1 The Contract Time may only be changed by a Change Order on form CMO:011. Any claim for an extension in the Contract Time shall be in writing and delivered to the OWNER'S REPRESENTATIVE within fifteen (15) calendar days of the occurrence of the event giving rise to the claim and stating general nature of the claim. Notice of the extent of the claim with supporting data (analysis and documentation) shall be delivered within sixty (60) calendar days after such occurrence (unless the OWNER'S REPRESENTATIVE allows an additional period of time to ascertain more accurate data in support of the claim) and shall be accompanied by the CONTRACTOR'S written statement that the adjustment claimed is the entire adjustment to which the CONTRACTOR has reason to believe it is entitled as a result of the occurrence of said event. If adverse weather conditions are the basis for a claim for additional time, such claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that the weather conditions had an adverse effect on the scheduled construction. No claim by the CONTRACTOR under this provision shall be allowed unless the CONTRACTOR has given the notice and the analysis and documentation required in this paragraph. All claims for adjustment in the Contract Time shall be determined by the OWNER'S REPRESENTATIVE. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

12.2 The COUNTY shall not be responsible for any delay in the completion of the project where the delay is beyond the control or without fault or negligence on behalf of the COUNTY. The COUNTY shall not be held accountable for extra compensation or an extension of time due to default by the CONTRACTOR, SUBCONTRACTORS, or suppliers in the furnishing of labor or materials for the project, or having to replace defective materials.

ARTICLE 12. - CHANGE OF CONTRACT TIME (Continued)

12.3 The CONTRACTOR shall be entitled to a claim for an extension of time when a delay or hindrance is caused by an act of God, or any act or omission on the part of the COUNTY, provided the CONTRACTOR gives notice to the OWNER'S REPRESENTATIVE within fifteen (15) calendar days of the occurrence of the event giving rise to the claim and having stated the general nature of the claim. The CONTRACTOR'S sole remedy shall be an extension of Contract Time.

12.4 No extension of Contract Time or increases in Contract Price shall be granted for any delay caused either by (1) inadequate crewing, default or bankruptcy of lower tier contract, slow submittals, etc., or (2) by severe though not unusual weather conditions (other than hurricanes and tornadoes) or (3) any delay impacting a portion of the Work within the available total float or slack time and not necessarily preventing completion of the Work within the Contract Time unless otherwise agreed to by the COUNTY in its sole discretion or (4) for any delay which is caused by the CONTRACTOR having to replace defective material or (5) delays attributable to the lack of performance by Subcontractors regardless of the reasons.

12.5 All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court cost) for delay by either party.

ARTICLE 13. - WARRANTY AND GUARANTEE: ACCEPTANCE OF DEFECTIVE WORK

Warranty and Guarantee

13.1 The CONTRACTOR warrants and guarantees to the COUNTY that all materials and equipment will be new unless otherwise specified and that all Work will be of good quality, free from faults or defects and in accordance with the requirements of the Contract Documents and any inspections, test or approvals referred to in this Article. All unsatisfactory Work, all faulty Work, and all Work not conforming to the requirements of the Contract Documents or such inspections, tests or approvals shall be considered defective. Prompt notice of all defects shall be given to the CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article. Contractor is to assign any and all warranties or guarantees on equipment, materials, etc. to the COUNTY.

Test and Inspections

13.2 If the Contract Documents, laws, ordinances, rules, regulations or order of any public authority having jurisdiction require any Work to specifically be inspected, tested or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the OWNER'S REPRESENTATIVE timely notice of readiness therefor. The CONTRACTOR will furnish the OWNER'S REPRESENTATIVE with the required certificates of inspection, testing or approval. All such tests will be in accordance with the methods prescribed by the American Society for Testing and Materials or such other applicable organizations as may be required by law or the Contract Documents. If any such Work required to be inspected, tested or approved is covered without written approval of the OWNER'S REPRESENTATIVE, it shall, if requested by the OWNER'S REPRESENTATIVE, be uncovered for observation at the CONTRACTOR'S expense. The cost of all such inspections, tests and approvals shall be borne by the CONTRACTOR unless otherwise provided.

13.3 Neither observations by the OWNER'S REPRESENTATIVE, nor inspections, tests or approvals by persons other than the CONTRACTOR shall relieve the CONTRACTOR from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

ARTICLE 13. - WARRANTY AND GUARANTEE: ACCEPTANCE OF DEFECTIVE WORK

(Continued)

Close Out Procedure

13.4 General Operating/Maintenance Instructions & Manuals

13.4.1 The CONTRACTOR shall organize maintenance operating manual information into four (4) suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Emergency instructions, spare parts listing, warranties, wiring diagrams, recommended "turn around" cycles, inspection procedures, shop drawings, product data, and similar acceptable information shall be included. The CONTRACTOR shall bind each manual of each set in a heavy duty, 3-ring vinyl covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder.

13.4.2 Arrange for each installer of work requiring continuing maintenance (by the OWNER) or operation, to meet with the OWNER'S personnel, at the project site, to provide basic instructions needed for proper operation and maintenance of the entire work. Include instructions by manufacturer's representatives where installers are not expert in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate start-up, shut-down, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. Review maintenance and operations in relation with applicable guaranties, warranties, agreements to maintain, bonds, and similar continuing commitments.

Access to the Work

13.5 The COUNTY and the OWNER'S REPRESENTATIVE shall at all times have access to the Work. The CONTRACTOR shall provide proper facilities for such access and observation of the Work and also for any inspection or testing thereof by others.

Uncovering the Work

13.6 If any work has been covered which the OWNER'S REPRESENTATIVE has not specifically requested to observe prior to its being covered, or if the OWNER'S REPRESENTATIVE considers it necessary or advisable that covered Work be inspected or tested by others, the CONTRACTOR, at the OWNER'S REPRESENTATIVE'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the OWNER'S REPRESENTATIVE may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, the CONTRACTOR will bear all the expense of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction. If, however, such Work is not found to be defective, the CONTRACTOR will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction, if he makes a claim therefor as provided in Article 11 and 12.

County May Stop the Work

13.7 If the Work is defective, if the CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, or if the CONTRACTOR fails to make prompt payments to SUBCONTRACTORS for labor, materials or equipment: the COUNTY may order the CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated: however, this right of the COUNTY to stop the work shall not give rise to any duty on the part of the COUNTY to exercise this right for the benefit of the CONTRACTOR or any other party.

ARTICLE 13. - WARRANTY AND GUARANTEE: ACCEPTANCE OF DEFECTIVE WORK
(Continued)

Correction or Removal of Defective Work

13.8 If required by the OWNER'S REPRESENTATIVE prior to approval of final payment, the CONTRACTOR will, promptly, without cost to the COUNTY and as specified by the OWNER'S REPRESENTATIVE, either correct any defective Work whether or not fabricated, installed or completed or, if the Work has been rejected by the OWNER'S REPRESENTATIVE, remove it from the site and replace it with non-defective Work. If the CONTRACTOR does not correct such defective Work or remove and replace such rejected Work within ten (10) calendar days, all as specified in a written notice from the OWNER'S REPRESENTATIVE, the OWNER'S REPRESENTATIVE may have the deficiency corrected or the rejected Work removed and replaced. All direct or indirect costs of such correction or removal and replacement shall be paid by the CONTRACTOR. The CONTRACTOR will also bear the expense of making good all Work of others destroyed or damaged by his correction, removal or replacement of his defective Work.

One (1) Year Correction Period

13.9 If, after the approval of the final payment and prior to the expiration of one (1) year after the date of Final Completion or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, the CONTRACTOR will promptly, without cost to the COUNTY, and in accordance with the OWNER'S REPRESENTATIVE'S written instructions, either correct such defective Work or, if it has been rejected by the OWNER'S REPRESENTATIVE, remove it from the site and replace it with non-defective Work. If, within seven (7) calendar days, the CONTRACTOR does not comply with the terms of such instructions, the Bonding Company shall be notified of default and requested to make repairs or replacement, the COUNTY may have the defective Work corrected or the rejected Work removed and replaced. All direct and indirect costs of such removal and replacement shall be paid by the CONTRACTOR.

Acceptance of Defective Work

13.10 If, instead of requiring correction or removal and replacement of defective Work, the COUNTY prefers to accept it, the COUNTY may do so. In such case, if acceptance occurs prior to approval of final payment, a Change Order shall be issued incorporating the appropriate revisions to the Contract Documents including an appropriate reduction in the Contract Price. If the acceptance occurs after approval of the final payment, an appropriate amount shall be paid by the CONTRACTOR to the COUNTY.

Neglected Work By Contractor

13.11 If the CONTRACTOR should neglect to prosecute the Work in accordance with the Contract Documents, including any requirements of the progress schedule, the COUNTY may, after three (3) calendar days written notice to the CONTRACTOR and without prejudice to any other remedy it may have, make good such deficiency and the cost thereof shall be charged against the CONTRACTOR. A Change Order shall be issued incorporating the appropriate revision to the Contract Documents including an appropriate reduction in the Contract Price. If the payments then or thereafter due the CONTRACTOR are not sufficient to cover such amount, the CONTRACTOR shall pay the difference to the COUNTY.

ARTICLE 14. - PAYMENT AND COMPLETION

Schedule of Values

14.1 Within ten (10) calendar days after the effective date of the Agreement, the CONTRACTOR will submit a schedule of values of the Work including quantities and unit prices totaling to the Contract Price. This schedule shall be satisfactory in form and substance to the COUNTY and shall subdivide the Work into sufficient detail to serve as the basis for progress payments during construction. Upon approval of the schedule of values by the OWNER'S REPRESENTATIVE, it shall be incorporated into the Estimate and Requisition for Payment form No. CMO:013 prescribed by the COUNTY. Unit Price Contracts shall have the bid proposal prices incorporated into the Estimate and Requisition for Payment.

Application for Progress Payment

14.2 Not more often than once a month, nor less often than specified in the approved payment schedule 1.4.3, and on a date established at the Project Pre-Construction Conference, the CONTRACTOR will submit to the OWNER'S REPRESENTATIVE for review the Estimate and Requisition for Payment form No. CMO:013 filled out and signed by the CONTRACTOR covering the Work completed as of the date of the Application and supported by such data as the OWNER'S REPRESENTATIVE may reasonably require. Also, if payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such supporting data, satisfactory to the OWNER'S REPRESENTATIVE, as will establish the COUNTY'S title to the material and equipment and protect its interest therein, including applicable insurance. All progress payments will be subject to the retainage percentage specified in the Contract Documents. Such retainage shall be paid and will be issued in the final payment after acceptance by the COUNTY of the Work.

Contractor's Warranty of Title

14.3 The CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by an application for progress payment, whether incorporated in the Project or not, will be passed to the COUNTY prior to the next making of application for progress payment, free and clear of all liens, claims, security interest and encumbrances; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by the CONTRACTOR or by any other person performing the Work at the site or furnishing materials and equipment for the Project subject to an agreement under which an interest therein or encumbrance thereon is retained by the seller or otherwise imposed by the CONTRACTOR or such other person.

Approval of Payments

14.4 The OWNER'S REPRESENTATIVE will, within ten (10) calendar days after receipt of each Application for Payment, either indicate his approval of payment and deliver the application to the COUNTY or return the Application to the CONTRACTOR indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and re-submit the Application. The COUNTY will, within five (5) calendar days after receipt of each approved application for payment, either indicate their approval of payment and within fifteen (15) calendar days pay the CONTRACTOR the amount approved or return the application to the CONTRACTOR thru the OWNER'S REPRESENTATIVE indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the application to the OWNER'S REPRESENTATIVE.

ARTICLE 14. - PAYMENT AND COMPLETION (Continued)

Approval of Payments (Continued)

14.4.1 The OWNER'S REPRESENTATIVE'S approval of any payment requested in an Application for Payment shall constitute a representation by him to the COUNTY, based on the OWNER'S REPRESENTATIVE'S on-site observations of the Work in progress and on his review of the Application for Payment and the supporting data that the CONTRACTOR is entitled to payment of the amount approved.

14.4.2 The OWNER'S REPRESENTATIVE'S approval of final payment shall constitute an additional representation by him to the COUNTY that the conditions precedent to the CONTRACTOR'S being entitled to final payment as set forth in this Article 14 have been fulfilled.

14.4.3 The OWNER'S REPRESENTATIVE may refuse to approve the whole or any part of any payment if in his opinion, he is unable to make such representations to the COUNTY. He may then refuse to approve any such payment because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect the COUNTY from loss because:

14.4.3.1 The Work is defective;

14.4.3.2 A portion of such payment is the subject of a dispute or claim that has been filed.

14.4.3.3 The Contract Price has been reduced because of Modifications;

14.4.3.4 The COUNTY has been required to correct defective Work or complete the Work in accordance with Article 13, or

14.4.3.5 Of unsatisfactory prosecution of the Work, including failure to clean up as required by Article 7.

Substantial Completion

14.5 Prior to final payment, the CONTRACTOR shall, in writing to the OWNER'S REPRESENTATIVE, certify that the entire Project is substantially complete and request that the OWNER'S REPRESENTATIVE issue a Certificate of Substantial Completion. Within fourteen (14) calendar days thereafter, the OWNER'S REPRESENTATIVE and the CONTRACTOR will make an inspection of the Project to determine the status of completion. If the COUNTY does not consider the Project substantially complete, it will notify the CONTRACTOR in writing giving the reasons therefore. If the COUNTY considers the Project substantially complete, a Certificate of Substantial Completion (Form No. CMO:014) will be issued. This certificate shall fix the date of Substantial Completion and the responsibilities between the COUNTY and the CONTRACTOR for maintenance, heat and utilities. The Certificate of Substantial Completion will also include a punch list of items to be completed or corrected, said time to be within the Contract Time. The COUNTY shall have the right to exclude the CONTRACTOR from the Project after the date of Substantial Completion but the COUNTY will allow the CONTRACTOR reasonable access to complete items on the punch list.

ARTICLE 14. - PAYMENT AND COMPLETION (Continued)

Partial Utilization

14.6 Prior to final payment, the OWNER'S REPRESENTATIVE may request the CONTRACTOR to permit the use of a specified part of the Project which the COUNTY believes it may use without significant interference with construction of the other parts of the Project. If the CONTRACTOR agrees, he will certify to the OWNER'S REPRESENTATIVE that said part of the Project is substantially complete and request the OWNER'S REPRESENTATIVE to issue a Certificate of Substantial Completion for that part of the Project. Within fourteen (14) calendar days thereafter, the OWNER'S REPRESENTATIVE and the CONTRACTOR will make an inspection of that part of the Project to determine its status of completion. If the COUNTY considers that part of the Project to be substantially complete, the OWNER'S REPRESENTATIVE will deliver to the CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, and listing the punch list of items to be completed or corrected before final payment and fixing the responsibility between the COUNTY and the CONTRACTOR for maintenance, heat and utilities as to that part of the Project. The COUNTY shall have the right to exclude the CONTRACTOR from any part of the Project which is so certified to be substantially complete but the COUNTY will allow the CONTRACTOR reasonable access to complete or correct items on the punch list.

Final Inspection

14.7 Upon written notice from the CONTRACTOR that the Project is complete, the OWNER'S REPRESENTATIVE will make a final inspection with the CONTRACTOR and will notify the CONTRACTOR in writing of any particulars which this inspection reveals that the Work is defective. The CONTRACTOR shall immediately make such corrections as are necessary to remedy the defects within a reasonable time.

Final Inspection for Payment

14.8 After the CONTRACTOR has completed any such corrections to the satisfaction of the OWNER'S REPRESENTATIVE and delivered all maintenance and operating instructions, schedules, guarantees, bonds. Certificates of Inspection and other documents as required by the Contract Documents, he may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by legally effective final releases or waivers of liens from the CONTRACTOR and all SUBCONTRACTORS which performed services for the CONTRACTOR pursuant to the Contract Documents and the consent of surety, if applicable to final payment.

Approval of Final Payment

14.9 If, on the basis of its observations and review of the Work during construction, its final inspection and its review of the final Estimate and Requisition for Payment, all as required by the Contract Documents, the OWNER'S REPRESENTATIVE is satisfied that the Work has been completed and the CONTRACTOR has fulfilled all of his obligations under the Contract Documents, it will, within ten (10) calendar days after receipt of the final Application for Payment, indicate in writing its approval of payment and deliver the application to the COUNTY. Otherwise, it will return the Application to the CONTRACTOR, indicating in writing its reason for refusing to approve final payment, in which case the CONTRACTOR will make the necessary corrections and re-submit the Application. The COUNTY will, within fifteen (15) calendar days after receipt of approved application for final payment, either indicate their approval of the estimate and requisition application for payment and within fifteen (15) calendar days pay the CONTRACTOR the amount approved by the COUNTY and issue a Certificate of Final Completion or return the application thru the OWNER'S REPRESENTATIVE indicating in writing the reason for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the application to the OWNER'S REPRESENTATIVE.

ARTICLE 14. - PAYMENT AND COMPLETION (Continued)

Approval of Final Payment (Continued)

14.10 If, after substantial Completion of the Work, final completion is materially delayed through no fault of the CONTRACTOR, and the OWNER'S REPRESENTATIVE so confirms, the COUNTY shall and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Article 6, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the CONTRACTOR to the OWNER'S REPRESENTATIVE, prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

14.11 If liquidated damages are to be deducted from the final payment, the COUNTY shall so notify the CONTRACTOR in writing at least seven (7) calendar days prior to the COUNTY'S submittal to Finance.

14.12 The Contractor will be required to submit with his final payment documents a DBE Participation Certification, Form No. CMO:017 indicating all DBE sub-contractor(s) and amount(s) utilized for the project.

If the CONTRACTOR did not utilize the DBE firm(s) listed on the Bid Proposal, Schedule D, a letter of justification, as to why shall be submitted along with the DBE Participation Certification.

14.13 At the final completion of the construction project if the county project manager experienced problems with the CONTRACTOR the project manager will prepare a Contractor Performance Evaluation, Form No. CMO:018 and forward to the Contractor for review, comment and signature.

14.14 Upon receipt of the Contractor Performance Evaluation the CONTRACTOR will have seven (7) calendar days, from the date received, to review, comment, sign and return back to the project manager. If the evaluation has not been received back from the CONTRACTOR within the seven (7) calendar days, the COUNTY will assume the CONTRACTOR fully agrees with and has no comments to the evaluation. The evaluation will then be placed on file with Lee County Contracts Management.

Contractor's Continuing Obligation

14.15 The CONTRACTOR'S obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or final payment by the COUNTY, the issuance of the Certificates of Completion, any payment by the COUNTY to the CONTRACTOR under the Contract Documents, any use or occupancy of the Project or any part thereof by the COUNTY, any act of acceptance by the COUNTY, any failure to do so, nor any correction of defective Work by the COUNTY shall constitute an acceptance of Work not in accordance with the Contract Documents.

Waiver of Claims

14.16 The making and acceptance of final payment shall constitute:

14.16.1 A waiver of all claims by the COUNTY against the CONTRACTOR other than those arising from unsettled liens, from defective Work appearing after final payment or from failure to comply with the requirements of the Contract Documents, or from the terms of any special guarantees specified therein, and,

14.16.2 A waiver of all claims by the CONTRACTOR against the COUNTY other than those previously made in writing and still unsettled.

ARTICLE 15. - SUSPENSION OF WORK AND TERMINATION

County May Suspend Work

15.1 The COUNTY may at any time and without cause suspend the Work or any portion thereof for a period of not more than ninety (90) calendar days by notice in writing to the CONTRACTOR. The COUNTY shall fix the date on which Work shall be resumed and the CONTRACTOR will resume the Work on the date so fixed. The CONTRACTOR will be allowed an increase in the Contract Price, an extension of the Contract Time or both, if such increases are justified and directly attributable to any COUNTY suspension and if he makes a claim thereof as provided in Articles 11 and 12.

County May Terminate

15.2 If the CONTRACTOR is adjudged bankrupt or insolvent, if he makes a general assignment for the benefit of his creditors, if a trustee or receiver is appointed for the CONTRACTOR or for any of his property, if he files a petition to take advantage of any debtor's act or reorganizes under the bankruptcy or similar laws, if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, if he repeatedly fails to make prompt payments to SUBCONTRACTORS for labor, materials or equipment, if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction, if he disregards the authority of the OWNER'S REPRESENTATIVE, or if he otherwise substantially violates any provisions of the Contract Documents, then the COUNTY may, without prejudice to any other right or remedy and after giving the CONTRACTOR and his surety seven (7) calendar days written notice, terminate the services of the CONTRACTOR and take possession of the Project and all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR and finish the Work by whatever method the COUNTY may deem expedient or arrange with the Surety to complete the project. The CONTRACTOR, if notified by the COUNTY to do so, shall promptly remove any part of his equipment and supplies from the property of the COUNTY; failing, the COUNTY shall have the right to remove such equipment and supplies at the expense of the CONTRACTOR.

15.2.1 In such case the CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect cost of completing the Project, including compensation for additional professional services, such excess shall be paid to the CONTRACTOR. If such cost exceeds such unpaid balance, the CONTRACTOR will pay the difference to the COUNTY. Such cost incurred by the COUNTY will be determined by the COUNTY and incorporated in a Change Order.

15.2.2 Where the CONTRACTOR'S services have been so terminated by the COUNTY, said termination shall not affect any rights of the COUNTY against the CONTRACTOR then existing or which may thereafter accrue.

15.2.3 If so terminated, any retention or payment of monies by the COUNTY due the CONTRACTOR will not release the CONTRACTOR from liability accruing under this Contract.

15.2.4 If after notice of termination of the CONTRACTOR'S right to proceed under the provisions of this clause, it is determined for any reason that the CONTRACTOR was not in default under the provisions of Article 15.2 or that the delay was excusable, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to Article 15.3.

15.3 Upon seven (7) calendar days written notice to the CONTRACTOR, the COUNTY may without cause and without prejudice to any other right or remedy elect to abandon the Project and terminate the Agreement. In such case the CONTRACTOR shall be paid for all Work executed and any expense sustained plus a reasonable profit.

ARTICLE 15. - SUSPENSION OF WORK AND TERMINATION (Continued)

Contractor May Stop Work or Terminate The Contract

15.4 If through no fault of the CONTRACTOR, or a Subcontractor, Sub-Sub-Contractor or their agents or employees or any other persons performing portions of the Work under Contract with the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) calendar days by the COUNTY or under an order of court or other public authority, or the OWNER'S REPRESENTATIVE has not issued a certificate for payment and has not notified the CONTRACTOR of the reason for withholding certification as provided in 14.4 or because the COUNTY has not made payment on a certificate for payment within the time stated in the Contract Documents, then the CONTRACTOR may, upon seven (7) calendar days written notice to the COUNTY and the OWNER'S REPRESENTATIVE, terminate the Agreement and recover from the COUNTY payment for all Work executed and proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages.

15.5 In addition and in lieu of terminating the Agreement, if the OWNER'S REPRESENTATIVE has failed to act on an application for payment or the COUNTY has failed to make any payment as aforesaid, the CONTRACTOR may upon seven (7) calendar days written notice to the COUNTY and the OWNER'S REPRESENTATIVE stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve the CONTRACTOR of the obligation under paragraph 7.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with the COUNTY.

ARTICLE 16. - MISCELLANEOUS

General

16.1 All Specifications, Drawings and copies thereof furnished by the COUNTY, to the CONTRACTOR, shall remain the COUNTY'S property. They shall not be used on another Project.

16.2 The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder, and, in particular but without limitation, the warrants, guarantees and obligations imposed upon the CONTRACTOR and the rights and remedies available to the COUNTY thereunder shall be in addition to and not a limitation of any otherwise imposed or available by law, by special guarantee or other provisions of the Contract Documents.

16.3 Should the COUNTY or the CONTRACTOR suffer injury or damage to its person or property because of any error, omission or act of the other or any of his employees, agents, or others for whose acts he is legally liable, claim should be made in writing to the other party within seven (7) calendar days of the first observance of such injury or damage.

16.4 The Contract Documents shall be governed by the laws of the State of Florida, the County of Lee, and the municipality in which the project is being done.

Computation of Time

16.5 When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

ARTICLE 17. - MAINTENANCE OF RECORDS

17.1 The CONTRACTOR shall keep adequate records and supporting documents applicable to this contractual matter. Said records and documentation will be retained by the CONTRACTOR for a minimum of five (5) years from the date of termination of this Contract. The COUNTY and its authorized agents shall have the right to audit, inspect and copy records and documentation as often as the COUNTY deems necessary during the period of this Contract and during the period of five (5) years thereafter; provided, however, such activity shall be conducted only during normal business hours. The COUNTY, during the period of time expressed by the preceding sentence, shall also have the right to obtain a copy of and otherwise inspect any audit made at the direction of the CONTRACTOR as concerns the aforesaid records and documentation.

ARTICLE 18. - FEDERAL REQUIREMENTS

18.1 In the event this Contract is paid in whole or in part from any Federal Governmental agency or source, the specific terms, regulations and requirements governing the disbursement of these funds are incorporated by reference and made a part of this Contract as if attached hereto and become a part of this clause.

PART G

SUPPLEMENTARY GENERAL CONDITIONS

These Supplementary General Conditions amend or supplement the LEE COUNTY CONSTRUCTION CONTRACT GENERAL CONDITIONS (PART F) as indicated herein. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 7. CONTRACTOR'S RESPONSIBILITIES

- SGC 7.4** Add Articles 7.4.1 through 7.4.4 to read as follows:
- 7.4.1 The Contractor shall provide temporary power for the Contractor's construction operations, as necessary.
 - 7.4.1.1 All work conducted at night or under conditions of deficient daylight shall be suitably lighted to insure proper work and to afford adequate facilities for inspection and safe working conditions. Temporary lighting shall be provided by the Contractor.
 - 7.4.1.2 All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.
 - 7.4.2 The Contractor shall provide water for the Contractor's construction operations.
 - 7.4.2.1 The Contractor may install a temporary water service connection to an existing potable waterline within the area. The Contractor shall be responsible for installing a registered meter and monitoring flow. Consumption will be charged at the current rate by the water service provider.
 - 7.4.3 Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.
 - 7.4.3.1 Such facilities shall be made available when the first employees arrive on the work site, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.
 - 7.4.3.2 The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. The Contractor shall rigorously prohibit

the committing of nuisances on the site of the work, on County land, or an adjacent property.

7.4.3.3 The County and the Owner's Representative shall have the right to inspect any building or other facility erected, maintained, or used by the Contractor, to determine whether or not the sanitary regulations have been complied with.

7.4.4 The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Owner's Representative and in accordance with all laws and regulations pertaining thereto.

SGC 7.7 Add Articles 7.7.1 and 7.7.2 to read as follows:

7.7.1 References to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations Code of Federal Regulations (OSHA), including all changes and amendments thereto.

7.7.2 References to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

SGC 7.12 Add Articles 7.12 through 7.12.2 to read as follows:

7.12 Unless otherwise specified herein, the CONTRACTOR will secure and pay for all permits, impact fees, and licenses and will pay all governmental charges and inspections' fees necessary for the prosecution of the Work which are applicable at the time of his bid. The CONTRACTOR will also pay all public utility charges and connection fees except as provided for in the Contract Documents. Permits and licenses of regulatory agencies which are necessary to be maintained after completion of the guarantee period shall be secured and paid for by the COUNTY.

7.12.1 It is the Contractor's responsibility to obtain and pay for permits required by all governmental entities having jurisdiction over the work.

7.12.2 Upon Notice of Award, the Contractor shall submit for all necessary permits from local and state regulatory agencies for the drilling of each production well.

SGC 7.16 Add Articles 7.16.1 through 7.16.4 to read as follows:

7.16.1 The Contractor shall employ a Florida Registered Professional Land Surveyor, for the completion of Record Drawings.

- 7.16.2 As-Built or Record Drawing data, with respect to the relocation and depth of the constructed utility lines or facilities, shall be taken and recorded on a set of plans, while the construction work is in progress.
- 7.16.3 During the entire construction operation, the Contractor shall maintain As-Built records showing the work performed and any deviations from the Drawings and Specifications and shall prepare therefrom a complete set of Record Drawings showing correctly and accurately all surface and subsurface structures, lines, valves, fittings, hydrants, services, meter boxes, concrete pads, edge of pavement, and other pertinent items. Actual elevations and distances of surface and subsurface structures from centerline or other appropriate reference shall be included to reflect the work as it was actually constructed. These drawings shall conform to recognized standards of drafting and shall be neat and legible.
- 7.16.4 Complete as-built record drawings shall be submitted to the Engineer for review no later than 30 working days after installation of the utility or appurtenances. Final contract payment will not be made to the Contractor until Record Drawings, signed and sealed by a Florida Registered P.L.S., have been submitted to the Department of Lee County Utilities representative and accepted. The basis of payment shall be included in the cost of all Pay Items.

SGC 7.17.3 Add Articles 7.17.3.1 through 7.17.3.3 to read as follows:

- 7.17.3.1 All paved areas cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. All temporary and permanent pavement shall conform to the requirements of the County. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.
- 7.17.3.2 Wherever required by the County, the Contractor shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by the County before proceeding with the final restoration of improvements.
- 7.17.3.3 In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

SGC 7.20 Add Articles 7.20.1 through 7.20.3 to read as follows:

7.20.1 During adverse weather, and against the possibility thereof, the Contractor shall take all necessary precautions so that the work may be properly done and satisfactorily in all respects. When required, protection shall be provided by use of tarpaulins, shelters, or other acceptable means.

7.20.2 The Owner's Representative may suspend construction operations at any time when, in the judgement of the Owner's Representative, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather conditions may be, in any season.

7.20.3 The Contractor shall take all precautions necessary to protect the work during hurricane and storm watches and warnings.

SGC 7.21 Add Articles 7.21.1 through 7.21.6 to read as follows:

7.21.1 The Contractor shall be responsible for the prompt submittal of all shop drawings so that there shall be no delay to work due to the absence of such drawings. The Owner's Representative will review submitted shop drawings and return to the Contractor (regular mail, posted) no later than 21 days after receipt.

7.21.2 The Contractor's responsibility for errors and omissions in submittals is not relieved by the Owner's Representative review of submittals. Also, the Owner's Representative review of submittals shall not be construed as a complete check and shall not relieve the Contractor from responsibility for complete compliance with the Contract requirements. No corrections, changes, or deviations indicated on submittals reviewed by the Owner shall be considered as a change order.

7.21.3 Time delays caused by rejection of submittals are not cause for extra charges to the County or time extensions.

7.21.4 All shop drawings shall be submitted to the Owner's Representative through the Contractor, including those from any subcontractors. All drawings shall be clearly marked with the name of the project, owner, Contractor, project number, and to which the drawing applies. Drawings shall be suitably numbered and stamped by the Contractor. Each shipment of drawings shall be accompanied by a Letter of Transmittal giving a list of the drawing numbers and the names mentioned above.

7.21.5 Where manufacturer's publications in the form of catalogs, brochures, illustrations, or other data sheets are submitted in lieu of prepared shop drawings, such submission shall specifically indicate the particular item offered. Identification of such items and relative pertinent

information shall be made with indelible ink. Submissions showing only general information will not be accepted.

- 7.21.6 The Contractor shall notify the Owner's Representative, in writing at the time of submission, of deviations in submittals from the requirements of the Contract Documents. The Contractor's responsibility for deviations in submittals from the requirements of the Contract Documents is not relieved by the Owner's Representative review of submittals, unless the Owner gives written acceptance of specific deviations.

SGC 7.31 Add Articles 7.31 to read as follows:

- 7.31.1 The CONTRACTOR has the responsibility to provide physical access to the drilling site.

The CONTRACTOR, in addition to furnishing the services of drillers experienced in the type of formations to be encountered, shall also furnish an adequate number of competent helpers. The driller(s) shall keep well logs and reports of the drilling, developing and test-pumping operations. Drillers shall also be capable of making accurate classifications of the formations and handling representative rock cuttings as indicated in Section 02055 Drilling.

The CONTRACTOR shall perform all work in a professional manner using qualified well drillers and shall conform to these Specifications.

The CONTRACTOR shall furnish capable equipment to construct, develop, modify, test, and log the wells, as specified. The CONTRACTOR's drilling rig, tools, equipment, pumps, compressors, and methods shall be subject to the ENGINEER's approval.

The CONTRACTOR's normal working hours shall be defined as 7:00 a.m. to 7:00 p.m., Monday through Friday.

The CONTRACTOR shall make every effort to avoid drilling and testing activities on nationally recognized holidays (i.e., Martin Luther King Jr. Day, Independence Day, Labor Day, Thanksgiving and the day following, Christmas Day and New Years Day). Work scheduled should accommodate these dates in particular.

During the process of the work under these Specifications, it may be necessary for the ENGINEER to perform work of an experimental nature that will require the services of the drilling crew and drilling equipment, or work that may require such crew and equipment to standby during normal working hours.

In such an event, the representative of the ENGINEER shall request that the CONTRACTOR furnish such assistance and the CONTRACTOR shall promptly furnish such assistance. The time required for this purpose shall be recorded on the CONTRACTOR's daily log and the ENGINEER's daily log. If there are any discrepancies, the time noted on the ENGINEER's daily log shall prevail. This time shall be paid as stated in the CONTRACTOR's Bid Schedule.

Standby time shall only be paid on an hourly basis, at the unit contract prices as stated in the Bid Schedule of these Specifications for any portion of the normal workday when the ENGINEER orders work to cease.

ENGINEER's Standby Time: All well activities that require direct coordination with the ENGINEER such as testing, geophysical logging, cementing, coring, pump testing, etc., shall be done during normal working hours, or as approved by the ENGINEER. The OWNER and the ENGINEER shall be given twenty-four (24) hours notice, exclusive of Saturdays, Sundays and holidays, prior to such activities. In the event that the ENGINEER is unable to meet the CONTRACTOR's schedule, payment to the CONTRACTOR for standby time shall commence at the end of the twenty-four (24) notice period, as long as such time is within normal working hours. If the OWNER and/or the ENGINEER are notified to be onsite by the CONTRACTOR, and the CONTRACTOR is not ready, then the OWNER shall be reimbursed for the ENGINEER's or ENGINEER Representative's time by the CONTRACTOR at a rate of \$100 per hour starting at the time scheduled by the CONTRACTOR as stated in the notification to the ENGINEER and the OWNER. Approval for any standby time to be paid to the CONTRACTOR must be made in writing by the ENGINEER within twenty-four (24) hours of such an occurrence.

The CONTRACTOR must use a mud tank during mud-rotary drilling. Mud pits will not be accepted unless approved by the ENGINEER. Settling tank equipment with baffles must be used while drilling with reverse-air circulation. Drill cuttings and/or drilling mud resulting from any of the operations shall be disposed of by the CONTRACTOR by hauling to an FDEP-approved disposal site.

The CONTRACTOR shall not cause nor permit an action to occur which would allow drilling fluids, high salinity water, or cuttings to escape the confines of the containment tanks. The CONTRACTOR shall remain solely responsible for any property damage, remediation costs, or regulatory fines which might result from such occurrences.

The construction summary and schedule presented in SECTION 01010 Summary of Work has been prepared to illustrate the general manner in which the ENGINEER intends that project activities shall proceed. This is not intended to be a complete step-by-step guide to this project. The CONTRACTOR

is advised to refer to all drawings and specifications for a complete project description.

ARTICLE 13. WARRANTY AND GUARANTEE: ACCEPTANCE OF DEFECTIVE WORK

SGC 13.1 Add Article 13.1.1 and 13.1.2 to read as follows:

13.1.1 Original warranties, called for in the Contract Documents, shall be submitted to the County through the Owner's Representative. When warranties are required, they shall be submitted prior to request for payment.

13.1.2 When advance copies of warranties are requested, they shall be submitted with, and considered as shop drawings.

ARTICLE 14. PAYMENT AND COMPLETION

SGC 14.1 Add Articles 14.1.1 through 14.1.4 to read as follows:

14.1.1 The bid items in the Bid Schedule are defined in the technical specifications and construction drawings. Payment will be made based on the specified items included in the description for each bid item. The Contractor shall receive and accept the compensation provided in the Proposal and the Contract as full payment for furnishing and mobilization/demobilization of all materials, labor, tools, and equipment for performing all operations necessary to complete the work under the Contract; and also in full payment for all loss or damages arising from the nature of the work, or from any discrepancy between the actual quantities of work and quantities herein estimated by the Engineer, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the Owner.

14.1.2 The prices stated in the Proposal shall include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the plans and specified herein. Should the Contractor feel that the cost for any item of work has not been established by the Bid Schedule or Basis of Payment, he shall include the cost for that work in some other applicable bid item, so that his proposal for the project does reflect his total price for completing the work in its entirety.

14.1.3 The Owner reserves the right to alter the project, modify incidental work as may be necessary, and increase or decrease quantities of work to be performed to accord with such changes, including addition, deduction or cancellation of any one or more of the Pay Items. Changes in the work shall not

be considered as a waiver of any conditions of the Contract nor invalidate the provisions thereof. When changes result in changes in quantities of work to be performed, the Contractor will accept payment according to Contract Unit Prices.

14.1.4 Payment shall fully reimburse the Contractor for cooperating with and meeting all the requirements of the State of Florida Trench Safety Act (90-96, Laws of Florida).

END SECTION

DIVISION 23 – HVAC TECHNICAL SPECIFICATIONS INDEX

LEE COUNTY UTILITIES

FIESTA VILLAGE WWTP

SWITCHGEAR AND GENERATOR REPLACEMENT PROJECT

BASIC MATERIALS AND METHODS

| | |
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| 23 01 31 | HOUSEKEEPING PADS, CONCRETE |
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SECTION 23 01 30

HVAC BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all equipment, materials, labor, and services as required for complete and properly functioning HVAC systems as shown on the Drawings, as specified, and in accordance with all applicable codes.
- B. The CONTRACTOR shall pay for all licenses, fees, inspections and permits required to complete the HVAC systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 (All Sections)
- B. Painting
- C. Electric Service and Distribution

1.03 GENERAL INFORMATION AND DESCRIPTION

- A. Electrical Provisions
 - 1. Work of HVAC shall include the electrical requirements which are indicated to be integral with HVAC work and which can be summarized to include (but not necessarily be limited to) the following:
 - a. Motors.
 - b. Motor starters.
 - c. Wiring from mechanical equipment to electrical work termination (junction box or disconnect switch).
 - d. Control switch, pilot lights, interlocks and similar devices.
 - e. Electrical work specified in Division 23 for the HVAC control system.
 - f. Drip pans to protect electrical work.
- B. Manufacturers: subject to compliance with requirements, provide products by one of the following:
 - 1. Marathon
 - 2. General Electric
 - 3. Reliance
 - 4. Westinghouse
 - 5. Baldor Electric Co.
 - 6. Emerson
 - 7. Lincoln
 - 8. MagnaTek

- C. General:
1. Select motors for continuous duty conditions in which they will be required to perform; i.e., general purpose, splash-proof, explosion proof, standard load, high torque, or any other special type as required by the equipment motor manufacturer's recommendations.
 2. Motor enclosures shall be of the type recommended by the equipment manufacturer for the specific application. Unless otherwise indicated or required, motors shall be totally enclosed fan cooled type.
 3. All motors shall be furnished for starting in accordance with electric utility company's requirements and shall be compatible with the motor starter and driven load. Motors shall not exceed full-rated nameplate load when operated at the specified capacity and under the most severe conditions likely to be encountered. The motor service factor shall not be used to justify exceeding nameplate amperage.
 4. Unless otherwise indicated, motors 1/3 horsepower and less shall be single phase. Motors 1/2 horsepower and larger shall be 3 phase, squirrel-cage induction type.
 5. All material shall be new and guaranteed for service intended. Sound power levels for motors shall be no greater than the guidelines recommended by NEMA MG 1-12.49. A motor which, in the opinion of the Engineer, generates excessive noise within the occupied area of the building shall be replaced with a quieter operating motor at no additional cost to the Owner.
 6. Verify the circuit voltage and phase being furnished to the motor. All motors shall be 1750 rpm unless noted otherwise. Motors shall operate with electrical input voltage variations of plus or minus 10 percent of nameplate rating or frequency variations of plus or minus 5 percent of nameplate rating.
- D. Design: Provide NEMA Design B for normal starting torque with Standard MG1-12.42 Class B insulation unless noted otherwise or required by the equipment on which the motor is being used. Motors shall be designed for operation in 40 degree C. ambient at 1.23 service factor and shall have all copper windings. Motors shall meet or exceed the locked-rotor (starting) and breakdown (maximum) torques for the NEMA rating. Locked rotor current shall not exceed 6 times full-load current. Motor current density and heating characteristics shall be such that the motor insulation will not fail if subjected to locked-rotor current for 20 seconds.
- E. Efficiency: Motors 1 horsepower and larger, except specifically wound motors, shall be high efficiency design. Nominal efficiency of each motor shall meet or exceed the value listed below when tested in accordance with NEMA MG 1-12.54.1 and shall be labeled on the motor nameplate in accordance with 1.12.54.2. High-efficiency motors shall be different from the manufacturer's standard product through the use of premium materials, design and improved manufacturing processes to reduce motor losses.

TABLE - MOTOR EFFICIENCY

| HP | 2-Pole 3600 RPM | | 4-Pole 1800 RPM | |
|-----|-----------------|---------|-----------------|---------|
| | Nominal | Minimum | Nominal | Minimum |
| 1.0 | 82.5 | 81.5 | 82.5 | 81.5 |
| 1.5 | 84.0 | 82.5 | 84.0 | 82.5 |
| 2.0 | 84.0 | 82.5 | 84.0 | 82.5 |
| 3.0 | 86.5 | 85.5 | 87.5 | 86.5 |
| 5.0 | 87.5 | 86.5 | 87.5 | 86.5 |
| 7.5 | 88.5 | 87.5 | 89.5 | 88.5 |
| 10 | 89.5 | 88.5 | 89.5 | 88.5 |

- F. Power Factor: All equipment furnished utilizing a combined electrical load of greater than 1000 watts shall have a power factor of not less than 0.90 under rated load conditions. Where motors are not available with a minimum 0.90 power factor, provide motor mounted power factor correction capacitor to improve power factor to at least 0.90 under rated load condition.

1.04 DISCONNECTING MEANS

- A. Location: Each electrically connected item which is part of the mechanical equipment or installation shall be provided with a disconnecting means as required by the NEC within sight of the item. A remote lockable type breaker or disconnect switch is not acceptable.
For disconnects not furnished as an integral part of the mechanical equipment see Section 16480, MOTOR CONTROLS AND RELATED EQUIPMENT.
- B. Fused Disconnect: A disconnecting device with fuse protection shall be provided where required by code or as directed by the authority having jurisdiction.

1.05 WIRING

- A. Power: All electrical circuit wiring for motors, heating elements, components, etc. which serves a part of any equipment or system is defined as power wiring.
- B. Interlock: Interlock wiring is defined as a series of interlocks applied to associated equipment in such a manner as to prevent or allow operation of the equipment in a prearranged sequence.

- C. Control: Control wiring is broadly defined as the methods and means of governing the performance of any electrical apparatus, machine, or system.

1.06 FACTORY PRE-WIRED CONTROL PANEL

- A. Quality Assurance: Factory pre-wired control panels furnished with any equipment shall be UL Listed.
- B. Starter: Motor starter included in a factory pre-wired control panel shall comply with the paragraph included in this Section entitled "MOTOR CONTROLLER".
- C. Disconnect: Each control panel shall be provided with a disconnecting means for each motor and control circuit controlled by the panel. Where more than one motor or control circuit is controlled each shall be provided with a fused disconnect or circuit breaker
- D. Wiring: Factory pre-wired control panels shall be provided with internal wiring to a single set of incoming lugs for a single point electrical power connection.
- E. Transformers: When control transformers are provided or other electrical voltages are required other than or in addition to the electrical power connection, provide fuse protection and disconnecting means.
- F. Electrical/HVAC Work
 - 1. Definitions:
 - a. Power Circuit: Circuit that carries main electric power to apparatus to which the power circuit is connected.
 - b. Control Circuit: Circuit that carries electrical signals directing the performance of a controller but which does not carry the main electric power. (See NEC, Section 430-71.) Such circuits shall also include those which serve a dual control and power function (e.g., a line voltage thermostat circuit which both activates and powers a small fan motor).
 - c. Controller: A device or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)
 - d. Control Device: A device which reacts to an operating condition (pressure, temperature, flow, humidity, etc.) and which initiates transmission of an electrical control signal which causes operation of a controller which causes operation of pressure switches, etc.
 - e. Auxiliary Control Device: A device (such as a low voltage control transformer, or electric relay) which is located in a control circuit and which carries or responds to (but does not initiate) an electrical control signal initiated by a control device.
 - 2. Work of HVAC includes (but is not necessarily limited to):
 - a. Provide:
 - 1) All controllers which are generally manufactured or shipped

- as integral with HVAC equipment.
 - 2) All electric motors and other electrical power consuming equipment which are specified in HVAC.
 - 3) All control circuits (including conduit and boxes) from the Division 16 panels to point of use including the necessary circuit breakers.
 - 4) All other control circuits, including conduit and boxes.
 - 5) All control connections to HVAC equipment.
 - 6) All control connections to controllers, switches, motors and other HVAC systems electrical power consuming equipment.
 - 7) Auxiliary control devices.
 - 8) All control devices (such as thermostats, pressure switches, and flow switches) and make control circuit connections thereto.
 - 9) Any and all electronic and electric control devices and electric or pneumatic connections thereto.
 - b. Furnish: All controllers which are generally manufactured, shipped, or manufactured and shipped as separate but companion items to HVAC equipment.
 - 3. Work of Division 16 relative to HVAC work includes (but is not necessarily limited to):
 - a. Provide:
 - 1) All power circuits, including conduit and boxes.
 - 2) All power connections to controllers, switches, motors and other HVAC systems electrical power consuming equipment.
 - 3) All remote motor disconnects (remote from the related controller) at all locations required by NEC and connections thereto except those disconnects which are specified in Sections relating to HVAC work to be provided as part of the equipment itself.
 - 4) All controllers (except those which are generally manufactured or shipped as separate but companion items to HVAC equipment.
 - b. Install: All controllers which are generally manufactured, shipped, or manufactured and shipped as separate but companion items to HVAC equipment.
- G. Coordination: Provide all required coordination and supervision where HVAC work connects to or is affected by work of others.
- H. Provisions for Openings: Provide all openings required for HVAC work. Provide sleeves or other approved methods to allow passage of items installed under any Section relating to HVAC work.

1.07 SUBMITTALS

- A. General: Submittals shall meet the requirements of the Section entitled "Submittals". Each submittal shall include the applicable equipment identification number and specification Section number.

- B. Time: Submit each item of manufacturer's literature, performance data and installation instructions covered in each section of this Division under an individual letter of transmittal within 30 days after Notice to Proceed unless otherwise indicated.
- C. Submitter's Review: All items required for each section shall be reviewed before submittal. Submittal information for each item shall bear a review stamp of approval, indicating the name of the submitter, the initials of checker and date checked. Responsibility for errors or omissions in submittals is not relieved by the Engineer's review of submittals.
1. If the submittal item is different than the scheduled item or if the item is not specified by manufacturer's name and model number, the submittal shall comply with the requirements of the paragraph entitled "Substitutions" in this section of these specifications.
 2. If the submittal item is different than the scheduled item and the manufacturer is listed in the specification, submit a completed REQUEST FOR ALTERNATE MANUFACTURER form that is included after the end of this section. An alternate manufacturer is defined as a manufacturer listed in the specifications by name only and is not scheduled or identified by a specific product name and number. The alternate manufacturer's submittal, other than the form used, shall comply with all of the specification requirements listed under the paragraph entitled "Substitutions".
 3. Review of the submittal data, whether indicated with "APPROVED" or with review comments, does not constitute authorization for or acceptance of a change in the contract price.
- D. Engineer's Review: The submittal data will be reviewed only for general conformance with the design concept of the project and general compliance with the contract documents. Any action shown is subject to the requirements of the plans and specifications. Submittal data review does not include quantities; dimensions, which shall be confirmed and correlated at the job site; fabrication processes; techniques of construction; and co-ordination of the submittal data with all other trades. Copies of the submittal data will be returned marked "APPROVED", "APPROVED AS NOTED", "RETURNED FOR CORRECTION AND RESUBMITTAL", "DISAPPROVED" or "SUBMIT SPECIFIED ITEM".
- E. Submittal Items: Submittal items shall be inserted in a Technical Information Book. Mark the appropriate specification section or drawing reference number in the right hand corner of each item. All typewritten pages shall be on the product or equipment manufacturer printed letterhead.
1. Manufacturer's Literature: Where indicated, include the manufacturer's printed literature. Literature shall be clearly marked to indicate the item intended for use and shall provide enough dimensional data for field coordination and installation.
 2. Performance Data: Provide complete information, including but not limited to the data indicated on the drawings or in these specifications, wiring and control diagrams, scale drawings showing that proposed equipment will fit into allotted space (indicate all service access, connections, etc.), and other

data required to determine if equipment complies with the requirements of the drawings and specifications. Where noted, performance curves shall be certified by the manufacturer at the actual design rating point.

3. Installation Instructions: Where requested, each product submittal shall include the manufacturer's installation instructions for that specific product. Generic installation instructions are not acceptable. Instructions shall be the same as those included with the product when it is shipped from the factory.
4. Operating Instructions: Instructions shall be the manufacturer's written operating instructions for the specified product. If the instructions cover more than one model or type of product they shall be clearly marked to identify the instructions that cover the product delivered to the project. Written instructions shall be in addition to the verbal instructions given to the Owner's personnel where field instructions are indicated. Operating Instructions shall be submitted immediately after the product or equipment submittal has been returned from the Engineer marked "APPROVED" or "APPROVED AS NOTED".
5. Maintenance Instructions: Information shall be the manufacturer's printed instructions and parts lists for the equipment specified. The maintenance instructions shall be for the equipment furnished. If the instructions cover more than one model or type of equipment they shall be marked to identify the instructions for the product delivered to the project. Submit maintenance instructions immediately after the product or equipment submittal has been returned from the Engineer marked "APPROVED" or "APPROVED AS NOTED".

F. Substitutions:

1. General: Substitutions may be considered for any product or equipment of a manufacturer. See paragraph entitled "MANUFACTURER" in section of these specifications. Any product or equipment may be submitted and will be reviewed by the Engineer; however, only one substitution per item will be considered. If a substituted product or equipment item is rejected, the product or equipment specified by the manufacturer indicated shall be provided.
 - a. Submittal shall include the name of the material or equipment to be substituted, substituted equipment model numbers, drawings, catalog cuts, performance and test data and any other data or information necessary for the Engineer to determine that the equipment meets all specification requirements. If the Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.
 - b. Substituted equipment with all accessories installed or optional equipment where permitted and found acceptable, must conform to space requirements. Substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at no additional expense to the Owner. Modifications of related systems of this or other trades as a result of substitutions shall be made at no additional expense to the Owner, and shall be so stated in the written request for substitution.
2. Deviations: The submittal form shall include a complete list of deviations

from the scheduled item stating both the features and functions of the scheduled item and the comparable features and functions of the proposed substitution.

- a. Any deviation not indicated in writing will be assumed to be identical to the specified item even if it is shown otherwise on the submittal data.
 - b. If a deviation not listed is found anytime after the review and acceptance by the Engineer and that deviation, in the opinion of the Engineer, renders the substituted item as unacceptable, the item shall be removed and replaced by the scheduled item at no additional cost to the Owner.
 - c. The Engineer shall retain the right to specify modifications to the substituted item, correcting or adjusting for the deviation, if the Engineer deems it to be in the best interest of the Owner.
3. **Scheduled Item:** A scheduled item shall be defined as product or item of equipment that is indicated on the drawings or in these specifications by manufacturer's name and model number identifying a single item. The manufacturer's trade name for a group of products that does not signify a single item including type, style, quality, performance, and/or sound rating shall not be classified as a scheduled item. Where more than one manufacturer and product model number is indicated, each shall be considered as a scheduled item.
 4. **Form:** When a product or item of equipment is proposed as a substitution a "REQUEST FOR SUBSTITUTION" form shall be completed and submitted with the required data. A copy of the form is included after the end of this section.
 5. **Rejection:** Substituted products or equipment will be rejected if in the opinion of the Engineer the submittal does not meet any one of the following conditions or requirements:
 - a. The submittal data is insufficient or not clearly identified. The Engineer may or may not request additional information.
 - b. The product or equipment will not fit the space available and still provide the manufacturer's published service area requirements.
 - c. The product or equipment submitted is not equivalent to or better than the quality of the specified item. Products or equipment of lesser quality may be considered provided an equitable financial rebate, satisfactory to the Engineer, is to be returned to the Owner.
 - d. The product or equipment submitted has less capacity, efficiency and safety provisions than the specified item.
 - e. The product or equipment submitted does not have warranty, service and factory representation equivalent to that specified.
 - f. The Owner prefers not to accept the submitted product.
- G. **Alternate Manufacturer:** An alternate manufacturer is defined as a manufacturer listed in the specifications by name only and is not scheduled or identified by a specific product name and number.
- H. **Technical Information Brochure:**

1. Binder: Include binders with the first submittal for the Technical Information Brochure. Each binder shall be size 3 inch, hard-cover, 3-ring type for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on spine of each binder, i.e., MECHANICAL SUBMITTAL DATA, MECHANICAL OPERATION INSTRUCTION and MECHANICAL MAINTENANCE INSTRUCTIONS.
2. Number: Submit not less than five sets of binders for each of the three mechanical brochures indicated above. Each set shall consist of minimum of two binders for submittal data and 1 binder each for operating instructions and for maintenance instructions. Additional binders shall be submitted at the request of the Engineer. One set of binders shall be retained by the Engineer. Three sets of binders shall be maintained for the Owner and the remaining set shall become the property of the Engineer.
3. Index: First sheet in each brochure shall be a photocopy of the "Division 23 Index" of the specifications. Second sheet shall list the firm name, address, phone number, superintendent's name for the contractor and all major subcontractors and suppliers associated with the project.
4. Dividers: Provide reinforced separation sheets tabbed with the appropriate specifications section reference number for each section in which submittal data or operation and maintenance instructions is required.
5. Specifications: Insert a copy of the specifications for each section and all addenda applicable to the section between each of the section dividers.

1.08 MANUFACTURER'S CHECKOUT

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

1.09 INSTRUCTION TO OWNER

- A. General: Instructions to the Owner's Representatives shall be by competent representatives of the manufacturers involved, with time allowed for complete coverage of all operating procedures. Provide classroom instruction and field training in the design, operation and maintenance of the equipment and troubleshooting procedures. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar provisions of the systems. On the date of substantial completion, turn over the prime responsibility for operation of the mechanical equipment and systems to the Owner's operating personnel.

- B. Training Period: Training period shall encompass a minimum of 4 hours of classroom and 4 hours of hands-on instructions with a maximum period of 4 hours per day.
- C. Scheduling: Submit any remaining required items for checking at least one week before final inspection of building. When submittal items are found acceptable, notify Owner, in writing, that an "Instruction in Operation Conference" may proceed. Conference will be scheduled by the Owner. After the conference, copies of a memo certifying that the "Instruction in Operation Conference" and "Completed Demonstration" have been made will be signed by Owner and the instructors, and one copy will be inserted in each Technical Information Brochure.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery: The CONTRACTOR shall be responsible for the delivery, storage, and handling of products. Load and unload all HVAC equipment, materials, and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Pad slings and hooks in a manner which prevents damage to products.
- B. Equipment: All HVAC equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, and other deleterious substances. Any dents, scratches or other visible blemishes shall be corrected and the appearance of the equipment made "like new" and to the satisfaction to the ENGINEER.
- C. Final Cleanup: Upon completion, and before final acceptance of the HVAC work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.
- D. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance.
- E. Damaged Products: Promptly remove damaged products from the job site. Replace damaged products with undamaged products.
- F. Damaged Finishes: Where factory finish damage occurs and damage is minor, finishes may be touched up. If, in the opinion of the ENGINEER the damage is excessive, factory finish shall be replaced to "new" condition.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Specified Products: Manufacturer's names and product model numbers indicated on the drawings and in these specifications establish the type, style, quality, performance, and/or sound rating of the desired product. Listing of other manufacturers indicates that their equivalent products would be acceptable if they

meet the requirements of these specifications, the specific use and installation shown on the drawings, including space and clearance requirements, and the energy consumption and efficiency of the specified product. The listing of additional manufacturers in no way indicates that the manufacturer can provide an acceptable product.

- B. Space Requirements: All manufactured products furnished on this project must have the required space and service areas indicated in the manufacturer's printed literature or shown on their shop drawing. When the manufacturer does not indicate the space required for servicing the equipment, the space shown on the drawings or as required by the Engineer must be provided.

2.02 MATERIAL AND EQUIPMENT

- A. General: Material and equipment used shall be produced by manufacturers regularly engaged in the production of similar items, and with a history of satisfactory use as judged by the Engineer.
- B. Specified Equipment: Equipment shall be the capacity and types indicated or shall be equivalent in the opinion of the Engineer. Material and equipment furnished and installed shall be new, recently manufactured, of standard first grade quality and designed for the specific purpose. Equipment and material furnished shall be the manufacturer's standard item of production unless specified or required to be modified to suit job conditions. Sizes, material, finish, dimensions and the capacities for the specified application shall be published in catalogs for national distribution. Ratings and capacities shall be certified by a recognized rating bureau. Products shall be complete with accessories, trim finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- C. Compatibility: Material and equipment of one and the same kind, type or classification and used for identical or similar purposes shall be made by the same manufacturer. Where more than one choice is available, select the option which is compatible with other products already selected. Total compatibility among options is not assured by limitations within contract documents but must be provided. Compatibility is a basic general requirement of product selection.

2.03 PAINTING AND MARKING

- A. Prohibited Material: The use of red lead or any lead-based component in primer or paint is prohibited.
- B. Marking: Refer also to sections describing identification of mechanical systems.

2.04 IDENTIFICATION OF PIPING SYSTEM

- A. General: Comply with ANSI A13.1-1981, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.
- B. Manufacturer: Refer to paragraph entitled "MANUFACTURERS" in this Section.

Model numbers or product type listed for one or more manufacturers are given to provide an example of the item required.

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

TABLE - IDENTIFICATION MARKER SIZES

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

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

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

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

- E. Equipment Labels: Provide either of the following types:

1. Plastic Type: Outdoor grade acrylic plastic to withstand weather, abrasion, grease, acid, chemical and other corrosive conditions; 1/16 inch min. thickness. Sized 3/4 inch x 2-1/2 inch, 1 inch x 2-1/2 inch, 1 inch x 3 inch or 1-1/2 inch x 4 inch as necessary to identify item.
 - a. Manufacturer:
 - 1) Seton, Setonite.
2. Aluminum Type: Engraved, flexible, 0.020 inch thick aluminum. Sized 3/4 inch x 2-1/2 inch, 1 inch x 3 inch, 1-1/2 inch x 4 inch or 3 inch x 6 inch as necessary to identify item.
 - a. Manufacturer:
 - 1) Seton, No. 06505.

2.05 PIPE HANGERS AND SUPPORTING DEVICES

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

- B. Material: Pipe supporting devices apply to all piping unless modified in subsequent sections (i.e., vibration isolation) or detailed on the drawings.
1. Pipe hangers for copper pipe shall be copper or copperplated stainless steel, clevis type. (Contractor has option of utilizing approved FRP products.)
 2. Hangers for all other types of piping shall be stainless steel clevis type or split ring. Pipe hangers shall be capable of vertical adjustment after erection of the piping. Hanger rods shall be stainless steel. (Contractor has option of utilizing approved FRP products.)
 3. Vertical piping riser clamp supports shall be constructed of stainless steel with rounded ears and two or four holes for clamping bolts. Riser clamps shall be stainless steel, except that riser clamps for copper and brass piping riser clamps shall have electro-plated copper or PVC coating finish. (Contractor has option of utilizing approved FRP products.)
 4. Manufacturer:
 - a. Grinnell
 - b. PHD Manufacturing Inc.
 - c. Fee and Mason
 - d. IMCO Reinforced Plastics, Inc.
- C. Beam Clamp: Beam clamps may be used when supporting piping from steel structures. Beam clamps shall be type 304 S.S. (Contractor has option of utilizing approved FRP products.)
- D. Inserts: Concrete inserts shall be placed in forms prior to the time that concrete is poured.
- E. Rods: Type 304 stainless steel. (Contractor has option of utilizing approved FRP products.)
- F. Tamp-ins: Lead tamp-ins may be used when installed in a concrete or masonry wall or other vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers from the underside of a concrete slab.
- G. Drilled-in Anchors: Steel anchor set in existing or new concrete by drilling and the use of an expansion device is permitted. The anchor shall be provided with a NPT threaded rod connection.
- H. Trapeze: For parallel runs of above ground suspended piping, trapeze-type hanger may be used. Provide permanent, non-conductive wrapping between copper pipe and steel trapeze hangers.
- I. Prohibited Type: Powder set type fasteners or inserts shall not be used.

2.06 FLOOR, WALL OR CEILING PLATES OR ESCUTCHEONS

- A. General: Shall be chrome-plated brass. Escutcheons for extended sleeves shall be of the type designed for that purpose. Split ring escutcheons will not be allowed.

- B. Manufacturer:
1. Guarantee Specialty Mfg. Co.
 2. American Sanitary Mfg. Co.
 3. Benton & Caldwell
- C. Location: Provide escutcheons or fabricated plates or collars at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equivalent to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equivalent to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18 gage galvanized sheet steel, secured to structure and neatly fitted around duct or pipe.

2.07 SLEEVE

- A. Walls and Partitions:
1. Sleeves 8 Inch Diameter and Smaller (Above Grade): Sleeves shall be mild steel pipe sleeves built into wall, partition or beam, sized to pass pipe and covering, leaving a clear space of 1/4 inch minimum between covering and sleeve. Penetrations of fire rated partitions shall have mild steel sleeves.

2.08 V-BELT DRIVE

- A. General: Each motor driven piece of equipment not direct connected shall be provided with a V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves and shall be carefully matched for each drive. Sheaves shall be cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. Drive rating shall be as recommended by the manufacturer for service but shall be at least 1.5 times the nameplate rating of motor.
- B. Fan Belt Drives: Fixed pitch sheaves shall be provided. Sheave-to-sheave centerline distances shall not exceed 3 times the sum of the sheave diameters, and shall not be less than the diameter of the larger sheave.
- C. Belt and Coupling Guards: Each belt drive shall be equipped with an OSHA approved guard. Guards shall be constructed of #12 U.S. standard gage 3/4 inch diamond mesh wire screen, or equivalent, welded to one inch steel angle frames, and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal or not less than #18 U.S. standard gage. Braces or supports must not "bridge" sound and vibration isolators. Guards shall allow adequate provision for movement of motor required to adjust belt tension. Provide means for oiling, use of tachometers, and other maintenance and testing operations with guard in place.
- D. Direct Driven Equipment: Direct-drive motor driven equipment shall coupling guards in accordance with OSHA Regulations.

2.09 BEARINGS

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

PART 3 - EXECUTION

3.01 GENERAL

- A. Concrete Bases and Structural Aluminum: Concrete bases and structural aluminum to support equipment and piping installed under each specification section of this division and not specifically shown on the structural engineer's plans shall be furnished.

3.02 PAINTING

- A. General: Paint all exposed piping, insulation, equipment, structural bases, racks, in equipment rooms, furnished under Division 23 of these specifications. All exposed metal surfaces shall be given one prime coat and two finish coats. All insulated surfaces shall be given one coat of glue sizing (omit this step if factory applied finish is suitable to receive prime coat), one prime coat and one finish coat. Factory painted or finished items do not require field painting but shall require "touch-up" with matching paint or finish where scratched. Follow manufacturer's recommendations on ambient conditions for painting, coat thickness, and drying time between coats.
- B. Ancillary Items: Pipe hangers, saddles, supports, riser clamps and accessories shall be painted to match their piping.
- C. Inaccessible Items: Equipment not completely accessible for painting when set in place shall be thoroughly cleaned and painted before installation and suitably protected.

- D. Concealed Items: Concealed piping need not be painted.
- E. Metal Surfaces: Use a scraper or wire brush to remove rust and roughen metal surfaces prior to painting. After wire brushing, wash surfaces to remove particulates, apply primer coat after surface is dry but not more than 48 hours after wire brushing.

3.03 IDENTIFICATION OF PIPING SYSTEMS

- A. General: Apply after completion of insulation, painting and cleaning work so that final identification is not disfigured.
 - 1. Coordinate with composition and operating temperatures of surface for permanent adhesion of markers and labels to surface.
 - 2. Locate marking and banding to facilitate ease of visual tracking. (For example, mark and band parallel runs of pipe that are side-by-side at the same general place.) Labels on vertical piping shall be 7 foot above the floor.
 - 3. Pipes less than 3/4 inch diameter may be identified with tags similar to those specified for valves.
 - 4. Adhere or affix all identification items permanently except where removal may be necessary for maintenance or service. Where labels or arrows are used, overlap the label ends 2 inches with matching color bands completely encircling the pipe.
 - 5. Apply labels on the bottom lower quarters of overhead pipe. Pipe within 4 inches of a wall does not require a label on the quarter facing the wall.
- B. Markers and Bands: Provide on piping as follows:
 - 1. Pipe Concealed in Inaccessible Locations (e.g., Chases, Underground): No identification required.
 - 2. Pipe Concealed in Accessible Locations (e.g., Ceiling Plenums):
 - a. Markers every 30 feet of pipe length. Bands every 23 feet of pipe length.
 - 3. Pipe Exposed in Equipment Rooms:
 - a. Markers and bands every 23 feet of pipe length for pipe through 12 inch O.D. and every 30 feet for pipe 14 inch O.D. and greater.
 - 4. Exterior Pipe, Exposed: No identification required unless otherwise indicated.
- C. Labels: Provide labels of proper size on mechanical system equipment including but not limited to, air handlers, condensing units, control panels and similar items. Equipment labels shall be mechanically fastened with machine screws or rivets; adhesive securing is not acceptable.
- D. Identification: Coordinate colors and finishes with pipe identification markers.

3.04 HANGERS AND INSERTS

- A. General: Refer also to other sections which may describe additional requirements for hanging and supporting.

- B. Location: Provide and properly locate hangers to adequately support piping and equipment. Arrange hangers to permit expansion and contraction. Do not hang piping from fire or smoke walls. Provide pipe hangers at each valve, strainer, and other piping accessory, and at each change of direction.
- C. Size: The size of hanger for non-insulated pipes shall be suitable for pipe size to be supported. For insulated piping, the size of the hanger shall be suitable for the pipe size, plus the insulation and an insulation shield. Refer to Section 23191, INSULATION, HVAC for insulation shield requirements.
- D. Protection: Isolation of copper pipe from steel trapeze hangers shall consist of wrapping pipe and 1 inch each side of contact surface with not less than two layers of adhesive type plastic dielectric insulating tape.

3.05 ESCUTCHEONS

- A. General: Provide escutcheons (for 1/4 or 1 inch projecting sleeves as required) at each point where pipe passes through a finished surface.

3.06 V-BELT DRIVE

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

TABLE - MAXIMUM ALLOWABLE FAN VIBRATION

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

3.07 FLASHING

- A. Flashing shall be done as work of other divisions.

3.08 PIPING SLEEVES

- A. CONTRACTOR shall furnish and set sleeves for his piping. Use galvanized sheet steel with water tight seams and joints or pipe for poured concrete. Extend sleeves through walls, partitions and ceilings to finished surface. Extend sleeves 1/4 inch above finished concrete floors and 1 inch above slab in chases. Sleeves, installed above finished ceilings, for fire/smoke rated wall assemblies shall extend 1" beyond each face of wall.

END OF SECTION

REQUEST FOR SUBSTITUTION

Project Name: _____ Location: _____

Date of Request: _____

Name of Party Requesting Substitute: _____

Reason for Substitution Request: _____

| <u>Drawing</u> | <u>Spec. Sect.</u> | <u>Paragraph</u> | <u>Specified Item</u> |
|----------------|--------------------|------------------|-----------------------|
| _____ | _____ | _____ | _____ |

Proposed Substitute: _____

Manufacturer and Model Number: _____

Deviations from the Specified Item: (See paragraph entitled "Deviations".)

Manufacturer's Recommendations for Use and Installation:
(List recommendations.)

Reason for Substitution:

Changes to Other Systems to Permit Use of Proposed Substitute:
(List changes. Submit drawings if required for clarity.)

Technical Data to Support Request for Acceptance:
(List ASTM or other standards designations, testing laboratory reports, experience records, etc.)

Other Supporting Data:
(Submit brochures, samples, drawings, etc.)

REQUEST FOR SUBSTITUTION (Cont'd)

Certification: In making request for substitution, the party whose authorized signature appears below, certifies that all of the following statements are correct and are accepted without exception:

The proposed substitution has been personally investigated and is equal or superior in all significant respects to the product specified for the specific applications required;

The proposed substitution will be warranted under the same terms required for the specified product;

Coordination aspects necessitated by the proposed substitution will be accomplished in a complete and proper fashion by the party signing this form without any additional cost to the Owner; and

Claims against the Owner for additional costs related to the proposed substitution which subsequently become apparent after acceptance by the Engineer are hereby waived.

Credit: If this substitution is acceptable the following credit shall be given to the Owner:

\$ _____

CERTIFICATION OF EQUIVALENT PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUIVALENT PERFORMANCE

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Submitted by: _____
Signature Title

Typed Name: _____

Company: _____

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide a legally binding signature will invalidate this request.

REQUEST FOR ALTERNATE MANUFACTURER
(For use when manufacturer is listed in the specifications
but was not used as the basis for design)

Date of Request:

Name of Party Requesting Alternate Manufacturer:

Reason for Request:

| <u>Drawing</u> | <u>Spec. Sect.</u> | <u>Paragraph</u> | <u>Specified Item</u> |
|----------------|--------------------|------------------|-----------------------|
| _____ | _____ | _____ | _____ |

Proposed Alternate Manufacturer:

Proposed Model Number:

Deviations from the scheduled Item: (See paragraph entitled "Deviations".)

Reason for using alternate manufacturer:

Change in Other Work to Permit Use of Proposed Alternate Manufacturer: (List changes. Submit drawings if required for clarity.)

Certification: In making request for alternate manufacturer, party whose authorized signature appears below certifies that all of the following statements are correct and accepted without exception:

The proposed alternate manufacturer and model has been personally investigated and is equal or superior in all significant respects to product specified for specific applications required;

All coordination with other work necessitated by the proposed alternate manufacturer will be accomplished in a complete and proper fashion by the party signing this form without any additional cost to the Owner; and

Claims against the Owner for additional costs related to the proposed alternate manufacturer and model which subsequently become apparent after acceptance by the Engineer are hereby waived.

REQUEST FOR ALTERNATE MANUFACTURER (Cont'd)

Optional Credit: If this request is acceptable the following credit shall be given to the Owner:

\$ _____

CERTIFICATION OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned stated that the function, appearance and quality are equivalent or superior to the specified item.

Submitted by:

Signature

Title

Typed Name:

Company: _____

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide a legally binding signature will invalidate this request.

SECTION 23 01 31

HOUSEKEEPING PADS, CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide concrete housekeeping pads for the equipment listed in this section. This work shall be performed by the concrete installer.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.
- B. This section directly related in particular to sections (which may or may not be included in this division) which describe concrete in other divisions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All concrete and steel for concrete housekeeping pads shall comply with those sections of the specification division describing concrete and steel.

2.02 HOUSEKEEPING PADS

- A. Provide reinforced (#4's @ 12" both ways with 1-1/2" top cover) concrete housekeeping pads for each individual machine. Pads shall extend six inches beyond the machine bases in all directions and be continuous beneath the machine. Pads shall have chamfered edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the machine.
- B. Coordinate exact length and width of each pad and any penetrations that may be necessary for piping or conduit with the actual equipment approved for use on the project.

PART 3 EXECUTION

3.01 GENERAL

- A. Refer to the section describing vibration isolation for equipment which is to rest on concrete housekeeping pads.

3.02 PAD HEIGHTS

- A. Provide concrete pads for the following:
 - 1. Condensing units – 8” high

END OF SECTION

SECTION 23 05 48

HVAC VIBRATION ISOLATION EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide vibration isolation supports for all equipment and piping as may be required to prevent transmission of vibration to building structure. This shall include air handling units and similar items.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division 23 and to all other applicable portions of the drawings and specification.

1.04 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Submittal data shall show type, point loading information, size and deflection of each isolator proposed and any other information as may be required for the Engineer/Engineer to check isolator selections for compliance with specifications. Include clearly outlined procedures for installing and adjusting the isolators.

1.05 MANUFACTURERS

- A. Products of the following manufacturers will be acceptable, provided they comply with all of the requirements of this specification: Consolidated Kinetics; Mason Industries; Amber-Booth; Keflex; Flexonics; Vibration Eliminator Company or equivalent. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of item(s) required.

1.06 OTHER REQUIREMENTS

- A. All vibration isolation equipment shall be both recommended by the manufacturer and approved by the Engineer/Engineer for each particular application on this project.

PART 2 - PRODUCTS

2.01 BASIC REQUIREMENTS

- A. Unless otherwise noted, neoprene vibration isolators shall be used for all equipment. It shall be the responsibility of isolation manufacturer to determine the amount of deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria referenced herein.

2.02 BASIC ISOLATORS

- A. General: Unit designations indicated are Engineer designations. Each of the following basic isolators may not be applicable to a specific installation application. See Part 3, "Execution".
- B. Neoprene Waffle Pad (Unit W) - 1/2" thickness, Mason Type W.

PART 3 - EXECUTION

3.01 GENERAL

- A. All isolators shall be installed in strict accordance with the manufacturer's instructions and shall be properly adjusted prior to requesting final inspection or the performance of any vibration testing specified.
- B. Each item of equipment (machinery, piping, etc.) which is provided with vibration isolation equipment shall rest in its intended, proper operating position (i.e; exactly level, etc.) after installation of vibration isolation equipment. Approval of such vibration isolation equipment by Engineer/Engineer shall not relieve the Contractor of this responsibility.
- C. Equipment which is specified to rest on concrete housekeeping pads shall have Unit NP pads unless otherwise indicated.

3.02 AIR HANDLING UNITS, FACTORY PACKAGED

- A. Floor Mounted:
 - 1. Neoprene waffle pads (Unit W) in sizes indicated on plans.

END OF SECTION

SECTION 23 07 19

INSULATION, HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide all work necessary to insulate all equipment, piping, ductwork, and other items related to the piping and air handling systems.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "Division 1 Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
 - 1. Piping systems.
 - 2. Duct systems
 - 3. Cooling equipment.

1.04 SHOP DRAWINGS

- A. General: Refer to the Section entitled "General Mechanical Provisions". Shop drawings shall contain complete descriptive and engineering data, including flame spread and smoke developed ratings (ASTM E84 test method) on all materials and adhesives. Where finishes, covers, or jackets are specified, provide complete data on same. Shop drawings shall contain specified information on: densities, conductivities, conductances, or resistances as required to establish conformance with the specified values or materials.
- B. Industry Standards: Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.
- C. Commencement of Work: Submit shop drawings before any work is commenced.

1.05 COMPLIANCE WITH CODES AND STANDARDS

- A. Applicable Codes: The total insulation system including insulation, sealant, finishes, etc., shall comply with or exceed all code requirements.

- B. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A as to flame spread and smoke developed ratings.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials: Materials listed are those used as basis of design; equivalent products of acceptable manufacturers will be accepted. Materials must be approved and recommended by the insulation product manufacturer for the particular application(s).
- B. Flame and Smoke Ratings: Application of insulation materials may require, in many cases that the final insulation system comply with NFPA 90A with regard to maintaining a flame spread rating of 25 or less and a smoke developed/fuel contributed value of 50 or less. In such cases, verify that the materials comply with the indicated flame spread and smoke developed ratings.
- C. Applicability: Products and manufacturers listed may not all be applicable. Use only those products and manufacturers which are indicated as being applicable to a specific insulation condition.
- D. Acceptable Manufacturers: Manufacturers which are listed are those manufacturers who may make one or more of the insulation products required. Listing of a manufacturer does not necessarily mean the manufacturer is approved for all applicable insulation conditions. Each listed manufacturer must still comply with the specific requirements of each insulation condition to be acceptable for the particular application. Acceptable manufacturers of insulation-related products include (but are not necessarily limited to) the following: Armstrong; CertainTeed; Childers Products Co.; Knauf; Manville; Owens-Corning; Pittsburg Corning; Rubatex; Upjohn Co.; Duracote Corporation; Ferro Corporation; Dow Corning Corporation; Duro Dyne Corporation; Goodloe E. Moore, Inc.; 3M Co.; United McGill Corporation, Vimasco Corporation; Foster; Gustin-Bacon; Nomaco Inc.; Insulcoustic; Molded Acoustical Products; Lion Nokorode and other manufacturers as may be listed for a specific application.

2.02 BASIC MATERIALS

- A. Elastomeric Insulation: Preformed (tube) roll or sheet as indicated or as applicable. Nitrile, rubber based, closed cell structure, K factor of 0.28 at 75°F. In tube, roll or sheet form of 3/4-inch thickness or less, ASTM E 84 flame spread rating of "25" or less and smoke developed rating of "50" or less. Recommended temperature applications are from -40°F to 220°F when installed in accord with manufacturer's recommendations. Do not install in return air plenums unless flame spread rating and smoke developed rating are within constraints of applicable codes. Manufacturers and/or series: Armstrong "Armaflex"; Manville "Aerotube"; "Rubatex"; Gustin-Bacon "Ultra-Foam".

- B. Fiberglass Insulation: inorganic fibrous glass. Flame spread of "25" or less and smoke developed rating of "50" or less per ASTM E84. Board: Rigid or semi-rigid form, faced. Stiffness of 475 EI, 800 EI or 1400 EI as indicated.

2.03 INSULATION PRODUCTS, BASIC

- A. Type PI-5: Pipe insulation, preformed elastomeric. Rubatex, Armaflex II or equivalent.
- B. Type DI-2: Duct insulation, fiberglass rigid board. Composed of resin bonded glass fibers faced with a foil scrim-kraft (FSK) reinforced laminate of aluminum foil and kraft bonded to provide a metallic surface finish vapor barrier. Conductivity (K) shall not be greater than 0.23 at 75 deg. F. Provide in thickness indicated. Provide with minimum density of 3-pcf. CertainTeed Industrial Insulation Board type IB-300; Manville 800 Series Spin-Glas Type 814; Owens-Corning 700 Series Industrial Insulation Board Type 703; or equivalent.

2.04 INSULATION ADHESIVES, MASTICS, SEALANTS

- A. Adhesive (Type A-E1): For joints and seams in elastomeric insulation (Type PI-5) not requiring weather protection. Rubatex R-373 Insulation Adhesive; Armstrong 520 Adhesive or equivalent.
- B. Adhesive (Type A-F1): For adhering fiberglass board insulations (Type DI-2) to metal substrate such as ductwork. Insulcoustic I-C 201, Foster 85-20 or equivalent.
- C. Mastic, General Purpose (Type M-GP1): Non hardening vapor barrier general purpose mastic. For use where indicated or otherwise applicable. Foster GPM 35-00 or equivalent.

2.05 INSULATION FINISHES

- A. Finishing Coating (Type FC-E1): For weather protection of elastomeric insulations (Type PI-5). Rubatex 374 coating; Armstrong Armaflex Finish or equivalent.

2.06 RELATED PRODUCTS

- A. Straps (Type ST-1): Stainless steel T-304 (18-8) soft annealed with deburred edge with stainless steel wing seals. Childers Products "Febstraps" or equivalent.
- B. Tape (Type T-1): High tensile strength rope stock flat back paper pressure sensitive tape. Pittsburg-Corning "PC Tape No. 25" or equivalent.
- C. Screws (Type S-1): Aluminum pan head type "A" slotted #8 by 1/2-inch.

PART 3 - EXECUTION

3.01 GENERAL

- A. Field Forming, Fitting and Finishing: Where preformed insulation products are indicated as being acceptable for a particular application, provide field formed, fitted and finished insulation systems if such application is more practical (such as due to size, configuration or dimensions which may be outside of the availability ranges for size, dimension and/or thickness of preformed products).
- B. Pre-installation:
 - 1. Do not apply insulation adhesives, materials or finishes until the item to be insulated has been completely installed and tested and proved tight and suitable for insulation.
 - 2. Prepare surfaces to be clean and dry before attempting to apply insulation.
- C. Insulation Shields: Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end.
- D. Valves, Cocks and Specialties: Insulate as for the related piping system in which they are located unless otherwise indicated.
- E. Factory Pre-insulated Components: Where equipment and other system components are specified in other sections to have factory installed insulation, then no additional insulation is required as work of this section unless additional non-factory-installed insulation is specifically described.
- F. Minimum Thicknesses: Insulation thicknesses which are indicated are minimum thicknesses. Contractor may provide the same insulation material in greater thickness as an aid to installation and handling procedures or due to material availability and procurement considerations.

3.02 COLD EQUIPMENT AND RELATED COMPONENTS

- A. Condensate Drain Piping:
 - 1. Insulate with preformed elastomeric pipe insulation (Type PI-5) secured with adhesive (Type A-E1) and finished with white finish coating (FCC-E1). Thickness 3/4-inch. Provide 25/50 flame/smoke rating.
- B. Refrigerant Piping:
 - 1. Insulate with preformed elastomeric pipe insulation (Type PI-5) secured with adhesive (Type A-E1) and finished with white finish coating (FCC-E1). Thickness 1-inch indoors and 2-inch outdoors. Provide 25/50 flame/smoke rating.

3.03 DUCT SYSTEMS

- A. Insulate externally with 2-inch thick rigid fiberglass (Type DI-2). Adhere duct insulation using adhesive (Type A-F1) applied in accordance with the manufacturer's

recommendations. Where duct width exceeds twenty four inches (24"), the insulation shall be additionally secured to the bottom of the duct using mechanical fasteners spaced one foot (1') on center. Insulation shall be applied with edges tightly butted, and all joints and breaks in the vapor barrier sealed using glass fabric and mastic applied in conformance with manufacturer's recommendations.

END OF SECTION

SECTION 23 21 13

PIPING: CONDENSATE DRAIN

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide condensate drain piping from cooling coil drain pans.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
 - 1. Air handling equipment with cooling coils.
 - 2. Insulation.

1.04 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.01 PIPE

- A. Type M hard drawn copper conforming to ASTM Spec. B88.

2.02 FITTINGS

- A. Wrought copper, solder joint, pressure type conforming to ANSI B16.22.

2.03 SOLDER

- A. Composition SB5 (95/5), Fed. Spec. QQ-S-571d and Class 3 (Sil Fos), Fed. Spec. AA-S-561d, ASTM B32.

PART 3 - EXECUTION

3.01 GENERAL

- A. Piping shall be sloped uniformly toward drain, and provided with trap seal having a depth, in inches, equivalent to one and one-half (1-1/2) times the total static pressure of the respective fan system. Traps shall be assembled using elbows and tees with threaded brass plugs to permit cleaning of trap and drain line. Piping shall be installed in a neat manner and shall be not smaller than full size of the equipment drain connection or three-quarters inch (3/4") whichever is larger.

3.02 JOINTS AND CONNECTIONS

- A. General: Joints and connections shall be made permanently air, gas, and water-tight.
- B. Solder Joints: Cut pipe square using cutting tool which does not crimp pipe. Remove all burrs using pipe reamer and taking care not to flare the pipe end. Thoroughly clean the outside of pipe and the interior of the fittings using a fine sand cloth. Apply non-corrosive paste flux to the cleaned surfaces immediately and apply solder and heat, in accordance with manufacturer's instructions, to complete joint.
- C. Equipment Connections: Connections to copper drain nipples may be made with solder joints provided care is exercised not to damage equipment, its insulation or finish. Connections to equipment having steel nipples shall be made using screwed to solder adapters with teflon tape applied to male threads prior to assembly.

3.03 INSULATION

- A. Insulate as specified in section describing insulation.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPE, VALVES AND SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide refrigerant piping systems, complete in all respects, between the system components and connected equipment.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.04 SHOP DRAWINGS

- A. Refer to the Section entitled "General Mechanical Provisions".

PART 2 - PRODUCTS

2.01 COPPER PIPE AND FITTINGS

- A. Refrigerant system piping shall be refrigerant grade, dehydrated and sealed seamless, uniformly dead soft temper.
- B. Refrigerant grade, wrought copper, long radius, solder joint type.

2.02 SOLDER

- A. Silver brazing alloy (Sil Fos) Fed. Spec. AA-S-56ld.

2.03 FLUX

- A. Non-corrosive, specifically designed for silver brazing.

2.04 ACCESS VALVES

LEE COUNTY UTILITIES

Fiesta Village WWTP

Switchgear and Generator Replacement
TECHNICAL SPECIFICATIONS

Section 23 23 00
REFRIGERANT PIPE, VALVES AND SPECIALTIES

Page 1 of 4

- A. Schrader type designed for use with quick coupler hose fittings and provided with individual cap.

PART 3 - EXECUTION

3.01 PIPE SIZES

- A. Provide sizes recommended by the manufacturer(s). Size piping to maintain minimum velocity of 500-fpm in horizontal lines and 1000 fpm in vertical risers for proper oil return; provide double suction risers and hot gas risers as may be necessary to accomplish this.

3.02 REFRIGERANT SPECIALTIES

- A. Refrigerant valves, driers, expansion valves, sight glasses and similar items shall be provided with each system. Where refrigerant access valves are not furnished by the manufacturer, they shall be field installed to enable charging and checking the system.

3.03 JOINTS AND CONNECTIONS

- A. General: All joints and connections shall be made permanently refrigerant tight.
- B. Solder Joints: Cut tubing square using tubing cutters, with sharp cutting wheels, so as not to crimp the tubing ends. Remove all burrs using a pipe reamer and taking care not to flare the ends of the tube. Thoroughly clean the outside of the pipe and the inside of the fitting using a fine sand cloth. Apply non-corrosive paste flux to the cleaned surfaces immediately and apply silver solder and heat in accordance with manufacturer's instructions. Use care not to damage equipment or refrigerant specialty items when making up joints (protect from excessive heat).
- C. Scale Prevention: During brazing, keep pipe system full of inert gas to prevent scale formation.
- D. Mechanical Joints: Where the Contractor uses refrigerant tubing sets, follow the manufacturer's installation instructions explicitly, including the use of special tools, when making up the joints.

3.04 HANGERS AND SUPPORTS

- A. Refer to other sections describing hangers and supports. Isolate copper tubing from contact with any dissimilar metals.

3.05 EVACUATION AND CHARGING

- A. When other than completely factory charged equipment and piping systems are used, they shall be evacuated and charged as follows: Charge the system with dry nitrogen and refrigerant and leak test all joints including factory piping within the units. Repair all

leaks by disassembling and remaking the joint. After all leaks are corrected, evacuate the system to an absolute pressure of 0.2" mercury. System shall hold this vacuum for two hours with no noticeable rise in pressure. After passing vacuum test, break vacuum twice using refrigerant and re-evacuate for a minimum of two hours each time. Charge the system in the manner and with the type and amount of refrigerant recommended by the manufacturer and in accordance with accepted refrigeration practice.

3.06 REFRIGERANT PIPING CONDUIT

- A. Install any refrigerant piping which is below slab or grade in Schedule 40 PVC piping. Size conduit as necessary to properly install piping. Provide long bend sweeps. Install so that conduit will drain and not trap water. Protect ends of conduit from entry by vermin, insects and water.

3.07 OTHER REQUIREMENTS

- A. Arrange piping generally as shown and such that service access is facilitated. Keep refrigerant lines as short and direct as possible with a minimum number of joints. Provide sleeves through floors, walls or ceilings, sized to permit installation of full-thickness insulation; seal air tight after installation of piping and insulation.
- B. Provide flexible piping arrangement in hot gas discharge line of compressor. Such arrangement shall consist of a piping loop or similar measure to prevent transmission of objectionable vibration.
- C. Provide a removable core filter-drier in liquid line. In-line filter-driers are acceptable in individual circuits of less than 10-ton nominal capacity. Provide a full size valved bypass around this filter-drier. Provide shut-off valves to isolate the filter drier while flow is through the bypass and also a shutoff valve in the bypass so that filter-drier can be put into use.
- D. Provide a refrigerant charging connection in the liquid line upstream from the filter-drier.
- E. Provide a moisture indicating sight glass in the liquid line downstream from the filter-drier. Install in vertical line if possible and a sufficient distance downstream from any valve such that the resulting disturbance does not appear in the glass.
- F. Provide a filter-drier with isolating shut-off valves and with valved bypass only if compressor is not equipped with a suction line filter or screen.
- G. Keep piping free from traps unless otherwise indicated. Install vertical pipe plumb. Pitch horizontal piping only where slope is desirable.
- H. Provide shut-off valves at inlet and outlet to all condensers, receivers and evaporators to permit isolation for service. If possible, use angle valves to minimize pressure drop. Use angle valves in all cases at receivers. Use globe valves only when angle valves are impractical.

- I. Provide solenoid valves upright in horizontal lines only, unless their design allows installation in vertical pipe.
- J. Where compressor(s) do not have pump down control and the compressor(s) associated evaporator coil(s) do not have bottom suction header connections and the evaporator coil(s) are located above the compressor(s), then loop suction lines(s) to top level of coil to prevent liquid slugging.
- K. To prevent erratic operation of thermal expansion valve, provide a suction line trap next to evaporator coil suction outlet with expansion valve bulb located between coil and trap. Provide only in suction lines which are level leaving coil outlet or which rise on leaving coil outlet. Trap not required when evaporator coil outlet suction line drops to compressor or suction header immediately after expansion valve bulb.

END OF SECTION

SECTION 23 31 13

HVAC DUCTWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide complete duct systems as indicated on drawings.
- B. Items Included: This section generally includes, but is not limited to, the following major items:
 - 1. Low pressure metal ductwork.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to other applicable portions of the Drawings and Specifications.

1.04 OTHER REQUIREMENTS

- A. Provide all ductwork and components thereof in accord with manufacturer's recommendations. All ductwork dimensions indicated are nominal free clearance internal dimensions which do not include insulation thickness.

1.05 DEFINITIONS

- A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc."
- B. Low Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities less than 2500 fpm and static pressure less than 2.0 inches wg. This ductwork may also be referred to in these specifications as "Low Velocity Ductwork". SMACNA "HVAC Duct Construction Standards, Metal and Flexible", First Edition, 1985, shall govern construction of this ductwork unless otherwise specified.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials shall comply with current SMACNA standards.

- B. ASTM: Unless otherwise specified, ASTM material specifications applicable are:

| <u>Material</u> | <u>Type</u> | <u>ASTM Number</u> |
|-----------------|-----------------------|--------------------|
| Aluminum | Alloy 3003 H14 Temper | B 209 |

2.02 LOW PRESSURE SHEET METAL DUCTWORK

- A. Material: Prime quality aluminum with one-side bright finish where installed exposed. Product shall conform to the requirements of ASTM B-209 as applicable to the intended use.
- B. Construction:
1. Construct to comply with +2 inches w.g. pressure / velocity classification.
 2. Reinforcing, Cross Breaking, Seams, Joints: Be in accord with latest SMACNA construction standard for low pressure metal duct.
 3. Gauge: As required by SMACNA for the dimensions and pressure/velocity classification involved.

PART 3 - EXECUTION

3.01 GENERAL

- A. All duct systems shall be free of noise, chatter, vibration and pulsation under all conditions of operation. Remove, replace or reinforce as directed by the Engineer if necessary to correct such conditions.
- B. If field conditions are determined to exist which would limit the guarantee of air delivery or system performance, due notice in writing shall be submitted to the Engineer of such conditions prior to starting fabrication.
- C. Construct all ductwork and accessories in accord with the latest indicated editions of applicable SMACNA construction standards; Sheet Metal and Air Conditioning Contractors' National Association.
- E. Protect all ductwork and system accessories from damage during construction until Engineer's final acceptance of project.
- F. Prior to ductwork fabrication, verify all ductwork as dimensioned and generally shown will satisfactorily fit allocated spaces. Take precautions to avoid space interference with beams, columns, joists, pipes, lights, conduit, other ducts, equipment, etc. Notify Engineer if any spatial conflicts exist, and then obtain Engineer/Engineer's approval of necessary routing. Make any such necessary revisions that are minor at no additional cost.

- G. Carefully correlate all duct connections to air handling units to provide proper connections, elbows and bends which minimize noise and pressure drop. Provide all mitered elbows with turning vanes.

3.02 LOW PRESSURE METAL DUCTS AND COMPONENTS

- A. Cross break or roll a cross bead in panels to increase stiffness; otherwise, use two gages heavier aluminum.
- B. Provide corner closures. Longitudinal seams and transverse joints shall be flat and smooth inside. Make slip joints in direction of air flow. See governing SMACNA manual for transition requirements.
- C. Seal all longitudinal and transverse duct joints with mastic sealant.

3.03 HANGERS AND SUPPORTS

- A. General: Comply with latest applicable SMACNA construction standard.

3.04 IMPROPER MATERIALS OR CONFIGURATION

- A. If ductwork materials or ductwork configurations are installed which do not meet these specifications, Contractor shall remove such ductwork and replace with materials or configurations which are acceptable. Any delay in job progress will be the responsibility of the Contractor.

END OF SECTION

SECTION 23 37 19

AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide all air distribution devices as indicated on the drawings and as specified herein for a complete and operable system.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.04 SHOP DRAWINGS

- A. Refer to the requirements of Section entitled "General Mechanical Provisions".

1.05 MANUFACTURER

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

- 1. Titus
- 2. Metalaire
- 3. Krueger
- 4. Carnes

- B. Manufacturers must be members of the Air Distribution Council unless otherwise indicated.

1.05 OTHER REQUIREMENTS

- A. All aluminum is to be extruded unless otherwise indicated.
- B. Appearance: Each air distribution device which has a portion thereof (frame, core, etc.) exposed to view in the finished area shall have a factory applied finish which matches

and is compatible with the color of the surrounding surface on which the device is installed.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Refer to air distribution devices on plan notes shown on drawings.

2.02 OTHER REQUIREMENTS

- A. All devices must each comply with the applicable portions of the Air Diffusion Council (ADC) Equipment Test Code 1062R4 "Certification, Rating and Test Manual", the Air Movement and Control Association, Inc. (AMCA) Standard 500 "Test Method for Louvers, Dampers and Shutters" and the "National Fire Protection Association" (NFPA) Standard 90A "Installation of Air Conditioning and Ventilating Systems".

PART 3 - EXECUTION

3.01 GENERAL

- A. Install neatly where indicated in accord with manufacturer's recommendations and in accord with SMACNA recommendations and as otherwise indicated.

3.02 INSTALLATION

- A. Install all devices as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.

3.03 PROTECTION OF WORK UNTIL FINAL ACCEPTANCE

- A. Coordinate the installation of the air distribution equipment with related work and finishing of adjacent surfaces to prevent damage to the devices or adjacent finishes. Protect the finish of all air distribution equipment until final acceptance. Replace or repair to the Engineer's satisfaction any damaged equipment.

END OF SECTION

SECTION 23 81 25

CONDENSING UNITS: AIR COOLED HERMETIC

PART 1 - GENERAL

1.01 SCOPE

- A. Provide packaged hermetic air cooled condensing units of the capacity, operating characteristics, and electrical characteristics indicated on drawings and specified herein.

1.02 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Include complete data on: unit dimensions; minimum operating and service clearances; capacities and rating conditions; maximum operating weights; power consumption; power and control wiring (both factory and field); and operating and safety controls.

1.03 MANUFACTURER

- A. Design Basis: Trane (Alternate manufacturers are not acceptable).

1.04 COMPATIBILITY

- A. Each unit must be compatible with evaporator coil arrangements and associated controls to which connected equipment is interfaced.

PART 2 - PRODUCTS

2.01 CASING

- A. Unit casing shall be constructed of 18 gauge zinc coated galvanized steel. End panels shall be removable for access to components and controls.

2.02 FINISH

- A. The frame, all structural members, and sheet metal panels shall be properly cleaned, phosphatized, painted with a zinc rich primer. Manufacturer shall ship the completed unit to Corrosion Solutions Inc. for factory application of "Heresite Protective Coatings, Inc." phenolic coating.

2.03 COMPRESSOR AND MOTOR

- A. The unit compressor(s) shall be of the hermetic reciprocating or scroll type with crankcase heater.

- B. Motor shall be suction gas cooled and sized for continuous operation over the full range of operating conditions indicated and with voltage variations indicated in the National Electric Code. Motor running protection shall be provided by temperature sensors embedded in the motor windings and by thermal overload relays.

2.04 CONDENSER

- A. Coil shall be seamless copper tubes with mechanically bonded aluminum fins. Manufacturer shall ship the completed unit to Corrosion Solutions Inc. for factory application of "Heresite Protective Coatings, Inc." phenolic coating on all coil surfaces. Provide PVC coated metal grilles to protect coil surfaces from wind-blown debris.

2.05 CONDENSER FANS

- A. Direct drive, propeller type with fan guards. Manufacturer shall ship the completed unit to Corrosion Solutions Inc. for factory application of "Heresite Protective Coatings, Inc." phenolic coating on all exposed surfaces of the fans. Fan motors shall be TEFC type and shall have thermal overload relays for running protection.

2.06 FACTORY PREWIRING

- A. Unit shall be factory wired with power connections brought out to a single set of terminal lugs for field connection.

2.07 CONTROLS

- A. See electrical plans for temperature control requirements.

PART 3 - EXECUTION

3.01 UNIT PLACEMENT

- A. The unit location shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the equipment approved for actual installation on this project.

3.02 COORDINATION

- A. Refer to Sections describing refrigerant piping systems and air handling units with DX refrigerant coils. Provide all piping, hangers, supports, valves, and specialty items as required for a complete and operable system.

3.03 VIBRATION CONTROL

A. Refer to Section entitled "Vibration Isolation" for vibration control.

3.04 TEST AND BALANCE

A. Refer to Sections describing tests and balancing.

END OF SECTION

SECTION 23 81 26

AIR HANDLING UNITS: SPLIT SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. Furnish and install medium duty factory packaged air handling units with direct expansion refrigerant coils of the types, sizes, and capacities indicated.

1.02 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Include complete performance data at the scheduled operating conditions, dimensions; weights; fan performance curves, airside pressure losses; coil descriptions; and fan discharge and radiated sound power levels, by octave bands, at the stated conditions.

1.03 CERTIFICATION

- A. Equipment performance ratings shall be certified as follows:
 - 1. Fans: AMCA Bulletin 210 or ARI Standard 430.
 - 2. Coils: ARI Standard 210-79.

1.04 MANUFACTURER

- A. Basis of design: Trane (Alternate manufacturers are not acceptable).

1.05 COMPATIBILITY

- A. Each unit must be compatible with the condensing units(s) to which it is matched. This includes unit arrangement/configuration, capacity, associated controls, piping and all other connected equipment to which the unit and its components are interfaced.

PART 2 - PRODUCTS

2.01 CASING

- A. Unit casings shall be fabricated of mill galvanized steel reinforced with formed "hat" channels or steel angle iron frames and bracing to provide a rigid assembly. Casing shall be provided with removable panels for access to and removal of coils and fan. Finish the housing in manufacturer's standard coating.

2.02 DRAIN PAN

- A. Unit drain pan shall be double sloped stainless steel construction.

2.03 DIRECT EXPANSION REFRIGERANT COOLING COILS

- A. Provide direct expansion refrigerant cooling coil of copper tubes with aluminum fins mechanically bonded thereto, circuited to provide proper refrigerant velocities, properly matched with compressor-condenser assembly for proper operation, with expansion valves selected for optimum refrigerant flow from 20% to 100% full load.

2.04 INSULATION

- A. The entire air handling unit casing (including accessory sections), including structural frame and channels shall be insulated from contact with the air stream with foil faced, high density insulation. The insulation shall be secured using a full coverage insulation and adhesives shall comply with the requirements of NFPA 90A as to flame spread and smoke developed ratings.

2.05 FILTERS

- A. Refer to schedule on drawings.

2.06 OVERALL CONSTRUCTION

- A. Shall be as recommended by the manufacturer for operation at the indicated conditions.

2.07 OTHER REQUIREMENTS

- A. Unit shall be designed for mounting in a vertical configuration and shall be complete with subbase and vibration isolators.
- B. Cooling coils shall not have face velocities in excess of 500 fpm unless otherwise indicated on drawings schedule (in such case, velocity obtained from drawings schedule shall be upper limit).
- C. Units shall be provided which will perform as indicated with proper consideration of any correction factors which are applicable to system unit casing configuration.

PART 3 - INSTALLATION

3.01 EQUIPMENT PLACEMENT

- A. Air handling equipment shall be located essentially as shown on drawings; however, actual placement of the unit shall be verified using field measurements and data relating to the units approved for actual installation on this project.

3.02 WIRING

- A. Conduit penetrations shall be provided by the manufacturer. The conduit openings shall be located on the drive side and positioned so as not to compromise access to any portion of the unit. The opening shall be provided with effective seals and the edges of the internal insulation shall be properly sealed.

3.03 VIBRATION CONTROL

- A. Refer to other sections for vibration control.

3.04 OTHER REQUIREMENTS

- A. Properly connect all piping.
- B. Allow adequate space for all service and operational clearances necessary.

END OF SECTION

SECTION 23 08 00

PERFORMANCE VERIFICATION, PRELIMINARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawing and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Put all work in a state of readiness for final performance verification.
- B. Final performance verification shall not begin until the systems are complete and operable in all respects and all related building systems are complete.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.
- B. Refer to the section which describes "Performance Verification, Final".

PART 2 - PRODUCTS

2.01 This section part not applicable.

PART 3 - EXECUTION

3.01 AIR SYSTEMS

- A. Prepare the air side for balancing in the following manner:
 - 1. All air handling equipment shall be mechanically checked and available to operate under design conditions.
 - 2. All controls, whether they are electronic or electric or a combination thereof, shall be mechanically checked and ready to operate under design code in an operable and non-overloading condition.

3.02 ADDITIONAL REQUIREMENTS

- A. Complete Installation: The Contractor shall complete the equipment and system installation to the satisfaction of the Engineer (who will be the sole judge of its state of readiness) prior to advising, the writing, that final performance verification is ready to begin. The Contractor is hereby advised that the Certificate of Substantial Completion

will not be issued prior to the completion of final performance verification work and that he should therefore, schedule all other work accordingly allowing no less than 60 days for completion of final performance verification.

- B. Correction of Defects: The Contractor shall promptly and properly correct all defects in workmanship, material, installation and equipment of which he is aware prior to requesting that final performance verification work begin. Once the final performance verification work has begun, the Contractor shall promptly correct all defects in workmanship, materials, installation, and equipment as they are called to his attention by Engineer.
- C. Drive Changes: Changes in pulleys or belts required for correct final balance during testing shall be made by the Contractor at no additional cost to the Owner.
- D. Scheduling and Coordination: The Contractor shall be responsible for proper scheduling and coordination of work involved in preliminary performance verification. This shall include, but is not necessarily limited to the timely provision of: mechanics, tools, equipment, correction of defects, equipment manufacturer's representatives, test modules, and all other items which may be required.
- E. Report: Submit a written report describing and certifying in detail all preliminary performance verification items and tasks that have been performed. Approval of this report by the Engineer will precede final performance verification.

END OF SECTION

SECTION 23 08 01

PERFORMANCE VERIFICATION, FINAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SCOPE

- A. Provide the services of an independent test and balance agency to verify the performance of the complete heating, ventilating and air conditioning systems as described by Division 23. Performance verification shall be accomplished by established testing and balancing procedures as described in this section.

1.03 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.04 TEST AND BALANCE AGENCY

- A. All performance verification shall be performed by an independent test and balance agency (herein referred to as the "T & B Agency") which is fully certified by and a current member of the Associated Air Balance Council (AABC).

1.05 CONTRACTUAL RELATIONSHIP

- A. Performance verification shall be performed as a service of the T & B Agency directly to the Contractor with no other subcontractors as part of the agreement.
- B. Performance verification is specified in this Division 23 because it relates predominantly to Division 23 work. However, the inclusion of this Section in Division 23 shall not preclude the T&B Agency from contracting directly to the Contractor nor with other subcontractors as part of such agreement.

1.06 AGENCY APPROVAL

- A. Submit the name and qualifications of the proposed T & B Agency to the Engineer for approval within thirty (30) days of Notice to Proceed.
- B. Include AABC National Project Certification Performance Guaranty.

1.07 WORK INCLUDED

- A. The T & B Agency shall provide all labor, supervision, professional services, tools, test equipment and instruments (except as otherwise specified) to perform the following work and all other work of this section:
 - 1. Where in the opinion of the T & B Agency conditions may exist in the system design or construction that may have the potential of adversely affecting system performance, then the T & B Agency shall identify the condition and submit in writing recommended correctives for consideration by the Engineer.
 - 2. During construction, review those shop drawings which have relevance to performance verification to confirm that the required, ductwork and equipment, and their respective specialties and accessories such as dampers, access doors, etc., are properly selected, sized and located to permit proper and complete testing and balancing to be accomplished.
 - 3. Perform site inspections to verify compliance with documents, and observe pressure tests on ductwork.
 - 4. Perform a complete test and balance of all heating, ventilating, air conditioning and exhaust air systems shown and described on the Construction Documents and as further described herein.
 - 5. Submit Equipment Test and Systems Balance Report.
 - 6. Furnish specifications to Contractor for properly sized fixed sheaves on fan systems after proper RPM has been established.

1.08 GUARANTEE

- A. The T & B Agency shall include a warranty period of ninety (90) days after completion and acceptance of test and balance work. During the warranty period, the Engineer may request a re-check or re-setting of any system component requiring testing and balancing. The T & B Agency shall provide technicians, instruments, and tools to assist the Engineer in conducting any test that he may require during this time. The foregoing shall be in addition to the A.A.B.C. National Project Certification Performance Guaranty which shall also be provided.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The tangible product of this section shall include the reports and documentation necessary to verify the systems' performance.

2.02 REPORT

- A. The T & B Agency shall in the course of his work record the information herein specified. Recorded test data shall be at the final balanced condition for each system.

Recorded data shall be arranged by system using the appropriate designation as established on the Construction Documents. Four (4) copies of the final report signed, bound and indexed shall be submitted to the Engineer for his approval or comments.

- B. Where actual measurements recorded for the final balance show deviations of more than 10% from the design, the T & B Agency shall note same in the report and submit recommendations for corrective action to the Engineer for his consideration.
- C. In those cases where recorded data can be reasonably interpreted to be inaccurate, inconsistent and/or erroneous, the Engineer may request additional testing and balancing. The T & B Agency shall at no additional cost perform such retesting and rebalancing as directed by and in the presence of the Engineer.
- D. Where, in the opinion of the T & B Agency, there is excessive vibration, movement or noise from any piece of equipment, ductwork, pipes, etc., the T & B Agency shall note same in the report and submit recommendations for action to the Engineer.
- E. The T & B Agency shall verify that each thermostat and the devices it is controlling, operate in the exact sequence required.
- F. Test Data: Include the following data in the Systems Test and Balance Report:
 - 1. Motors:
 - Manufacturer
 - Model and serial number
 - Rated amperage and voltage
 - Rated horsepower
 - Rated RPM
 - Corrected full load amperage
 - Measured amperage and voltage
 - Calculated BHP
 - Measured RPM
 - Sheave size, type and manufacturer
 - 2. Fans:
 - Manufacturer
 - Model or Serial number, BI or Air Foil - number of blades
 - Rated CFM, measured CFM
 - Rated RPM, measured RPM
 - Measured pressures - Inlet and Outlet Static Pressure
 - Pulley size, type and manufacturer
 - Belt size and quantity
 - Rated TSP
 - Operating TSP & operating ESP (at discharge side of Supply Fan or suction side of Exhaust/Return Fan)
 - 3. Air Systems (including inlets and outlets):
 - Provide single line diagrammatic plan locating each air inlet and outlet and its reference number.

Grille or diffuser reference number and manufacturer.
Grille or diffuser location.
Design velocity.
Design CFM.
Effective area factor and size.
Measured velocity.
Measured CFM

- G. Other Report Requirements: Where any systems have equipment or components which are not covered by the above, then the Final Test and Balance Report shall include the following data as applicable to such equipment or systems to confirm actual operation:
1. All inlet and outlet areas.
 2. Outside, inside, and supply air conditions.
 3. All fluid velocities, flow rates, temperatures and pressures at appropriate locations.
 4. All speeds.
 5. All voltage and ampere ranges.
 6. Descriptions of each test method used.

2.03 INSTRUMENTATION

- A. All test and balance equipment and instruments to be furnished by the T&B Agency shall have been calibrated within six (6) months of use on this work. A list of equipment and instruments to be used shall be submitted to the Engineer prior to commencing test and balancing operations and shall include equipment and/or instruments, name, manufacturer, serial number and certification of last calibration date. Instruments without calibration adjustment capability shall be accompanied with manufacturer's certification of accuracy. Test and balance equipment and instruments furnished by the Contractor to the T&B Agency shall be accompanied with certification as required above. The T&B Agency shall be responsible for the protection from damage due to accident, abuse or misuse, all equipment and instruments provided by the Contractor, and shall return same in good working condition at the completion of the test and balance work to the Contractor. The T&B Agency shall repair at his expense to original condition and accuracy or replace with like equipment and instruments damaged in the work.

2.04 DIAGRAMS

- A. Provide a schematic diagram (i.e., one-line) of system(s) tested. Indicate on the diagram the relative location of all air distribution devices, heating/cooling coils, points of data measurements (i.e., pitot traverse, temperature, static pressure) fans, air handling units, and similar equipment included in the system. Diagram shall identify each component tested. Said identification shall utilize the conventions shown on the drawings (i.e., AHU-1 or SF-6) and correlate with the data sheets provided in the Test and Balance Report.

2.05 LOGS AND FORMS

- A. Logs and forms shall clearly indicate following:
 - 1. All inlet and outlet areas.
 - 2. All applicable coil sizes.
 - 3. Outside, inside, and supply air conditions.
 - 4. All fluid velocities, flow rates, temperatures and pressures at significant locations (e.g., fluid pressures before and after each fan.)
 - 5. All fan speeds.
 - 6. All motor ampere ranges.
 - 7. Descriptions of each test method used.
- B. Associated Air Balance Council log and data forms.

PART 3 - EXECUTION

3.01 GENERAL

- A. Sheaves: The Contractor shall provide applicable fans with V-belt drives and fixed pitch sheaves. In order to provide the properly sized fixed pitch sheave, the Contractor shall initially provide fans with V-belt drives, variable pitch sheaves. The Contractor, upon completion of system balancing by the T & B Agency, will replace these adjustable pitch sheaves with fixed sheaves of the size and type specified by the T & B Agency. The Contractor shall tag the adjustable sheaves, transmit same to Owner, and receive written receipt by Owner of acceptance of these sheaves.
- B. Load Conditions: All testing and balancing of systems shall be undertaken with maximum attainable load. Testing and balancing of all air handling systems shall be accomplished with ceiling tile in place and enclosing partitions and doors erected.
- C. Observe all equipment for noise, movement or vibrations under normal operating conditions and report excesses to the Engineer and Owner.

3.02 PERFORMANCE VERIFICATION, PRELIMINARY

- A. The Contractor, prior to commencement of the balancing by the T & B Agency, shall verify in writing:
 - 1. That all air filters have been installed and are in clean condition.
 - 2. That all linkages between dampers and their actuators are secure.
 - 3. That all fans are operating at the specified RPM.

- B. The Contractor shall confirm in writing that the systems as scheduled for balancing, are operational and complete and that and ductwork have been pressure tested and accepted.

3.03 PROTECTION OF WORK

- A. The Contractor shall protect all mechanical devices during the testing and balancing period. The activities of the T & B Agency will include but not be limited to the adjustments of designated balancing devices including; adjustment of balancing dampers, adjustment of air extractors, air splitters, or manual dampers, the adjustment of adjustable sheaves for fan speed. The existence of the T & B Agency shall not relieve the Contractor of his responsibility for the complete operation of the mechanical systems in conformance with the contract documents.

3.04 CORRECTION OF WORK

- A. The Contractor shall at no additional cost to the Owner rectify discrepancies between the actual installation and contract documents when in the opinion of the T & B Agency the discrepancy will significantly affect system balance and performance.

3.05 COORDINATION AND ASSISTANCE

- A. The Contractor shall assist the T & B Agency by providing all labor, equipment, tools and material required to operate all of the equipment and systems necessary for the testing and balancing of the systems and for the adjustment, calibration or repair of all electric or automated control devices and components. These services shall be available on each working day during the period of final testing and balancing. The Contractor shall assist the T & B Agency by arranging to have all ceilings, partitions, windows, and doors installed prior to the scheduled commencement of balancing within each specified area.
- B. The Contractor shall provide to the approved T & B Agency a complete set of plans and specifications and an approved copy of all heating, ventilating and air conditioning equipment shop drawings. The Contractor shall include the cost of all pulley, belt, and drive changes, as well as balancing dampers required to achieve proper system balance recommended by the T & B Agency.

3.06 AIR SYSTEMS

- A. The testing and balancing shall include, but is not limited to, the following requirements:
 - 1. Adjust fan speeds to deliver the required cfm and static pressure, and record rpm and full load amperes.
 - 2. Observe all equipment for noise, movement or vibration under normal operating conditions and report excesses to the Engineer.

- B. After all air distribution devices have been balanced to distribute calculated design indicated air quantities and if temperature in any area (where such area does not have the particular zone temperature control thermostat located therein) of any zone is not maintained within 2 degrees plus or minus of the zone areas which does have the zone temperature control thermostat, then notify Engineer of such conditions and obtain approval to rebalance devices to obtain air quantities other than those indicated so that air temperature in entire zone will be as even as possible regardless of calculated design air quantities. After obtaining approval to rebalance, perform such necessary rebalancing.

END OF SECTION

DIVISION 26 – ELECTRICAL TECHNICAL SPECIFICATIONS INDEX

LEE COUNTY UTILITIES

FIESTA VILLAGE WWTP

SWITCHGEAR AND GENERATOR REPLACEMENT PROJECT

DIVISION 26 – ELECTRICAL TECHNICAL SPECIFICATIONS INDEX

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SECTION 26 05 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes: General requirements for providing basic electrical materials and methods.
- B. Related Work Specified in Other Sections Includes:
 - 1. Certain items of equipment, and various control devices including conduit and wiring which are indicated on electrical drawings to be connected, but are specified in other sections pertaining to plumbing, heating, ventilating, air conditioning, temperature control systems, process equipment, process control systems, and instrumentation. Install and connect these items to the electrical system as indicated or required in accordance with the Contract Documents.
- C. Overall Application of Specifications: This Section applies to all sections of Division 26 and to other sections that include electrical equipment requirements except when in these individual sections requirements are otherwise specified to provide and install all materials necessary for a complete operational system.
- D. Temporary Requirements: This Section applies to any temporary circuits, overcurrent devices, conduit, wiring, and other equipment required during changeover from existing to a new electrical system. This Section also applies to temporary rewiring of lighting and power circuits, instruments and devices.

1.2 DEFINITIONS

- A. Hazardous Areas: Equipment, materials and installation in areas designated as hazardous on the Drawings shall comply with NEC Articles 500, 501, 502 and 503. Hazardous areas as defined by the NEC as Class I, Division 1, Group D, or Class I, Division 2, Group D; hazardous areas as follows:
 - 1. Class 1, Division 1, Group D
 - a. Wet Wells
 - b. Pretreatment
 - 2. Class 1, Division 2, Group D
 - a. Pump Rooms and Dry Well
 - b. Odor control

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design requirements are specified in the applicable sections.
- B. Performance Requirements: Performance requirements are specified in the applicable sections.

1.4 SUBMITTALS

- A. General: Provide submittals for all electrical material and devices. Including the following:
1. Submit Technical Information Brochures at start of construction or within 30 days after Award of the Contract. Each brochure shall consists of an adequately sized, hard-cover, 3-ring binder for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on end of brochure. When, in the judgment of the Engineer, one binder is not enough to adequately catalog all data, an additional binder will be required and data split as directed by the Engineer. Specific shop drawing submittals may be submitted separately after technical information brochures but before any equipment is purchased; provide index and schedule of shop drawings to be submitted within the technical information brochures.
 2. First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be prepared by the Contractor, and shall list Project Addresses and phone numbers with key personnel for this project.
 3. Provide reinforced separation sheets tabbed with the appropriate specification reference number.
 4. The General Contractor shall review the brochures before submitting to the Engineer. No request for payment will be considered until the brochure has been submitted and reviewed completely.
 5. Submit cost breakdown "Schedule of Values" for electrical work in the Technical Information Brochures. Cost of material and labor for each major item shall be shown.
 6. Acceptance: When returned to Contractor, submittals will be marked with Engineer's stamp. If box marked "returned for correction resubmit" is checked, submittal is not approved and Contractor is to correct and resubmit as noted, otherwise submittal is approved and Contractor is to comply with notation making necessary corrections on submittal and resubmit for final record.
 7. Note that the approval of shop drawings, or other information submitted in accordance with the requirements hereinbefore specified, does not assure that the Engineer, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Approval of shop drawings does not invalidate the plans and specifications if in conflict with the submittal. It is the contractor's responsibility to request in writing and seek written approval from the engineer for all deviations of the plans and specifications.
- B. Product Data and Information: Provide complete list of electrical equipment and materials to be furnished showing manufacturer, catalog number, size, type, voltage rating and other pertinent information.
1. Provide catalog data on manufacturer's standard equipment and materials. Clearly indicate on catalog cuts the equipment and devices being proposed.
 2. Identification: Provide complete schedule and listing of system and equipment identification labels with legends.
 3. Material shall not be ordered or shipped until the shop drawings have been approved.

4. The Engineer's shop drawing review shall be for conformance with the design concept of the project and compliance with the Specifications and the Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and the Drawings.
 5. Shop drawings shall be stamped with the date checked by the contractor and a statement indicating that the shop drawings conform to the Specifications and the Drawings. This statement shall also list all exceptions to the Specifications and the Drawings. Shop drawings not so checked and noted shall be returned.
- C. CONTRACTOR's Shop Drawings: Provide shop drawings on items manufactured for the Contract.
1. Provide connection diagram and schematic for each piece of electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one method of connection is not acceptable unless it is clearly marked to show the intended method of connection.
 2. Provide diagrams showing connections to field equipment. Clearly differentiate between manufacturer's wiring and field wiring.
 3. Provide raceway layout drawings showing conduits, boxes, and panels which contain the conductors to be provided. Include schedules listing conduit sizes and conductor content and identification.
 4. Where additions and modifications are made to existing equipment, provide drawings which include both retained existing equipment and new Work.
- D. Coordination Drawings: Prepare to scale coordination drawings (1/4"=1'-0"); detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of major raceway systems, equipment, and materials. All dimensions shall be field verified at the job site and coordinated with the work of all other trades. Include the following:
 - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 - b. Exterior wall and foundation penetrations.
 - c. Fire-rated wall and floor penetrations.
 - d. Equipment connections and support details.
 - e. Sizes and location of required concrete pads and bases.
- E. Record Documents: Prepare record documents, and in addition to the requirements specified in Division 1. As the work progresses, legibly record all field changes on a set of Project Contract Drawings, (the "Record Drawings"). Indicate installed conditions for:
1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, and actual equipment and materials installed.
 4. Record Drawings shall accurately show the installed condition of the following items: Power Riser Diagram(s). Equipment elevations (front views). Raceways and pullboxes. Conductor sizes and conduit fills. Control Wiring Diagram(s). Underground raceway and duct bank routing. Plan view, sizes and locations of distribution transformers and outdoor electrical equipment enclosure.
 5. Submit a schedule of control wiring raceways and wire numbers, including the following information: Circuit origin, destination and wire numbers. Field wiring terminal strip names and numbers.
 6. In addition to the schedule, provide point to point connection diagrams showing the same information submitted in the schedule of control wiring raceways including all designations and wire numbers. Comply with PLC tag designation on all instrumentation and control cabling in and out of PLC racks.
 7. The schedule of control wiring raceways and wire numbers and the point to point connection diagrams shall be in electronic Autocad and Word format (i.e. no hand-written or drawn schedules, drawings, or diagrams will be accepted)
- F. Operation and Maintenance Manuals: Prepare operation and maintenance manuals, and in addition to the requirements specified in other Divisions, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and catalog numbers of replacement parts. Complete parts list with stock numbers, including spare parts. A complete bill of material supplied, including serial numbers, ranges and pertinent data.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. A comprehensive index.
 5. A complete "As Built" set of approved shop drawings.
 6. A table listing of the "as left" settings for all timing relays and alarm and trip setpoints. A complete listing of As left programmable parameters for all drives, soft-starters and other microprocessor controlled equipment.
 7. System schematic drawings "As Built", illustrating all components, piping and electric connections of the systems supplied under this Section.

1.5 QUALITY ASSURANCE

- A. Codes: Provide all electrical Work in accordance with applicable local codes, regulations and ordinances. If there is a conflict between the requirements specified in the Contract Documents and the codes, follow the more stringent requirements as determined and approved.

- B. Testing: As a minimum, provide standard factory and field tests for each type of equipment. Other tests may be specified in the applicable equipment section.
- C. Labeling: Provide all electrical equipment and materials listed and approved by Underwriters Laboratories with the UL label or other OSHA recognized testing laboratories attached to it.
- D. Standard Products: Unless otherwise indicated, provide electrical materials and equipment which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these Specifications. When two or more units of the same class of material and equipment are required, provide the products of the same manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver, store and handle all products and materials as specified in Division 1 and as follows:
- B. Shipping and Packing: Provide materials and equipment suitably boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Clearly label such boxes, crates or enclosures with manufacturer's name, and name of material or equipment enclosed.
- C. Acceptance at Site: Conform to acceptance requirements as required in Division 1. Repair or replace all materials and equipment damaged by handling and storage as directed at no additional Contract cost.
- D. Storage and Protection: Protect materials and equipment from exposure to the elements and keep them dry at all times. Handle and store to prevent damage and deterioration in accordance with manufacturer's recommendations.

1.7 PROJECT CONDITIONS

- A. General: The Drawings indicate the extent and general arrangement of the principal electrical elements, outlets and circuit layouts. Connect and install all electrical elements and devices to form a workable system as required by the Contract Documents whether the connections and installations are specifically stated in the Specifications or shown. Provide necessary materials and installation wherever required to conform to the specific requirements of the furnished equipment and for proper installation of the Work.
- B. Schematics: In general the runs of feeders are shown schematically and are not intended to show exact routing and locations of raceways. Verify actual and final arrangement, equipment locations, and prepare circuit and raceway layouts before ordering materials and equipment. Equipment locations are approximate and are subject to modifications as determined by equipment dimensions.
- C. Coordination of Work: Coordinate the Work so that the electrical equipment may be installed without altering building components, other equipment or installations.

- D. Coordinate arrangement, mounting, and support of electrical equipment: To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated. To provide for ease of disconnecting the equipment with minimum interference to other installations. To allow the right of way for piping and conduit installed at the required slope. To clear connecting raceways, cables, wireways, cable trays, and busways of obstructions and of the working and access space of other equipment. Coordinate the installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed. Coordinate electrical testing of electrical, mechanical, and architectural items, so that functionally interdependent equipment and systems demonstrate successful interoperability.
- E. Departure from Design: If departures are deemed necessary due to structural conditions, obstructions or other problems, provide details of such departures and the reasons for requesting approval as soon as practicable but not later than the submittal of the raceway layout drawings. Do not make any departures without written approval.

PART 2 – PRODUCTS

2.0 FLOOR MATING

- A. Provide rubber insulation mats on floor in front of electrical equipment extending 18” beyond. Mats to be minimum 3 feet wide or equal to aisle width. Provide OSHA approved insulating mats meeting OSHA regulation 1910.137 with 30,000 volt insulating strength (Matworks or equal, 800 336-4604).

PART 3 – EXECUTION

3.0 ROUGH-IN

- A. Final Location: Verify final locations for rough-ins with field measurements, vendor shop drawings and with the requirements of the actual equipment to be connected.
- B. The Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.
- C. Install each 3 phase circuit in a separate conduit unless otherwise shown.
- D. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
- E. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

- F. All floor mounted electrical equipment shall be placed on 4-inch thick (3/4-inch, 45 degree chamfer at all exposed edges) concrete pads, provide reinforcement, anchors, etc.
- G. All "LB" type fitting hardware to be stainless steel or brass. All junction box hardware to be aluminum or stainless steel only.

3.1 ELECTRICAL INSTALLATIONS

- A. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.
 3. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.
 4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 5. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete and other structural components, as they are constructed.
 6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 8. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 9. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the ENGINEER for resolution.
 10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 11. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 12. Install access panel or doors where units are concealed behind finished surfaces.

13. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.2 CUTTING AND PATCHING

- A. Perform cutting and patching as specified in Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
 1. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Locate existing structural reinforcing where core drilled penetrations are required so as not to cut the steel reinforcing.
 2. Cut, remove, and properly dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work. Deliver all the existing removed to the OWNER as directed.
 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
Patch finished surfaces and building components using new materials as specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

SECTION 26 05 11

SPECIAL ELECTRICAL REQUIREMENTS

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install complete and make operational, electrical and process instrumentation systems for the Lee County Utilities Department as shown on the Drawings and as specified herein.
- B. The work shall include furnishing, installing and testing the equipment and materials specified in other Sections of the Specifications and shown on the Drawings.
- C. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost. The work shall include but not be limited to furnishing and installing the following:
 - 1. Furnish and Install new class 1 reliable service entrance switchgear and electrical service. Demolition of existing switchgear and electrical service.
 - 2. Furnish and install stand-by power generator set in walk-in enclosure with sub-base fuel tank.
 - 3. Furnish and install Concrete encased ductbank and conduit racking system for power distribution.
 - 4. Selective demolition of existing electrical service distribution equipment
 - 5. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions of these specifications.
 - 6. Power wiring for all heating, ventilating, and air conditioning (HVAC) equipment furnished under other divisions of the specifications, including power wiring for 120 volt motors, thermostats, fan motors, dampers and other HVAC in line unit wiring.
 - 7. Maintain existing lighting in existing switchgear room. Provide new lighting in proposed switchgear room
 - 8. Construct manholes and furnish and install precast handholes. Furnish and install manhole and handhole frames and covers.
 - 9. Provide a complete grounding system and special grounds as required or noted.
 - 10. Provide Power and signal Surge Suppression systems.
 - 11. Provide Concrete work for pad mounted equipment.
 - 12. Provide Instrumentation and control conduit and wiring systems.
 - 13. Provide complete Arc Flash evaluation, short circuit and coordination study and Electrical testing of equipment including SKM file of approved studies.
 - 14. Provide Lightning protection, bonding and grounding systems.
 - 15. Provide complete set of electronic and hard copy project record drawings and Vendor Operation and Maintenance manuals.
 - 16. Provide detailed training sessions
 - 17. Provide witness testing of switchgear.
- D. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing site and structures in which work under this Division is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that their representative has

visited the site and structures and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing the work.

- E. Field verify all existing underground electrical and mechanical piping.
- F. The Contractor shall prepare and furnish electrical and instrumentation conduit layout shop drawings for yard electrical, within and under all roads, buildings and structures to the Engineer for approval prior to commencing work. Layouts shall include but not be limited to equipment, pull boxes, conduit routing, dimensioning, methods and locations of supports, reinforcing, encasement, materials, conduit sizing, equipment access, potential conflicts, building and yard lighting, and all other pertinent technical specifications for all electrical and instrumentation conduits and equipment to be furnished. All layouts shall be drawn to scale on 22 x 34 sheets
- G. The work shall include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
- H. A single manufacturer shall provide panelboards, main breakers, transformers, disconnect switches, etc.
- I. Contractor shall provide their own temporary power for miscellaneous power (drills, pumps, etc.). No facility circuits shall be used unless approved by the engineer. Any temporary added shall be removed at job completion.
- J. Complete coordination with other contractors. Contractor shall coordinate with all other contractors equipment submittals and obtain all relevant submittals.
- K. Mount transmitters, process instruments, operator's stations, etc. furnished under other Divisions of these specifications.
- L. Concrete electrical duct encasement, including but not limited to excavation, concrete, conduit, reinforcement, backfilling, grading and seeding is included. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished herein is included in this Division.

1.02 QUALIFICATIONS

- A. The electrical contractor shall have regularly engaged in the installation of industrial electrical power systems for a minimum period of ten (10) years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- B. Provide a field superintendent who has had a minimum of ten (10) years previous successful experience on projects of comparable size and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected. A resume of the Superintendent's experience shall be submitted to Engineer before starting work.

1.03 RELATED WORK

- A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is specified in other Divisions.
- B. Cast in place concrete work, including concrete encasements for electrical duct banks, equipment pads, and reinforcing steel, is specified in other Divisions.

1.04 REFERENCE STANDARDS

- A. Electric equipment, materials and installation shall comply with the latest edition of National Electrical Code (NEC) and with the latest edition of the following codes and standards:
 - 1. National Electrical Safety Code (NESC)
 - 2. Occupational Safety and Health Administration (OSHA)
 - 3. National Fire Protection Association (NFPA)
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. American National Standards Institute (ANSI)
 - 6. Insulated Cable Engineers Association (ICEA)
 - 7. Instrument Society of America (ISA)
 - 8. Underwriters Laboratories (UL)
 - 9. Factory Mutual (FM)
 - 10. International Electrical Testing Association (NETA)
 - 11. Institute of Electrical and Electronic Engineers (IEEE)
 - 12. American Society for Testing and Materials (ASTM)
 - 13. Electrical Safety in the Workplace (NFPA70E-2009)
 - 14. State and Local Codes and Ordinances
- B. All electrical equipment and materials shall be listed by Underwriter's Laboratories, Inc., and shall bear the appropriate UL listing mark or classification marking. Equipment, materials, etc. utilized not bearing a UL certification shall be field or factory UL certified prior to equipment acceptance and use. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 ENCLOSURE TYPES

- A. Unless otherwise specified herein or shown on the Drawings, electrical enclosures shall have the following ratings:
 - 1. NEMA 12 continuous hinge, 3 point latch for dry, non-process indoor locations.
 - 2. NEMA 4X 316 SS, powder coated white continuous hinge, 3 point latch, screw down door clamps for all outdoor locations, rooms below grade (buried vaults), "DAMP" and "WET" locations.
 - 3. NEMA 4X 316 SS, powder coated white continuous hinge, 3 point latch, screw down door clamps for "CORROSIVE" locations.
 - 4. NEMA 7 (and listed for use in the area classifications shown) for "Class I Division 1 Group D", "Class I Division 2 Group D" and "Class II Division 1" hazardous locations shown on the Drawings.
- B. Unless otherwise specified herein or shown on the Drawings, junction boxes shall have the following ratings:
 - 1. NEMA rating as applicable and specified above.
 - 2. Have continuous hinge with quick connect door clamp. Flush mounted screw down fronts are not acceptable.

1.06 CODES, INSPECTION AND FEES

- A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction. Completed electrical installation shall be inspected and certified by all applicable agencies that it is in compliance with all codes.
- B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.07 TESTS AND SETTINGS

- A. Test systems and equipment furnished under Division 26 and other divisions supplying electrical equipment. Repair or replace all defective work and equipment. Refer to section 260800 and the individual equipment sections for additional specific testing requirements.
- B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.
- C. In addition to the specific testing requirements listed in section 260800 and the individual Sections, the following minimum tests and settings shall be performed. Submit test reports upon completion of testing in accordance with Section 260800.
 - 1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, motor starters, overload relays, control circuits and equipment for proper operation.
 - 2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.
 - 3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.
 - 4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.
 - 5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
 - 6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is incorrect for the driven equipment correct motor connections at the motor terminal box.
 - 7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.
 - 8. Inspect each piece of equipment in areas designated as HAZARDOUS to ensure that equipment of proper rating is installed.
 - 9. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A", "B" and "C" phases.
 - 10. Check all wire and cable terminations. Verify to the Engineer connections meet the equipments torque requirements.
 - 11. Field set all transformer taps as required to obtain the proper secondary voltage.
 - 12. Infra-red hot spot inspection shall be made of all electrical equipment including but not limited to switchgear, motor control centers, transformers, switches, power and control panels, etc. This shall be done under representative load conditions before the equipment is used by the Owner.

1.08 PHASE BALANCING

- A. The Drawings do not attempt to balance the electrical loads across the phases. Circuits on panelboards shall be field connected to result in evenly balanced loads across all phases.
- B. Field balancing of circuits shall not alter the conductor color coding requirements as specified herein.

1.09 EQUIPMENT IDENTIFICATION

- A. Identify equipment (disconnect switches, control stations, etc) furnished under Division 16 with the name of the equipment it serves. Control panels, panelboards, main breakers, junction or terminal boxes, etc, shall have nameplate designations as shown on the Drawings. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for approval. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 277/480V, 3-phase, 4-wire". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.
- B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high black letters on a white background. Attach with pan head brass or machine type nuts and bolts.
- C. Electrical systems shall be identified at junction and pull boxes, terminal cabinets and equipment racks. Electrical contractor is responsible for nameplates on electrical equipment supplied by other divisions and installed and wired by electrical including all instrumentation and controls equipment. A portion of existing equipment affected by this contract shall also receive nameplates as determined by the Engineer.
- D. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate, the nameplate shall be permanently fastened to the adjacent mounting surface. Cemented nameplates shall not be drilled.
- E. All voltages (e.g. 480 volts, 240 volts, etc.) within pull boxes, junction boxes etc. shall be identified on the front exterior cover. Signs shall be red background with white engraved lettering, lettering shall be a minimum of 1" high.
- F. All receptacles, wall switches, lighting fixtures, photo cells, emergency lights, exit lights, etc. shall be identified with the panel and circuit to which it is connected. Identification shall be with machine generated labels with ¼" high letters.

1.10 SAFETY REQUIREMENTS

- A. The Contractor shall make every effort to keep all employees and/or subcontractors aware of the danger inherent in working in dangerous proximity to the existing power lines. The minimum recommended precautionary measures are as follows:
 - 1. Make sure that all persons responsible for operating cranes, draglines and other mobile equipment have a copy of, and are familiar with the State Department of Commerce Regulations for Use of Cranes, Draglines and Similar Equipment Near Power Lines, as well as the U.S. Department of Labor OSHA Regulations, before commencing operation of said equipment.
 - 2. Make sure that all cranes, draglines and other mobile equipment have attached to them the black and yellow Department of Commerce warning signs required by the said Regulations of State Department of Commerce.
 - 3. Warn all employees on the ground, new and old employees alike, of the danger of holding on to or touching a cable or other piece of equipment or machinery that is located or working close to any overhead power line.
 - 4. If, during the course of construction, it becomes necessary for the contractor, or subcontractor, and their employees, to operate cranes, draglines, or their mobile equipment, in dangerous proximity of any overhead power lines, or in such a manner that such equipment might come close to any overhead power lines, the Contractor shall give the Power Company or overhead power line owner prior notice of such proposed operation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.
- D. Seal all openings, sleeves, penetration and slots as specified in Section 260551.

3.02 INSTALLATION

- A. Any work not installed according to the Drawings and this Division or without approval by the Engineer shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.
- B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If an apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to the Owner, the damaged unit(s) or systems shall remain on

site and returned to the manufacturer after the replacement unit(s) or systems have been delivered to the site. Under no circumstances will electrical equipment damaged by water be rehabilitated or repaired, new equipment shall be supplied and all cost associated with replacement shall be borne by the Contractor.

- C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting requirements Section 09902, at no additional cost to the Owner.
- A. All "LB" type fitting hardware to be stainless steel or brass. All junction box hardware to be aluminum or stainless steel only.

3.03 MANUFACTURERS SERVICE

- A. Provide manufacturer's services for testing and start-up of all major electrical equipment: VFDs, ATS, Gensets, MCCs, Switchboards, Switchgear, Etc.
- B. Testing and startup shall not be combined with training. Testing and start-up time shall not be used for manufacturers warranty repairs.
- C. The manufacturers of the above listed equipment shall provide experienced Field Service Engineer to accomplish the following tasks:
 - 1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on-site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.
 - 2. The Field Service Engineers shall provide engineering support during the energization and check-out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.
 - 3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.
 - 4. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action. The reports after review by the Contractor shall be submitted to the Engineer.

3.04 TRAINING

- A. The cost of training programs to be conducted with Owner's personnel shall be included in the Contract Price. The training and instruction, insofar as practicable, shall be directly related to the system being supplied.
- B. Provide detailed O&M manuals to supplement the training courses. The manuals shall

include specific details of equipment supplied and operations specific to the project.

- C. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance including trouble-shooting of each system.
 - D. All training schedules shall be coordinated with and at the convenience of the Owner. Shift training may be required to correspond to the Owner's working schedule. The training shall be conducted with record "as-built" drawings sufficient for each class member.
 - E. The Contractor shall submit an overview of the proposed training plan. This overview shall include, for each course proposed:
 - 1. An overview of the training plan.
 - 2. Course title and objectives.
 - 3. Recommended types of attendees.
 - 4. Course Content - A topical outline.
 - 5. Course Format - Lecture, laboratory demonstration, etc.
 - 6. Schedule of training courses including dates, duration and locations of each class.
- 3.05 The work under this Division shall include a two-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material that has been furnished under this Contract at no cost to the Owner for a period of two years from the date of substantial completion of the System. This guarantee shall not include light bulbs or batteries in service after six months from date of Substantial Completion of the System.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE WIRES AND CABLES

PART 1 – GENERAL

1.01 REFERENCED STANDARDS

- A. Institute of Electrical and Electronics Engineers, Inc./American National Standards Institute (IEEE/ANSI):
- B. Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies.
- C. National Electrical Manufacturers Association (NEMA): ICS 4, Industrial Control and Systems: Terminal Blocks.
- D. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA): WC 57/S-73-532, Standard for Control Cables: WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- E. National Fire Protection Association NFPA-70, National Electrical Code (NEC).
- F. Underwriters Laboratories, Inc. (UL44): Standard for Safety Thermoset-Insulated Wires and Cables; (UL83): Standard for Safety Thermoplastic-Insulated Wires and Cables; UL467 Standard for Safety Grounding and Bonding Equipment. UL486A Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors; UL 486C, Standard for Safety Splicing Wire Connections. UL510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.

1.02 DEFINITIONS

- A. Building Wire: Copper single conductor, cross link polyethylene insulated; type XHHW-2;
- B. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- C. Instrumentation Cable (Analog signal cable): Multiple conductor, insulated, twisted Pair/Triad, with individual Pair/Triad shield and outer overall shield and outer sheath. Used for the transmission of low current (e.g., 4-20mA DC) using No. 16 AWG conductors. Common Types, TSP: Twisted shielded pair, TST: Twisted shielded triad.
- D. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, AWG. With overall shield where specified. Type SIS and MTW approved for use in the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers; otherwise type XHHW-2.

- E. Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 12 AWG and larger. Rated XHHW-2
- F. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc. Common Types: Ethernet UTP-unshielded twisted pair.

1.03 SUBMITTALS:

- A. Submit cut sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs, conductor identification systems and connectors and cable sleeves. Submit sample of all instrumentation and control cable. Sample shall be a minimum of 24" with exterior sheath clearly marked.
- B. Submit sample of all cable identification systems products.
- C. Submit conduit schedule identifying conduit tag numbers, locations the conduit connects and the wire count.

PART 2 – PRODUCTS

2.01 POWER CONDUCTORS:

- A. Branch circuits and feeder conductors for all three phase electric power shall be stranded copper type XHHW-2 cross-link polyethylene (XLP) insulation and derated to 75 degrees Centigrade. No aluminum wiring shall be permitted. Wire shall be in accordance to NEC and minimum No. 12, except that branch "homeruns" over 50 ft. in length shall be minimum No. 10 for 120/208V circuits. All branch lighting circuits serving HID and Fluorescent fixtures shall be minimum #10 with each circuit provided with a separate neutral. All wire shall be manufactured in the USA.
- B. Motor leads from variable frequency drives to driven motor shall be shielded VFD drive cable for all VFD motors. Provide flexible VFD shielded drive cables, 3 Class-I conductor cable plus 3 trisectional green insulated ground wires. Provide electrostatic shielding of tinned copper braided shield with aluminum-polyester laminated tape shielding system. Cross-linked polyolefin insulation system and neoprene outer jacket, type TC cable as manufactured by Rockbestos-Surprenant Cable Corp. or equal. Shielded VFD motor cables require increased conduit sizes over standard wire installations. Contractor to verify conduit sizes.
- C. Taps and Splices:
 - 1. All power wiring taps and splices in No. 8 or smaller wire shall be fastened together by means of terminal strips except within lighting fixtures and wiring devices where conformance to NEC practices will be acceptable (Twist/screw on type connectors). All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire. Tape shall be heavy duty, flame retardant and weather resistant vinyl electrical tape, minimum 7 mil premium grade with an operating temperature of 0 degree F. to 220 degree F. Provide tape meeting UL 510 and CSA standard C22.2.
 - 2. All taps and splices in manholes or in ground pull boxes, etc. shall be approved by the engineer on a case by case basis; be made with high press long barrel double

crimp compression type connectors and covered with Raychem heavy wall cable sleeves (type CTE or WCS) with type "S" sealant coating. Install sleeve kits as per manufacturer's installation instructions.

E. Color Coding:

1. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel except for the wire markings.
2. Unless otherwise approved, color-code shall be as follows: Neutrals to be white for 120/208V system, natural grey for 277/480V system; ground wire green, bare or green with yellow strips. Nominal Voltage: 120/208V, Phase A -black; Phase B - red; Phase C - blue. 480/277V, Phase A brown; Phase B - orange; Phase C - yellow. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those above. In exiting or expansion projects, comply with existing color coding established within the facility.

2.02 INSTRUMENTATION AND CONTROL CABLE:

- A. Multiconductor and Multi pair Process instrumentation cable shall be #16 AWG stranded, twisted pair, 600 V, (XLP) cross link polyethylene insulated, aluminum tape pair shielding, cross link polyethylene or chlorinated polyethylene (CPE) overall sheathed and shielded, type TC instrument cable as manufactured by the American Insulated Wire Co., Belden Wire Co. or equal.
- B. Multiconductor control cable shall be #14 AWG stranded, 600V, (XLP) cross link polyethylene insulated or polyolefin, with cross link polyethylene or chlorinated polyethylene (CPE or Hypalon) overall sheathed type TC control cable except for control cable into and out of VFD cabinets. Multiconductor control cable into and out of VFD cabinets shall be as indicated above and in addition include an aluminum polyester tape overall shield and drain wire. As a contractor alternate to shielded control cable into and out of VFD cabinets, provide twisted shielded instrument cable as specified above. Contractor to provide increased conduit size as required if instrument cable alternate is used into and out of VFD cabinets.
- C. Connections:
 1. All conductor connections shall be on terminal strips including all spare conductors. Provide terminal strips in all cabinets; motor control centers; etc.
 2. All connections of stranded wire to screw terminals shall be by insulated spade lugs, crimp fastened to wire. Provide stranded wire crimp ferrules for all stranded wire connections not requiring spade lugs for screw type terminal blocks. The stranded wire ferrule is to be crimped to all stranded wire using a crimping tool specifically approved for crimping the size and type of ferrule.
 3. All conductors shall be marked with mylar wrap type "Brady" labels. Identification labels shall be permanent type and be machine printed. All terminal block terminations shall be labeled. The inside portion of the terminal cabinet doors shall display a protected terminal cabinet drawing with all connections shown and described as to color code, number assigned to

- connection function of conductor and destination.
4. Wire shall be guided within terminal cabinets by cable supports. All conductors shall be neatly led to terminations.
 5. Instrumentation and control field cables on the unprotected side of SPD devices within the cabinet shall not run in parallel to the cables on the protected side of the SPD device. Separate cable supports (duct) will be provided.
 6. Cabinets: All cabinets shall be labeled with an engraved plastic laminate label riveted to the door.
 7. No splices shall be made within a conduit run or in manholes.
- D. All plant control system field wiring shall be labeled per the instrumentation and control contractor loop drawings from the field device, through the intermediate cabinets, to the PLC cabinet. The labeling system shall be consistent throughout the loop and follow the standard tag designation: PLC#-Rack#-Slot#-Point# (example PLC1-R2-S3-P4).
- E. Provide for separation of instrumentation, control and power conductors. Provide a minimum of 24" inch separation for parallel run of power conduit and instrumentation or control conduit. This separation can be reduced to 8" if metallic grounded separation is provided.

PART 3 – EXECUTION

3.01 SPARE CONDUCTORS

- A. All runs of Multi pair Process instrumentation cable and multi conductor Control cable shall have a minimum of 2 spare conductors per conduit.
- B. All branch circuit feeders of #3 and smaller shall have 2 spare conductors pulled in per circuit.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

- 1.01 DESCRIPTION; the terms “connect”, “ground” and “bond” are used interchangeably in this specification and have the same meaning
- A. This section specifies general grounding and bonding requirements of electrical equipment operations and to provide a low impedance path for possible ground fault currents.
 - B. “Grounding electrode system” refers to all electrodes required by NEC, as well as including made, supplementary, perimeter counterpoise ground, lightning protection system grounding electrodes.
- 1.02 RELATED WORK
- A. Section 26 05 00, 26 05 11 Common material and methods: General electrical requirements.
 - B. Section 26 05 19, Conductors & Cables
 - C. Section 26 41 00, Lightning Protection Systems
- 1.03 SUBMITTALS
- A. Submit in accordance with Section 26 05 00
 - B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
 - C. Test Reports: Provide certified test reports of ground resistance.
 - D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Project Engineer:
 - 1. Certification, by the Contractor, that the complete installation has been properly installed and tested.
- 1.04 APPLICABLE PUBLICATIONS
- A. American Society for Testing and Materials (ASTM):
 - B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - C. National Fire Protection Association (NFPA):
National Electrical Code (NEC) 2008

- D. Underwriters Laboratories, Inc. (UL):
Thermoset-Insulated Wires and Cables
Thermoplastic-Insulated Wires and Cables
Grounding and Bonding Equipment
Wire Connectors

PART 2 – PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 2 AWG and smaller may be solid copper unless noted otherwise noted on the drawings. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 4 AWG and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 2 AWG and smaller may be ASTM B1 solid bare copper wire.
- C. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.02 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

2.03 GROUND CONNECTIONS

- A. Above Grade:
 - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lock washers.
 - 2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.

PART 3 – EXECUTION

3.01 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified. Minimum size #12AWG.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames,

and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

- D. Provide conduit sleeves for all bare equipment ground conductors stubbing through concrete.

3.02 GROUNDING CONNECTIONS

- A. Make grounding connections that are below grade by exothermic weld. Make grounding connections that are above grade but are otherwise normally inaccessible (poured columns, within walls) with exothermic weld.

3.03 SECONDARY EQUIPMENT AND CONNECTIONS

- A. Transformers:
 - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the ground bar at the service equipment.
- B. Conduit Systems:
 - 1. Ground all metallic conduit systems. All conduit systems shall contain an equipment grounding conductor (except service entrance with grounded neutral). Ground conductor shall be bonded to metallic conduit systems at the entrance and exit from the conduit.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- E. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- F. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

3.04 CORROSION INHIBITORS

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.05 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system.

3.06 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 2 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the owner. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the Project Engineer prior to backfilling. Provide ground inspection wells at all ground rod locations.

3.07 GROUND ROD INSTALLATION

- A. Drive or drill each rod vertically in the earth, not less than 20 feet in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make above grade accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, drill rock then install rod. Backfill with flowable fill or concrete mix. Obtain the necessary permits if required for drilling.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

- A. The work under this sections includes conduit and equipment supports, straps, clamps, steel channel, etc, and fastening hardware for supporting electrical work. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pull boxes and other equipment furnished under this Division. All supporting devices and hardware exterior of buildings or interior of structures shall be stainless steel. Aluminum and non metallic supports (fiberglass) and hardware will be reviewed by the Engineer on a case-by-case basis.
- B. All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.
- C. The Contractor shall furnish and install all sleeves that may be required for openings through floors, wall etc. Where plans call for conduit to be run exposed, the Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If the Contractor does not properly install all sleeves and inserts required, contractor to provide cutting and patching to the satisfaction of the Engineer.

1.02 RELATED WORK: Applicable provisions of Division 1 govern work under this Section. Section 26 05 51 – Conduit Systems

1.03 SUBMITTALS: Product Data: Provide data for support channel.

1.04 QUALITY ASSURANCE: Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Support Channel: Stainless steel throughout
- B. Hardware: Stainless steel throughout
- C. Minimum sized threaded rod for supports shall be 3/8".
- D. Conduit clamps, straps, supports, etc., shall be stainless steel or malleable iron. One-hole straps shall be heavy duty type.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All steel conduits shall be securely fastened in place on maximum of 6 foot intervals; all PVC conduits shall be securely fastened in place on maximum of 3 foot intervals vertically and 2 foot intervals horizontally. Hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by two-hole malleable straps, clamp-backs, or other approved devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. On concrete or masonry construction, use "Tapcon" type fasteners. For brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. Steel members shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from stainless steel, or approved substitution.
- C. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only). Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction.
- D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not drill structural steel members unless approved by the engineer.
- E. Fabricate supports from stainless steel or galvanized steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall.
- F. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 Provide underground duct banks for power and lighting feeders; instrumentation and control systems as shown or as specified herein; from point of service switchgear or equipment to the point of distribution or equipment served.

1.02 SUBMITTALS

- A. Submit shop drawings or cut sheets on
 - 1. Conduit
 - 2. Fittings
 - 3. Conduit Separators
 - 4. PVC solvent
 - 5. Precast concrete manholes
 - 6. Composite handholes
 - 7. Cable lubricants

1.03 DESCRIPTION OF ASSEMBLY

- A. Underground duct banks shall be multiple individual conduits encased in reinforced concrete as indicated on the drawings. Conduits within building or structural foundations and protected by a concrete slab above them do not require encasement (except provide encasement or flowable fill under electrical and pump room slabs). The conduit shall be of plastic (PVC sch 40 for concrete encasement and Sch80 without concrete encasement), unless indicated or specified otherwise. The conduit used shall not be smaller than 4 inches in diameter, inside, unless otherwise noted. The concrete encasement surrounding the duct bank shall be rectangular in cross-section, having a minimum concrete thickness of three inches around all conduits. All concrete encased duct banks shall be steel reinforced as detailed. Power distribution conduits shall be separated by a minimum dimension of four inches and not less than 7.5" center to center. Power conduits shall be separated from low voltage instrumentation & control conduits by a minimum dimension of twenty four inches.
- B. The concrete work shall conform to Section on "Concrete". The top of the concrete envelope shall be not less than 24 inches below grade unless otherwise indicated. Concrete shall be installed in a continuous pour to eliminate joints in the duct run. The duct bank sides shall be formed in place using suitable concrete form work or corrugated metal forms. Open trench pours will not be allowed.
- C. Plastic conduit, fittings and joints shall not have been stored in the sun or weather, in any excessively heated space, or unevenly supported during storage. Use and installation shall be in accordance with the National Electrical Code requirements for the installation of non-metallic rigid conduit. Plastic conduit shall be protected against the direct rays of the sun prior to installation. Conduit shall be PVC schedule 40 manufactured by Carlon, Queen City Plastics, or approved substitution. Conduit

shall be U.L. listed and conform to NEMA Standards for schedule 40 PVC conduit.

- D. Trenches for duct banks shall be completely dry before setting conduits or pouring concrete. Provide well pointing as required if necessary to keep trench dry.
- E. Wires and cables in manhole/handhole shall be placed on cable racks. Manhole/handhole shall be cleaned of all loose materials, dirt and debris immediately after completion of new work and shall be in a clean condition when project is completed. Cable racks shall be stainless steel or non metallic with stainless steel hardware, cable racks shall be complete with insulators. Racks shall be Underground Devices or approved substitution.
- F. Back filling of trenches shall be in layers not more than 8 inches deep, and shall be thoroughly tamped. The first layer shall be earth or sand, free from particles that would be retained on a 1/4 inch sieve. The succeeding layers shall be excavated material having stones no larger than would pass through a 4-inch ring. The back fill shall be level with adjacent surface, except that in sodded or paved areas, a space equal to the thickness of the sod or paving shall be left.
- G. The surface disturbed during the installation of duct shall be restored to its original elevation and condition if not refinished in connection with site work.
- H. All unused conduit openings shall be plugged or capped with a suitable device designed for the purpose; caulking compound shall not be used for plugging conduit openings.
- I. One No. 2 bare solid tinned copper counterpoise shall be run above all duct banks and shall be run into all manholes/handholes and grounded to 5/8" X 20' driven ground rods. Counterpoise shall run into buildings and be grounded at each structures service ground.
- J. All conduits entering a building or structure shall be sealed with duct seal.

PART - 2 PRODUCTS

2.01 DUCT BANK STRUCTURES

- A. Precast Concrete Construction: Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and pullboxes.
 - 1. General: Concrete for precast work shall have an ultimate 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated precast monolithically and placed as a unit, or structures may be assembled sections, design and produced by the manufacturer in accordance with the requirements specified. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.
 - 2. Construction: Structure top, bottom and wall shall be of a uniform thickness of not less than 4 inches. Quantity, size, and location of duct bank entrance windows shall be as required, and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by

at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be 2 inches. Provide drain sumps for precast structures a minimum of 12 inches in diameter and 6 inches deep.

3. Joints: Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to AASHTO M198, Type-B. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.
- B. Precast Concrete manholes and pullboxes (handholes): ASTM C 478. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete manholes and pullboxes. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Metal Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, shall be adequate to accommodate the cable.
- C. Metal Frames and Covers: Shall be made of cast iron. Covers shall weight a minimum 100lb. Frames and covers of steel shall be welded by qualified welders in accordance with standard commercial practice. Covers shall have raised letters of identification as indicated on the drawings. Covers shall have an approved antislip surface. Covers shall be rated AASHTO H20.
- D. Pulling-In Irons: Shall be steel bars bent cast in the walls and floors. In the floor they shall be centered under the cover and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole or pullbox. Pulling-in irons shall project into the box approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.
- E. Cable Racks: Rack arms and insulators, shall be sufficient to accommodate the cables. Racks in manhole and pullbox shall be spaced not more than 2 feet apart, and each box wall shall be provided with a minimum of two racks. The wall bracket shall be stainless steel or fiberglass. Slots for mounting cable rack arms shall be spaced at 8-inch intervals. The cable rack arms shall be of stainless steel or

fiberglass and shall be of removable type. Insulators shall be dry-process glazed porcelain. All metal fasteners and hardware portion of racks shall be stainless steel.

- F. Grounding in manholes and pullboxes: Provide No. 6 AWG bare copper grounding pigtailed on walls of each manhole and pullbox. The pigtailed shall be exothermically welded to the reinforcing bars and shall extend at least 8 inches into box. Two pigtailed shall be provided in each box.
- G. Pull Wire: Plastic rope having a minimum tensile strength of 200 pounds in each empty duct. Leave a minimum of 24 inches of slack at each end of the pull wires.
- H. Composite Handholes: Only where composite handholes are indicated on the drawings, use handholes, covers and boxes of polymer concrete as manufactured by Quazite Corporation. The material shall consist of aggregate bound together with a polyester resin and reinforced with continuous woven glass strands. The covers and boxes shall be designed to be installed flush to grade with cover fitting flush to the box and shall be capable of withstanding normal shipping and installation process without chipping, cracking or structural damage. All boxes shall be manufactured with the use of male/female molds to ensure a consistent wall thickness and structural strength and shall be stackable or extra depth. The boxes and covers shall have dimensions as indicated and shall be concrete gray in color. The cover logo shall be recessed into the cover and shall read INSTRUMENTATION or ELECTRIC as indicated. The composite covers shall be designed for a static vertical load of 8,000 pounds and shall be tested, in the box, to a static load of 12,000 pounds (1.5 safety factor). The test load shall be distributed over a 10 inch by 10 inch by 1 inch thick distribution plate located at the center of the cover. The maximum deflection at a load of 8,000 pounds shall not exceed 0.50 inches. The covers shall be skid resistant and have a minimum coefficient of friction of 0.50 on the top surface for the life of the cover. Coatings will not be provided. The permanent deflection of any surface shall not exceed 10% of the maximum allowable test load deflection. The lockdown mechanism shall be capable of withstanding a minimum torque of 30 foot-pounds. All inserts and fasteners shall be of stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION: conform to NFPA 70 and ANSI C2.

- A. The top of the conduit shall be not less than 24 inches below grade, for low voltage conduits and 48 inches for high voltage ducts. Run conduit in straight lines except where a change of direction is necessary. Provide not less than 3 inches clearance from the conduit to each side of the trench. A minimum clearance of 2 1/2 inches shall be provided between adjacent conduits. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve.
- B. Precast manhole and pullbox Installation: Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted granular fill, 3/4-inch to 1-inch size, extending 12 inches beyond the manhole or pullbox on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

- C. Buried Warning and Identification Tape: Metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch-minimum width, color coded as specified below for the intended utility and warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
- Warning Tape Color Codes
Yellow or red: Electric power
Orange: Instrumentation and Control
- D. Conduit Placement: Duct lines shall have a continuous slope downward toward manholes/handholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, accomplish changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, by long sweep bends having a minimum radius of curvature of 25 feet. Manufactured bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.
- E. Termination and Cleaning of Conduit: Terminate conduits in end-bells where duct lines enter manholes and pullboxes. Separators shall be of precast concrete, high impact polystyrene, steel, or a combination of these. Stagger conduit joints by rows and layers to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt with suitable conduit plugs. As each section of a duct line is completed, draw a non-flexible testing mandrel not less than 12 inches long with a diameter 1/4 inch less than inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush having the same diameter of the duct through the duct, until duct is clear of particles of earth, sand, and gravel; then immediately install end plugs.
- F. Conduit Protection at Concrete Penetrations: Conduits which penetrate concrete (slabs, pavement, and walls) shall be galvanized rigid steel; protected by a PVC sheath at the penetration; PVC sheath shall be 40-mils thick conforming to NEMA RN 1, and shall extend from at least 2 inches below the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches above concrete).
- G. Cable Pulling: Pull Cables down grade with the feed-in point at the manhole or pullbox or point of the highest elevation. Use flexible cable feeds to convey cables through box opening and into duct runs. Accumulate cable slack at each box where space permits by training cable around the interior to form one complete loop. Maintain minimum allowable bending radii in forming such loops.
- H. Cable Lubricants: Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables. Cable lubricants shall be soapstone, graphite, or talc for rubber or plastic jacketed cables. Lubricant shall not be deleterious to the cable sheath, jacket, or outer coverings.
- I. Cable Pulling Tensions: Tensions shall not exceed the maximum pulling tension

recommended by the cable manufacturer.

- J. Installation of Cables in manholes and pullboxes and Handholes: Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators at a maximum of 18 inches. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space opening for future cables, except as otherwise indicated for existing installations.
- K. FIREPROOFING OF CABLES IN MANHOLES: All wire and cables in manholes shall be fireproofed. Strips of fireproofing tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in one-half lapped wrapping, or in two butt-jointed wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable, and shall extend one inch into the ducts. To prevent unraveling, the fireproofing (Arc-proofing) tape shall be random wrapped with tape conforming to type FGT of specification MIL-I-15126. The fireproofing (arc proofing) tape shall consist of a flexible, conformable fabric having one side coated with a flame-retardant, flexible, polymeric coating and/or a chlorinated elastomer. The tape shall not be less than 0.050 inch thick, and shall weigh not less than 2.5 pounds per square yard. The tape shall be non-corrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, saltwater, sewage and fungus. The tape shall have a tensile strength of not less than 40 pounds per inch width, and when tested under USA Standard L14.184 cut strip method. Provide certification the product retains 65 percent of its original tensile strength for the following tests for 168 hours for each requirement;
1. Immersion in distilled water,
 2. Immersion in 3 percent salt water,
 3. Exposure to ultra-violet light (30-watt germicidal lamp),
 4. Exposure to sunlight (Type S-1 sun lamp), and exposure to concentrated sewage

END OF SECTION

SECTION 26 05 51

CONDUIT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Description of System: This Section includes requirements for raceways, fittings, boxes, enclosures, and cabinets for electrical, instrumentation and control system wiring.
- B. Heavy wall PVC (Schedule 80) shall be used for all raceways trapped underground without concrete encasement protection. Conduits in concrete encasement use Schedule 40-PVC. Above ground in areas subject to chemical degradation (chemical storage, chlorine rooms, odor control and scrubber area, etc) use Schedule 80-PVC. Use rigid aluminum conduit for exposed above grade interior area. Electrical Metallic Tubing shall be used within air conditioned electrical rooms for power and for instrumentation and control conduits. Use rigid aluminum conduit above grade on exterior of buildings.
- C. Minimum conduit size for all systems shall be 3/4". All conduits shall be U.L. listed and labeled. Conduit sizes shown on the drawings are to aid the contractor in bidding only; the contractor is responsible for conduit sizes as required by NEC fill tables but do not provide smaller conduits than indicated. The contractor is responsible to coordinate the required conduit sizes and conductor quantities for all control and instrumentation system conduit and wiring with the controls subcontractor prior to installation.
- D. Provide stainless steel or non-metallic conduit supports and 316 stainless steel or brass hardware in all areas.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Product data shall be submitted on:
 - a. Conduit, raceways, wireways.
 - b. Conduit fittings, boxes, enclosures and cabinets.
 - c. Surface metal raceway
 - d. Conduit Schedule identifying conduit tag numbers, locations the conduit connects and the wire count.

PART 2 - PRODUCTS

2.01 ELECTRIC METALLIC TUBING

- A. Electric metallic tubing (thin wall) shall meet Federal EMT Specifications WW-C-563 ANSI C80.3.

2.03 FLEXIBLE CONDUIT

- A. Continuous length, spirally wound. Federal Specification WW-C-566. Liquid-tight Flexible Conduit: Plastic (PVC) jacketed flexible conduit with copper bonding conductor (UL 1660). Flexible conduit fittings: UL 514B.

2.04 PVC CONDUIT

- A. PVC conduit shall be composed of High Impact Virgin homopolymer, PVC (polyvinyl chloride C-200 Compound), and shall conform to industry standards, and be UL 651 listed in accordance with Article 347 of National Electrical Code for underground and exposed use and NEMA standard TC-2. Materials must have tensile strength of 55 PSI, at 70oF, flexural strength of 11,000 PSI, compression strength of 8600 PSI. Manufacturer shall have five years' extruding PVC experience. Consistent with requirements provide PVC conduit products by one of the following manufacturers:
 - 1. Carlon
 - 2. Cantex
 - 3. J.M. Plastics
 - 4. Queen City Plastics

2.05 RIGID ALUMINUM CONDUIT

- A. Provide Rigid Aluminum Conduit of 6063 alloy in temper designation T-1. The fittings are of the same alloy. Provide threaded Rigid Aluminum Conduit to Underwriters Laboratories U.L. 6A, "Standard for Electrical Rigid Metal Conduit and manufactured to ANSI C80.5.
- B. Provide threaded aluminum conduit fittings, of 6063 alloy, cast aluminum with integral insulated throat as manufactured by Allied, OZ Gedney, T&B, Crouse-Hinds, Killark or Appleton.
- C. Provide supplementary corrosion protection for aluminum conduit imbedded in concrete or in contact with soil. Where aluminum conduits are in contact with or penetrate concrete, coat conduit with asphaltic or bitumastic type coating.

2.06 CONDUIT FITTINGS

- A. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
- B. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
- C. Fittings for EMT: Steel compression type.
- D. Fittings, surface boxes and conduit bodies for Rigid Aluminum Conduit shall be heavy cast aluminum with external raised hubs and mounting lugs;- Appleton, Crouse Hinds or approved substitution. Cover plates cast aluminum. Zinc die cast not acceptable.
- E. Conduit locknuts shall be aluminum throughout except steel is acceptable within air conditioned spaces.

- F. Conduit expansion fittings shall be malleable iron, and shall be hot dipped galvanized inside and outside. These fittings shall have a four-inch expansion chamber to allow approximately two-inch movement parallel to conduit run in either direction from normal. They shall have factory-installed packing and internal tinned copper braid packing to serve as an emergency bonding jumper. Unless the fitting used is listed by Underwriters' Laboratories for use "without external bonding jumpers", an external copper bonding jumper shall be installed with each expansion fitting with one end clamped on each conduit entering fitting.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All raceways shall be run in neat and workmanlike manner and shall be properly supported in accordance with latest edition of NEC with approved conduit clamps, hanger rods and structural fasteners except for PVC conduit installed in exterior locations. PVC conduit installed in exterior locations shall be supported at two foot intervals. Supporting conduit and boxes with wire is not approved. All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Exposed raceways shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit, not metal conduit. This does not apply to bare copper ground conductors run with feeders (as specified in this section). Conduits shall be run parallel to building walls wherever possible, exposed or concealed, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- B. All raceways runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- C. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- D. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- E. All raceways shall be run from outlet to outlet exactly as shown on the drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of drawings as previously specified.
- F. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300-5 of the NEC except that the minimum cover for any conduit shall be two feet. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.

- G. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings. Minimum size #12AWG.
- H. Insulated bushings shall be used on all rigid steel conduits terminating in panels, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
- I. Spare conduit stubs shall have pull string pulled in, be capped and location and use marked with concrete marker set flush with finish grade or terminated in a manhole. Marker shall be 6" round X 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- J. All conduit stubbed above floor shall be separated with plastic interlocking spacers manufactured specifically for this purpose, or shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel.
- K. Raceways which do not have conductors furnished under this Division of the specifications shall be left with an approved nylon pullcord in raceway.
- L. Rigid Metallic Conduit, electrical metallic tubing, flexible conduit and PVC conduit shall be manufactured within the United States.
- M. All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12" nor more than 20" of flexible liquid-tight conduit, using special type of connectors with strain relief fittings at both terminations of conduit. Flex connectors shall have insulated throat and shall be T & B 3100 Series or approved substitution. Use angle connectors wherever necessary to relieve angle strain on flex conduit. Connections to dry type transformers shall be made with flexible conduit. Typical length of flex conduit shall be limited to 20" unless specifically approved by the engineer.
- N. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings, except for rigid steel to PVC couplings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand held heat guns are prohibited.
- O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than fifty feet long and interval between expansion fittings in such a runs shall not be greater than 100 feet for steel conduit and 50 feet for PVC conduit.

- P. Electric metallic tubing (thin wall) where installed inside air conditioned buildings above grade shall be joined with steel fittings and steel compression connectors.
- Q. Rigid metallic conduit installed underground shall be coated with waterproofing black mastic before installation, and all joints shall be recoated after installation.
- R. Conduit installations on roofs shall be kept to a bare minimum. Where required, conduit shall be rigid aluminum conduit, including couplings. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.
- S. Underground cable identification: bury a continuous, pre-printed, bright colored metalized plastic (electronically traceable) ribbon cable marker with each underground conduit (or group of conduits), regardless of whether conduits are in ductbanks. Locate directly over conduits, 6" to 8" below finished grade. Delete this requirement under building slabs.
- T. Provide for separation of instrumentation, control and power conductors. Provide a minimum of 24" inch separation for parallel runs of power conduit to instrumentation or control conduit with either conduit being PVC or Aluminum. This separation can be reduced to 8" if metallic grounded separation is provided (steel conduit).
- U. Duct seal all conduit entrances. Foam seal is not acceptable.
- V. All conduits with #3 wire and smaller pulled through them shall have 2 spare conductors pulled in them.
- W. All conduit runs shall have (1) spare conduits installed in the run sized to match the largest conduit in the run.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL

- A. Provide materials and installation for the identification of electrical equipment, components, cables and wiring and safety signs.
- B. Related Work Specified in Other Sections Includes:
Section 26 05 00-Basic Electrical Materials and Methods; Section 26 08 00 Acceptance Testing; Section 26 05 19 Wires and Cables; Section 26 29 13 Control Panels,

1.02 REFERENCES:

- A. Codes and standards incorporated within this Section are:
 - 1. ANSIC2/NFPA70E National Electrical Safety Code (NESC)
 - 2. ANSI Z535.1 Safety Color Code
 - 3. ANSI Z535.2 Environmental and Facility Safety Signs
 - 4. ANSI Z535.3 Criteria for Safety Symbols
 - 5. OSHA Occupational Safety and Health Act: specification 1910.145, Standards for Accident Prevention, Signs and Tags

1.03 SUBMITTALS: Furnish all product submittals used.

- A. Product Data and Information: Furnish manufacturer's catalog data for safety signs, nameplates, labels and markers.
- B. Furnish manufacturer's instructions indicating application conditions and limitations of use; and storage, handling, protection, examination and installation of product.

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

- A. Acceptable Manufacturers: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.
 - 1. W. H. Brady Company
 - 2. Seton
 - 3. Thomas & Betts A.
 - 4. Approved Equal

2.02 MATERIALS

- A. General: Provide identification materials listed and classified by UL or tested by an acceptable Electrical Testing Company certifying the equivalence of the materials to UL listing requirements and OSHA approved.
- B. Laminated Plastic Nameplates: Provide engraved three layer laminated plastic nameplates with black letters on white background with lettering etched through the outer covering and fastened with corrosion resistant pan head brass or stainless

- steel machine nuts and bolts. Do not use mounting cement for fastening nameplates.
1. Provide nameplates with 1-inch high lettering for main breakers, automatic transfer switches, panelboards, transformers, VFD's, control panels and disconnect switches.
 2. Provide nameplates for each motor identifying service or function and lettering of an appropriate size to suit each motor. Submersible motor nameplates to be affixed to equipment disconnect.
 3. Provide approved directories of circuits with typewritten designations of each branch circuit in each panelboard.
 4. Provide smaller lettering for a neat, legible nameplate where the amount of lettering causes excessively large nameplates.

2.03 WIRE MARKERS: Identify wire bundles and each individual wire.

- A. Wire bundles: Provide a permanent waterproof brass or rigid fiber identifying tag attached with nylon self locking "Ty-Raps".
- B. Wire identification markers: Provide a printed white, heat-shrink, seamless tubing type with black bold lettering for wires size No. 10 AWG and smaller. Provide a printed self-laminating white, vinyl type with black bold lettering for wires No. 8 AWG and larger
- C. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Write-On Tags: Polyester tag, 0.015-inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable: Marker for Tags: Permanent, waterproof, black-ink marker recommended by tag manufacturer.

2.04 SAFETY SIGNS: Provide safety signs in accordance with OSHA standards meeting the requirements of ANSI C2, ANSI Z535.1 , ANSI Z535.2 and ANSI Z535.3. Comply with NFPA 70 and 29 CFR 1910.145

- A. Provide safety signs manufactured from vinyl having a minimum thickness of 60 mils with red and black letters and graphics on a white background.
- B. Size: Provide 7-inch by 10-inch signs or smaller if larger size cannot be applied.
- C. Mount safety signs using corrosion-resistant screws. Do not use mounting cement.
- D. 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.
- E. All receptacles and switches shall be identified on the inside of the cover plate by circuit number and panelboard.
- F. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application and with 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

- G. 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 and with 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

2.05 EQUIPMENT IDENTIFICATION LABELS

- A. 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. Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, pilot lights, disconnect switches, manual starting switches, magnetic starters, and all miscellaneous controls, switches and enclosures.
- B. Process control devices and pilot lights shall have identification plates. Identification plates shall be furnished for all line-voltage enclosed-circuit breakers; the plates shall identify the equipment served, voltage, phase(s), and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.
- C. Identification plates shall be three-layer white-black-white, engraved to show black letters on a white background. Letters shall be uppercase. Identification plates 1-1/2 inches high and smaller shall be 1/16 inch thick with engraved lettering 1/8 inch high. Identification plates larger than 1-1/2 inches high shall be 1/8 inch thick with engraved lettering not less than 3/16 inch high. Identification plates having edges of 1-1/2 inches high and larger shall be beveled:
- D. Provide nameplates of minimum letter height as follows: Panelboards, switchboards, safety switches and motor control centers: 1/4-inch, identify panel name; 1/8-inch, identify voltage, phase, number of wires, and source.
- E. Safety color coding for identification of warning signs shall conform to NEMA Z 535. Red identification plates reading CAUTION: 480/277 VOLTS shall be provided in switch and outlet boxes containing 277-or 480-volt circuits. An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. Identification plate shall use white lettering on a red laminated plastic.
- F. Any equipment with externally powered wiring shall be marked with a laminated plastic name plate having 3/16-inch-high white letters on a red background as follows: DANGER – EXTERNAL VOLTAGE SOURCE.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: Install nameplates on the front of equipment, parallel to the equipment lines and secured with corrosion resistant pan head nuts and bolts. Labels to be consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual designations. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

- B. Install laminated nameplates identifying, each electrical equipment enclosure and Individual equipment and devices. The following items shall be equipped with nameplates: All motors; motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches panelboards, circuit breakers, contactors, recorders, transmitters, instruments or relays in separate enclosures, thermostats, photocells, power receptacles, switches controlling equipment or receptacles, switches controlling lighting fixtures where the fixtures are not located within the same space as the controlling switch, termination cabinets, manholes and pull boxes, instrumentation and control terminal cabinets, pull boxes manholes and cabinets. Special electrical systems shall be identified at junction and pull boxes, terminal cabinets and equipment racks.
- C. Electrical contractor is responsible for nameplates on electrical equipment supplied by other divisions and installed and wired by electrical including all instrumentation and controls equipment. A portion of existing equipment affected by this contract shall also receive nameplates as determined by the engineer.
- D. Surface Preparation: Degrease and clean surfaces to receive nameplates, labels and marking paint.
- E. Nameplates shall adequately describe the function of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 277/480V, 3-phase, 4-wire". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine. Equipment Requiring Workspace Clearance shall be labeled According to NFPA 70 applied to door or cover of equipment.
- F. Label all disconnects with nameplates as well as the location from which they are fed
- G. Rework or reuse of existing equipment will require new identification tags for some existing equipment.
- H. Wire Markers: Identify each individual wire with identification tags as follows:
 - 1. Wire identification markers: Provide wire identification markers on each wire at all termination points.
 - a. On power and lighting circuits: The branch circuit or feeder number as indicated on drawings
 - b. On control circuits terminated in motor control centers, switchgears, control panels and alike: The field device and terminal number of the opposite end connection.
 - c. On control circuits at each field device: The panel or compartment number and terminal number of the opposite end connection.
 - 2. Provide oversize wire markers so that after heat shrinking the wire marker can be rotated on the wire. Rotate wire markers so that wire identification number is visible.
 - 3. All wires whether spare or used shall be tagged.
 - 4. Mark wire at both ends.
- I. Raceway Tags
 - 1. Provide raceway tags to identify origin and destination of conduit. Install tags at each terminus and at midpoint of run. Provide tags at minimum intervals of every 50 feet of above grade raceway except where concealed in walls.

- Provide two color hard plastic engraved tags and UV resistant cable ties for attachment.
2. Tag numbers to match that submitted on approved conduit schedule.
- J. Safety Signs: Provide safety signs as follows or as shown:
1. Wording: "DANGER -ELECTRICAL EQUIPMENT, AUTHORIZED PERSONNEL ONLY"
Location: On the outside door of all electrical equipment rooms or areas. On the outside door of all electrical equipment cabinets.
 2. Wording: "DANGER -POWERED FROM MORE THAN ONE SOURCE"
Location: Outside all equipment that operates from more than one power source; ATS, PLCs, Main Tie Main switchgear/MCCs, etc.
 3. Wording: "NOTICE -KEEP DOOR CLOSED" Location: On all doors with another safety sign installed.
 4. Wording: "CAUTION -CONTROLS & INTERLOCKS POWERED FROM MULTIPLE SOURCES". Location: On all control panel doors, MCCs I&C terminal cabinets, etc.
- K. Create and submit conduit schedule. Schedule to identify conduit tag numbers, the locations the conduit connects and the wire count.

END OF SECTION

SECTION 26 05 70

WIRING DEVICES

PART 1 – GENERAL

- 1.01 SCOPE: The Work of this Section shall consist of furnishing all labor, materials, and equipment necessary for installation of wiring devices and plates.
- 1.02 REFERENCES: The latest edition of the following codes or standards shall apply to the design and fabrication of the products and equipment to be supplied under this contract.
- A. NEC (NFPA 70) National Electrical Code
 - B. NETA International Electrical Testing Association - Acceptance Testing specifications
 - C. NEMA 250 - Enclosure for Electrical Equipment (1,000 Volts Maximum)
 - D. Local Building Codes and Standards
 - E. UL 1449 3rd edition Standard for Surge Protection Devices
 - F. UL 498 Standard for Safety Attachment Plugs and Receptacles
- 1.03 SUBMITTALS-submit in accordance with Section 26 05 00.
- A. Shop Drawings: Complete catalog cuts of switches, receptacles, enclosures, covers, and appurtenances, marked to clearly identify proposed materials
 - B. Documentation showing that proposed materials comply with the requirements of NEC and U.L.
- 1.04 TESTING:
- A. Provide checkout, field, and functional testing of wiring devices in accordance with Section 26 05 11.
 - B. Test each receptacle for polarity and ground integrity with a standard receptacle tester.
 - C. Test GFCI receptacle for correct tripping operation with tester.

PART 2 – PRODUCTS

- 2.01 SNAP SWITCHES:
- A. Unless otherwise specified, each snap switch (flush tumbler-toggle) shall be of the Specification grade, heavy-duty type for mounting in a single-gang spacing, fully rated 20 amperes, minimum, at 120-277 VAC, conforming to minimum requirements of the latest revision of the UL.
 - B. Switches shall operate in any position and shall be fully enclosed cup type with entire body molded phenolic or melamine. Fiber, paper or similar insulating material shall not be used for body or cover. Ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts. Brass contact arm.
 - C. Switches for hazardous locations shall be factory sealed, rated at 20 amperes, 120-277 VAC, capable of controlling 100 percent tungsten filament, fluorescent and HID lamp loads.

2.02 RECEPTACLES:

- A. Industrial or Hospital Grade: receptacles shall be in accordance with NEMA Publications and UL Listings. Receptacles shall be rated for 125VAC, 20 amperes, shall be polarized 3 wire type for use with 3 wire cord with grounded lead and 1 designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Receptacles shall also be fire-resistant, with nylon top (face) and bodies and bases with metal plaster ears (integral with the supporting member).
- B. Provide single or duplex receptacles as shown or noted on drawings, and ivory color unless otherwise noted, with triple wipe or equivalent brass alloy power contacts for each prong. Approved manufacturers are Hubbell, Cooper, Pass & Seymour, or Leviton.
- C. All receptacles shall be grounding type with a green-colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper in accordance with NEC, Article 250. Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.
- D. GFCI: Ground-fault circuit interrupting receptacles (GFCI's) shall be installed at the locations indicated and as required by the NEC. GFCI's shall be duplex, Industrial or Hospital grade, tripping at 5 mA. Ratings shall be 125 V, 20 amperes, NEMA WD-1, Configuration 5-20R, capable of interrupting 5,000 amperes without damage.
- E. Provide GFCI receptacles where shown and as required. Feed-through type GFCI's serving standard receptacles will not be permitted.
- F. Pedestal type boxes receptacles shall be cast iron 3/4 inch N.P.T. tapped flanged inlet; double gang, meeting UL Standard 514.
- G. Special purpose receptacles shall have ratings and number of poles as indicated or required for anticipated purpose. Matching plug with cord-grip features shall be provided with each special-purpose receptacle.
- H. Receptacles for hazardous locations shall be single gang receptacles with spring door. Receptacles shall have a factory sealed chamber. The receptacles shall have a delayed action feature requiring the plug to be inserted in the receptacle and rotated before the electrical connection is made. The receptacle shall not work with non-hazardous rated plugs. One plug shall be furnished with each receptacle. The receptacles shall be rated for 20 amps at 125 VAC.
- I. SPD Receptacles: Transient voltage surge suppressing receptacles provide with a filtering capacitor for 7 to 1 average noise reduction and Two way protection for line equipment. Response time less than 1 nanosecond for un-mounted Metal Oxide Varistor (MOV); Overcurrent protection; Thermal protection; Varistor with voltage capabilities of 150V RMS

2.03 PLUG CAPS & CORDS: Provide and install a matching plug cap and properly sized cord for equipment items noted on the drawings.

2.04 DEVICE PLATES:

- A. Provide device plates for each switch, receptacle, signal and telephone outlet, and special purpose outlet. Do not use sectional gang plates for multi-gang boxes.
- B. All Plates shall be of stainless steel except provided cast covers for cast boxes.
- C. Coverplates for exterior GFCI receptacles shall be cast.

PART 3 – EXECUTION

- 3.01 GENERAL: Perform work in accordance with the National Electrical Code.
- 3.02 CONNECTION: Rigidly attach wiring devices in accordance with National Electrical Code. Coordinate installation avoiding interference with other equipment.
- 3.03 GROUNDING: Ground all devices, including switches and receptacles, in accordance with NEC, ART 250.
 - A. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.
 - B. Ground flush receptacles and their metal plates through grounding jumper connections to outlet box and grounding system.

END OF SECTION

SECTION 26 05 73

SHORT CIRCUIT & COORDINATION STUDY & ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 GENERAL SCOPE

- A. Provide the services of a recognized corporately and financially independent firm for the purpose of performing electrical studies and reports on all new electrical equipment supplied in this contract and on existing equipment as herein specified. It is the intent of these Specifications that the study firm work in direct communication with the engineer of record with frequent updates as the work progresses. The study firm shall provide all material, equipment, labor and technical supervision required to perform the studies and reports.
- B. Provide a short circuit, coordination and arc-flash study for entire electrical system. Provide a single final electrical study report incorporating the short circuit, coordination and arc flash study. The final document shall become part of the operation and maintenance manuals for the facility. The report shall be submitted on 8.5-inch by 11-inch paper bound with all field data in appendix form. Drawings within the testing report shall be on 11-inch by 17-inch paper folded to 8.5-inch by 11-inch and drawn with a computer aided design (CAD) package. The computer aided design package shall be Autocad or converted to Autocad. All adjustable breakers shall be fitted with a sticker indicating the coordination values for the equipment.
- C. Provide a short circuit, coordination and arc-flash study from the Utility Service primary OCP to all points downstream. Provide system studies in latest release of SKM Power Systems software. Provide CD-Rom electronic version of SKM Power Systems software data files bound in study report for future use by Owner. The electrical system studies shall be signed and sealed by a Florida registered electrical engineer. All documentation and record drawings shall be verified by the signing engineer. The signing engineer shall meet at the Site with the electrical design Engineer during the information gathering phase and after system evaluation to discuss remedial changes necessary for code compliance. The remedial work study changes shall be incorporated within the electrical studies at no additional cost to the Owner.

1.02 APPLICABLE CODES, STANDARDS, AND REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems.
 - IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
 - IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis.
 - IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings.
 - IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.

B. American National Standards Institute (ANSI):

ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

ANSI C37.5 – Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents.

C. The National Fire Protection Association (NFPA):

NFPA 70 - National Electrical Code, latest edition.

NFPA 70E – Standard for Electrical Safety in the Workplace.

1.03 QUALIFICATIONS

A. The study firm shall be regularly engaged in the study of electrical equipment devices, installations, and systems. The lead, technical person shall be a electrical professional engineer in the state of Florida. The study firm shall provide in house electrical studies and reports as specified. The study firm shall submit proof of 5 similar studies with the above qualifications when requested. At least two of the similar project examples shall include arc flash studies with variable frequency drives.

B. Pre-qualified study firms are:

Emerson Electrical Reliability Services, Inc. (239)-693-7100.

Industrial Electrical Testing, Inc. (904) 260-8378.

Electric Power Systems 407-578-6424.

C. Other firms will be considered by the engineer on submittal of qualifications on or before 20 days prior to Bid.

PART 2 PRODUCT

2.01 SHORT-CIRCUIT ANALYSIS AND COORDINATION STUDY FOR ALL NEW AND EXISTING ELECTRICAL EQUIPMENT

A. Provide an integrated complete study for the total electrical system.

1. Data Collection: Study Firm shall furnish all field data as required by the power system studies. All data shall be verified on site by the signing engineer. The study firm shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to

2. the release of the equipment for manufacturing.
 2. Data may require combination to include present and future utility supplies, motors, and generators.
 3. Load data utilized may include existing and proposed loads obtained from Contract Documents and site visits.
 4. Include fault contribution of existing motors in the study, with motors < 10 hp grouped together. The testing firm shall obtain required existing equipment data, if necessary, to satisfy the study requirements.
- B. Provide a current and complete short-circuit study, equipment interrupting or withstand evaluation, and a protective device coordination study for the electrical distribution system.
1. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.
 2. The studies shall be submitted to the project electrical engineer prior to granting final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture.
 3. The study shall be in accordance with applicable ANSI and IEEE Standards. The study input shall include the utility company's short circuit single and three phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 4. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
 5. An equipment evaluation study shall be performed to determine the adequacy of new and existing circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the existing equipment shall be documented back to the project engineer with recommended remedial actions. The study firm shall coordinate with the supplier of the new equipment to assure all specifications of the new equipment meet or exceed the ratings required by the study at no additional cost to the owner.
 6. A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings. The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.
 7. The time current characteristics of the specified protective devices shall be plotted on appropriate log-log paper. The plots shall include complete

titles, representative one-line diagram and legends, associated power company's relays of fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electric Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate the coordination achieved to each utility main breaker, primary feeder breaker, unit \ substation primary protective device rated or more. There shall be a maximum of four protective devices per plot.

8. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be coordinated with the equipment suppliers and resolved within the scope of the Project and at no additional cost to the Owner.

- C. The results of the power system study shall be summarized in a final report and made part of the operation and maintenance manuals. The report shall include the following sections:

1. Description, purpose, basis written scope, and a single line diagram of the portion of the power system which is included within the scope of study.
2. Tabulations of circuit breaker, fuse and other equipment ratings versus calculated short circuit duties, and commentary regarding same.
3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding same.
4. Fault current tabulations including a definition of terms and a guide for interpretation.

- D. The Contractors certified study firm shall be responsible for setting the breakers. Each breaker shall be fitted with an engraved tag or permanent vinyl label indicating the breaker name and the settings listed:

1. Adjustable pickups and time delays (long time, short time, ground); Adjustable time-current characteristic; Adjustable instantaneous pickup; Recommendations shall incorporate revised settings to mitigate excessive arc flash hazard.

2.02 ARC FLASH EVALUATION

- A. Provide an investigation to quantify the arc-flash hazard to which workers could be exposed to throughout the facility. Establish arc-flash intensity data for all electrical equipment where there may be an occasion to open doors, remove

covers or work on the electrical equipment in such a way that workers are exposed to energized conductors.

- B. Provide a safety policy to include procedures and information regarding the arc flash data developed for the Site. Provide a written recommendation for PPE equipment. The Site safety manual to include procedures and methods related to energized work, PPE standards, and the arc-flash data developed in the analysis.
- C. Provide arc flash evaluations in conformance to IEEE Std. 1584-2004a *IEEE Guide for Performing Arc-Flash Hazard Calculations* and NFPA 70-2008 (NEC) and NFPA 70E-2009 *Standard for Electrical Safety in the Workplace*. The arc flash study shall be performed using computer software that uses methods based on IEEE Std. 1584-2004a. The software used must be capable of modeling all protective devices at the Site and any mitigation devices used to limit the incident energy. The software used must have the capability of modeling user defined PPE descriptions and ATPV values as well as limiting the maximum clearing time where engineering judgment deems it prudent.
- D. The study firm shall collect all data required for the arc flash evaluation. The existing settings and equipment types and ratings shall be field verified. Any data that should be determined to be unverifiable (due to safety or operational concern) shall be identified to the engineer and alternate means to determine the data shall be used.
- E. Where the calculations determine that the breaker settings result in arc flash hazard of category three, four or with incident energy levels ($>40 \text{ cal/cm}^2$), the study engineer shall provide recommended breaker settings or other mitigation recommendations to reduce the incident energy to the lowest level and where energized work is capable of being performed. The study firm shall document the recommended changes and provide time-current curves indicating the coordination that reflects the recommended settings. Where main switchgear incorporates fully compartmentalized breakers and insulated bus, analyze utility main and genset main breaker compartments separate from feeder breaker compartments.
- F. Provide color coded labels per ANSI Z535.4; Yellow=Caution, Orange=Warning, Red=Danger. Use yellow "Caution" labels for Category 0. Provide arc flash hazard category 1-4 equipment with Orange "Warning" Labels. Provide Red "Danger" labels with the words "Energized Work Prohibited" in areas of extreme hazard above 40 cal/cm^2 . Provide labels as approved by the engineer consistent with utility standards.

- G. Provide permanent labels for each electrical enclosure or equipment where workers could be exposed to energized conductors and where required by NEC. Provide die-cut 4-inch by 6-inch labels with preprinted headers. Organize safety information in approved order to communicate quickly, clearly and accurately. Provide Die-cut labels made from industrial grade indoor/outdoor vinyl, providing a long label life. Labels shall not include study firm information. Label layout shall be approved by the Project Engineer. Provide yellow Caution; orange Warning and red Danger labels for category zero, 1-3, 4 and above incident energy categories. Study firm shall supervise installation of labels and provide a statement in the project report that the labels are approved as installed. These labels shall comply with the requirements of NFPA 70E-2009 and include at least the following information:
1. Voltage (phase to phase).
 2. Flash Protection Boundary (inches).
 3. Incident Energy at the working distance (cal/cm^2).
 4. PPE Class and Description (Including glove rating).
 5. Restricted Approach Boundary (inches).
 6. Limited Shock Approach Boundary (inches).
 7. Prohibited Shock Approach Boundary (inches).
 8. Location Identification.
- H. Provide a comprehensive report that includes the basis for and results of numerical assessments. The report shall include any significant conclusions and recommendations for corrective or mitigative action as appropriate. In addition, the report shall include the following:
1. Summary of Project.
 2. Description of system and equipment included in the assessment.
 3. Identification of the methods or software used.
 4. Date Work was performed.
 5. Identification of the person that performed the assessment.
 6. Tabular data indicating; the incident energy and required PPE for all locations evaluated.
 7. Detailed datasheets for each location studied.
 8. Tabular data of recommended settings changes.
 9. Time-current curves for the locations with recommended settings changes.
 10. A one-line diagram of the computer model.
- I. Provide all arc flash hazard tables within the report for all possible scenarios. Provide Arc Flash Labels for the worst case and highest hazard rating for each piece of equipment from any of the possible scenarios. Additionally provide the best case and lowest hazard rating informational CAUTION label adjacent to the worst case hazard label. Provide HRC tables for the following scenarios:
1. Utility main breaker closed in open transition; normal operation.
 2. Generator breakers closed in open transition; normal operation with two generators paralleled.
 3. Generator breaker closed in open transition; normal operation with one generator.
 4. Utility man breaker closed in open transition with the generators locked out and the arc flash maintenance mode operational.

6. Generator breaker closed in open transition with the utility main breaker locked out and the arc flash maintenance mode operational.
7. Switchgear tie breaker closed and one bus utility and standby main breakers open and locked out.
8. Provide additional scenarios as may become evident during the study report.

2.03 SAMPLE LABELS.

Sample Arc Flash Label:



ARC FLASH & SHOCK HAZARD No Energized Work Permitted

| FLASH PROTECTION | | SHOCK PROTECTION | |
|----------------------------|------------------------|-------------------------------|-----------|
| Flash Hazard at: | 18 inches | Glove Class: | 00 |
| Flash Hazard Category: | D | Voltage Rating: | 480 VAC |
| Min. Arc Rating: | 52 cal/cm ² | Limited Approach Boundary: | 42 inches |
| Flash Protection Boundary: | 180 inches | Restricted Approach Boundary: | 12 inches |
| EQUIPMENT: | | Prohibited Approach Boundary: | 1 inches |

PPE Required: DANGEROUS!! NO SAFE PPE CATEGORY



ARC FLASH & SHOCK HAZARD APPROPRIATE PPE REQUIRED

| FLASH PROTECTION | | SHOCK PROTECTION | |
|----------------------------|-------------------------|-------------------------------|---------------|
| Flash Hazard at: | 18 inches | Glove Class: | 00 |
| Flash Hazard Category: | 1 | Voltage Rating: | 240 VAC |
| Min. Arc Rating: | 4.0 cal/cm ² | Limited Approach Boundary: | 42 inches |
| Flash Protection Boundary: | 38 inches | Restricted Approach Boundary: | Avoid Contact |
| EQUIPMENT: | 240V EQUIPMENT | Prohibited Approach Boundary: | Avoid Contact |

PPE Required: Cotton or Non-Melting Undergarments, FR Shirt & Pants or FR Coveralls (Cat 1 or above), Hardhat, Arc-Rated Face-shield, Safety Glasses, Hearing Protection, Leather Work-boots



ARC FLASH & SHOCK HAZARD APPROPRIATE PPE REQUIRED

| FLASH PROTECTION | | SHOCK PROTECTION | |
|----------------------------|-------------------------|-------------------------------|-----------|
| Flash Hazard at: | 18 inches | Glove Class: | 00 |
| Flash Hazard Category: | 0 | Voltage Rating: | 480 VAC |
| Min. Arc Rating: | 1.0 cal/cm ² | Limited Approach Boundary: | 42 inches |
| Flash Protection Boundary: | 17 inches | Restricted Approach Boundary: | 12 inches |
| EQUIPMENT: | | Prohibited Approach Boundary: | 1 inches |

PPE Required: Cotton or Non-Melting Undergarmets. Untreated Cotton Long Sleeve Shirt & Pants or FR Shirt & Pants or FR Coveralls, Hardhat, Arc-Rated Face-shield, Safety Glasses, Hearing Protection, Leather Work-boots

B. Sample

Informational Labels:

CAUTION

Arc Flash Hazard is Reduced to Category-X when Generator Source is locked out from operation.

CAUTION

Arc Flash Hazard is Reduced to Category-X when Generator Source is locked out and Switchgear Arc Flash Maintenance Mode is Active.

END OF SECTION

SECTION 26 08 00

ACCEPTANCE TESTING & PERFORMANCE VERIFICATION

PART 1 - GENERAL

1.01 GENERAL SCOPE

- A. The Contractor shall engage the services of a recognized corporately and financially independent testing firm for the purpose of performing inspections and tests on all new electrical equipment supplied in this contract and on existing modified equipment as herein specified. All tests shall be documented. It is the intent of these specifications that the testing firm work in direct communication with the engineer of record with frequent testing data updates as the work progresses.
- B. The testing firm shall provide all material, equipment, labor and technical supervision to perform such tests and inspections. Testing shall be supervised by qualified professional engineering staff.
- C. It is the purpose of these tests to assure that all tested electrical equipment, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications. Tests shall be performed with and in cooperation with certification tests performed by switchgear and generator manufacturer. The testing contractor shall be an integral part in assuring the coordinated testing and startup of the power system. The tests and inspections shall determine suitability for energization.
- D. An itemized description of existing equipment to be inspected and tested is as follows:
 - 1. Provide testing of existing feeders that are relocated, extended or disturbed in any way.
 - 2. Provide testing of existing breakers that are re-fed, relocated, re-cabled or disturbed in any way.
- E. The above electrical testing shall be used in the development of the final testing report encompassing all new and existing electrical equipment; submitted with the operation and maintenance manuals prior to substantial completion of the project. The testing report shall be submitted on 8.5" X 11" paper bound with all field test data in appendix form plus an electronic copy in Adobe PDF format. All tested breakers shall be fitted with a sticker indicating the testing firm, date and technician performing the test.

1.02 APPLICABLE CODES, STANDARDS, AND REFERENCES

- A. All inspections and test shall be in accordance with the following codes and standards except as provided otherwise herein:
 - 1. National Electrical Manufacturer's Association - NEMA
 - 2. American Society for Testing and Materials - ASTM
 - 3. Institute of Electrical and Electronic Engineers - IEEE
 - 4. International Electrical Testing Association - NETA Acceptance Testing Specifications - ATS-1991
 - 5. American National Standards Institute - ANSI C2: National Electrical Safety

- Code.
- 6. State and local codes and ordinances
- 7. Insulated Cable Engineers Association - ICEA
- 8. Association of Edison Illuminating Companies - AEIC
- 9. Occupational Safety and Health Administration - OSHA
- 10. National Fire Protection Association – NFPA
 - a. ANSI/NFPA 70: National Electrical Code
 - b. ANSI/NFPA 70B: Electrical Equipment Maintenance
 - c. NFPA70E: Standard for Electrical Safety in the Workplace
 - d. ANSI/NFPA 780: Lightning Protection Code
 - e. ANSI/NFPA 101: Life Safety Code

- B. All inspections and test shall utilize the following references:
 - 1. Project design specifications
 - 2. Project design drawings
 - 3. Manufacturer's instruction manuals applicable to each particular apparatus

1.03 QUALIFICATIONS OF TESTING FIRM

- A. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, supplier, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full Member company of the International Electrical Testing Association (NETA).
- D. The lead, on-site, technical person shall be currently certified by the International Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing or be a electrical professional engineer in the state of Florida.
- E. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services. The testing firm shall provide in house electrical studies and reports as specified. The testing firm shall have a Florida registered professional electrical engineer on staff.
- F. The testing firm shall submit proof of the above qualifications when requested. Pre-qualified testing firms for this project are:
 - 1. Emerson Electrical Reliability Services, Inc.
 - 2. Industrial Electrical Testing, Inc.
 - 3. Electric Power Systems

Other firms will be considered by the engineer on submittal of qualifications on or before 20 days prior to bid.

1.04 DIVISION OF RESPONSIBILITY

- A. The contractor shall perform routine insulation-resistance, continuity, and rotation test for all distribution and utilization equipment prior to and in addition to tests

performed by the testing firm specified herein.

- B. The contractor shall supply a suitable and stable source of electrical power to each test site.
- C. The contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling. However the testing firm shall visit the job a minimum of once a week to perform coordination duties required and make reports to the engineer of the installation progress.
- D. The testing firm shall notify the engineer prior to commencement of any testing.
- E. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported to the engineer.
- F. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.
- G. Safety and Precautions
 - 1. Safety practices shall include, but are not limited to, the following requirements:
 - a. Occupational Safety and Health Act.
 - b. Accident Prevention Manual for Industrial Operations, National Safety council
 - c. Applicable state and local safety operating procedures.
 - d. Owner's safety practices.
 - e. National Fire Protection Association - NFPA 70E
 - f. American National Standards for Personnel Protection
 - 2. All test shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.
 - 3. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

1.05 SUITABILITY OF TEST EQUIPMENT

- A. All test equipment shall be in good mechanical and electrical condition.
- B. Digital multimeters used shall be RMS sensing when the variable be measured contains harmonics or dc offset or any deviation from a pure sine wave. Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of 2 percent of the scale used.

PART 2 - INSPECTION AND TEST PROCEDURES

2.01 SWITCHGEAR AND SWITCHBOARD ASSEMBLIES

- A. Visual and Mechanical Inspection

1. Inspect for physical, electrical, and mechanical condition.
2. Compare equipment nameplate information with latest one-line diagram.
3. Check for proper anchorage, required clearances, physical damage and proper alignment.
4. Inspect all doors, panels, and sections for paint, dents, scratches, fit and missing hardware.
5. Verify that fuse and/or circuit breaker sizes and types correspond to drawings.
6. Verify that current and potential transformer ratios correspond to drawings. Inspect all bus connections for high resistance.
7. Check tightness of bolted bus joints by using a calibrated torque wrench. Refer to manufacturer's instructions for proper torque levels. Inspect shipping splits for mechanical connection assuring adequate surface contact.
8. Test all electrical and mechanical interlock systems for proper operation and sequencing. Closure attempt shall be made on locked open devices. Opening attempt shall be made on locked closed devices. Key exchange shall be made with devices operated in off normal positions.
9. Clean entire switchgear using manufacturer's approved methods and materials.
10. Inspect insulators for evidence of physical damage or contaminated surfaces.
11. Verify proper barrier and shutter installation and operation.
12. Lubrication: Verify appropriate contact lubricant on moving current carrying parts. Verify appropriate lubrication on moving and sliding surfaces.
13. Exercise all active components.
14. Inspect all mechanical indicating devices for proper operation.

B. Electrical Tests

1. Perform tests on all instrument transformers.
2. Perform ground resistance tests.
3. Perform insulation resistance on each bus section, phase-to-phase and phase-to-ground for three (3) minutes. Test voltages and minimum resistances shall be in accordance with NETA recommendations.
4. Perform low ohm resistance test on ground bonding & shipping splits with ductor tester (Digital low ohm resistance meter) to insure connection is a low resistance connection. Test from one fixed bus to adjacent fixed bus through the shipping split connector to measure both connection points. Microhm values shall not vary more than 50% from other phase readings and meet the manufactures published data based on bus size, ampacities and material.
5. Perform an overpotential test on each bus section, each phase-to-ground, for three (3) minutes at values indicated in ANSI/IEEE C37.20.2. or manufacturer's recommended potential.
6. Perform insulation-resistance test on control wiring except where connected to solid state components.
7. Perform control wiring performance test. Use the elementary diagrams of the switchgear to identify each remote control and protective device. Conduct tests to verify satisfactory performance of each control feature.
8. Perform secondary voltage energization test on all control power circuits and potential circuits as detailed in this specification. Check voltages levels at each point on terminal boards and at each terminal on devices.
9. Perform current injection tests on the entire current circuit in each section of switchgear. Perform current test by primary injection where possible; secondary injection if not.

10. Determine accuracy of all meters and calibrate watt-hour meters. Verify multipliers.
 11. Perform phasing check on double-ended switchgear to ensure proper bus phasing from each source.
 12. Control Power Transformers - Dry Type
 - a. Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - b. Verify proper primary and secondary fuse ratings or circuit breakers.
 - c. Verify proper interlock function and contact operation.
 - d. Perform insulation-resistance test. Perform measurements from winding-to-winding and windings-to-ground.
 - e. Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to proper secondary voltage. Check potential at all devices. Verify proper secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
 13. Potential Transformer Circuits
 - a. Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to proper secondary voltage. Check for proper potential at all devices.
 - b. Verify secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.
- C. Test Values: Verify Bolt-torque values, Insulation resistance, overpotential levels in conformance to NETA standards or specified by manufacturer.
- 2.02 CABLES - LOW VOLTAGE - 600V Maximum (all cables except 20 and 30amp lighting and receptacle circuits).
- A. Visual and Mechanical Inspection
 1. Inspect cables for physical damage and proper connection in accordance with drawings.
 2. Test cable mechanical connections to manufacturer's recommended values or NETA Standards using a calibrated torque wrench.
 3. Check cable color coding with applicable engineer's specifications and National Electrical Code standards.
 - B. Electrical Tests
 1. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 3 minutes.
 2. Perform continuity test to insure proper cable connection.
 3. Test Values; Evaluate results by comparison with cables of same length and type. Minimum acceptable value shall be no less than 50 megohms for new feeders; 5 megohms for existing reused, renovated, rerouted or extended feeders.
- 2.03 CIRCUIT BREAKERS (all breakers except 20 and 30amp breakers; test all GFCI breakers)
- A. Circuit Breakers - Low Voltage insulated case/molded case
 1. Visual and Mechanical Inspection

- a. Check circuit breaker for proper mounting and compare nameplate data to drawings and specifications.
 - b. Operate circuit breaker to ensure smooth operation.
 - c. Inspect case for cracks or other defects.
 - d. Check tightness of connections using calibrated torque wrench. Refer to manufacturer's instructions or NETA standards for proper torque levels.
2. Electrical Tests
- a. Perform a contact-resistance test.
 - b. Perform an insulation-resistance test at 1000 volts dc from pole to pole and from each pole to ground with breaker closed and across open contacts of each phase.
 - c. Determine long-time minimum pickup current by primary current injection where practical.
 - d. Perform long-time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time.
 - e. Determine short-time pickup and delay by primary current injection, if applicable.
 - f. Determine ground-fault pickup and time delay by primary current injection, if applicable.
 - g. Determine instantaneous pickup current by primary injection using run-up or pulse method.
3. Test Values
- a. Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
 - b. Insulation resistance shall not be less than 100 megohms.
 - c. Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - d. All trip times shall fall within NETA Standards. Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
 - e. Instantaneous pickup values shall be within NETA standards.

2.04 METERING AND INSTRUMENTATION

- A. Visual and Mechanical Inspection
 - 1. Examine all devices for broken parts, shipping damage and tightness of connections.
 - 2. Verify that meter types, scales and connections are in accordance with drawings and specifications.
- B. Electrical Tests
 - 1. Determine accuracy of meters at 25/50/75/100% of full scale.
 - 2. Calibrate watt-hour meters to one-half percent (0.5%).
 - 3. Verify all instrument multipliers.
 - 4. Verify calibration of all instrumentation is accurate to the operator interface terminals

2.05 GROUNDING SYSTEMS: (provide for new and upgraded grounding systems)

- A. Visual and Mechanical Inspection
- B. Inspect ground systems for compliance with drawings and specifications.
- C. Perform ground-impedance measurements utilizing the fall-of-potential method per ANSI/IEEE Standard 81 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System." Instrumentation utilized shall be as Approved by NETA Standards and shall be specifically designed for ground impedance testing. Provide sufficient spacing so that plotted curves flatten. In large ground grid systems where adequate pole distance is not practical provide Tagg Slope technique or the intersecting curves method. (Ref. Nos. 40 and 41 in IEEE Std. 81.)of calculating system resistance.
- D. Equipment Grounds: Utilize two-point method of IEEE Std. 81. Measure between equipment ground being tested and known low-impedance grounding electrode of system:
- E. Lightning protection ground system test values within the ground system should be 5 ohms or less tested with a clamp on ground test instrument. Down conductor tests at grade level should be 2 ohms or less. Investigate high resistance connections and correct readings above these limits.
- F. The main ground electrode system impedance-to-ground should be no greater than one (1) ohms. Equipment grounds, depending on size and length of grounding conductor, should be only fractionally higher than system ground.

2.06 GROUND-FAULT SYSTEMS

- A. Visual and Mechanical Inspection
 - 1. Inspect for physical damage and compliance with drawings and specifications.
 - 2. Inspect neutral main bonding connection to assure:
 - a. Zero-sequence sensing system is grounded.
 - b. Ground-strap sensing systems are grounded through sensing device.
 - c. Ground connection is made ahead of neutral disconnect link on zero-sequence sensing systems.
 - d. Grounded conductor (neutral) is solidly grounded.
 - 3. Inspect control power transformer to ensure adequate capacity for system.
 - 4. Manually operate monitor panels (if present) for: Trip test; No trip test; Non-automatic reset.
 - 5. Record proper operation and test sequence.
 - 6. Set pick-up and time-delay settings in accordance with the settings provided by the manufacturer.
- B. Electrical Tests
 - 1. Measure system neutral insulation resistance to ensure no shunt ground paths exist. Remove neutral-ground disconnect link. Measure neutral insulation resistance and replace link.
 - 2. Determine the relay pickup current by current injection at the sensor and operate the circuit interrupting device.

3. Test the relay timing by injecting three hundred percent (300%) of pickup current, or as specified by manufacturer.
4. Test the system operation at fifty-seven percent (57%) rated control voltage, if applicable.
5. Test zone interlock systems by simultaneous sensor current injection and monitoring zone blocking function.
6. On multiple source, tie breaker, etc., systems, devise a simulation scheme that fully proves correct operation.

C. Test Parameters

1. System neutral insulation shall be a minimum of one hundred (100) ohms, preferable one (1) megohm or greater.
2. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves but in no case longer than one (1) second for fault currents equal to or greater than 3,000 amperes.
3. Relay pickup value shall be within 10% of setting and in no case greater than 1200A.

2.09 TRANSFORMERS - DRY TYPE TRANSFORMERS - Small Dry Type, Air-Cooled (600 Volt and Below)

- A. Inspect for physical damage, broken insulation, tightness of connections, defective wiring, and general condition.
- B. Thoroughly clean unit prior to making any tests.
- C. Perform insulation-resistance test. Perform test verification for impedance.
- D. Energize primary winding with system voltage. Measure secondary voltage with the secondary load disconnected. Record results.

2.10 THERMOGRAPHIC SURVEY (provide for all new or modified switchgear, bus ducts, transformers, points of power connection equal to or greater than 30amps, MCC's and distribution centers)

- A. Visual and Mechanical
 1. Remove all necessary covers prior to scanning.
 2. Inspect for physical, electrical, and mechanical condition.
- B. Equipment to be Scanned
 1. All new and existing equipment with ratings of 30amps or more.
- C. Provide report indicating the following:
 1. Problem area (location of "hot spot")
 2. Temperature rise between "hot spot" and normal or reference area.
 3. Cause of heat rise
 4. Phase unbalance, if present
 5. Areas scanned
- D. Test Parameters
 1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
 2. Equipment shall detect emitted radiation and convert detected radiation to

- visual signal.
- 3. Infrared surveys should be performed during periods of maximum possible loading but not less than twenty percent (20%) of rated load of the electrical equipment being inspected.
- 4. Provide photographs and/or the thermogram of the deficient area as seen on the imaging system

2.11 LOW VOLTAGE SURGE SUPPRESSORS

- A. Visual and mechanical inspection
 - 1. Verify suppressors are installed with minimum length leads to the protected equipment. Verify connections to bus.
 - 2. Verify ground connections to ground bus.
- B. Electrical Tests
 - 1. Test clamping voltage and verify meets specified ratings; test in accordance with ANSI C62.33 section 4.4 and 4.7

2.12 LOW VOLTAGE AIR SWITCHES (disconnect switches, manual & automatic transfer switches)

- A. Visual and Mechanical Inspection
 - 1. Compare equipment nameplate data with drawings and specs.
 - 2. Inspection for mechanical and physical damage. Cleaning of interior, insulators, arc chutes.
 - 3. Testing of mechanical operator. Cleaning and lubrication of contacts and mechanism, as applicable.
 - 4. Verification of contact alignment and wipe. Verify phase barrier insulation.
 - 5. Inspect anchorage, alignment, grounding, and required clearances..
 - 6. Documentation of fuse and types are in accordance with drawings, short circuit studies and coordination study.
 - 7. Verification of tightness of accessible bolted electrical connections by calibrated torque-wrench method.
 - 8. Verification of presence of expulsion-limiting devices on all holders having expulsion-type elements.
 - 9. Verification of interlocking systems for proper operation and sequencing.
 - 10. Verify proper lubrication on current carrying and moving sliding parts.
- B. Electrical Tests
 - 1. Contact resistance testing across each switch blade and fuse holder.
 - 2. Measurement of fuse resistance.
 - 3. Insulation resistance testing on each pole, phase-to-phase and phase-to-ground with switch closed and across each open pole for one minute.
 - 4. AC or DC overpotential testing phase-to-phase and phase-to-ground.
 - 5. Verification of proper space heater operation.

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.01 DESCRIPTION-this section specifies the furnishing, installation and connection of the dry type general-purpose transformers.

1.02 RELATED WORK

- A. Section 26 05 11, Requirements For Electrical Installations:
- B. Section 26 05 51, Conduit Systems:
- C. Section 26 05 19, Low-Voltage Electrical Power Conductors And Cables
- D. Section 26 05 26, Grounding And Bonding For Electrical Systems:

1.03 SUBMITTALS

- A. In accordance with Section 26 05 00
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, impedance, dimensions, weight, mounting details, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
 - 3. Complete nameplate data including manufacturer's name and catalog number.
- C. Manuals:
 - 1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.

1.03 REFERENCES

- A. National Fire Protection Association (NFPA) 70-08 National Electrical Code (NEC)
- B. National Electrical Manufacturers Association (NEMA): ST 20-97 Dry-Type Transformers for General Applications

PART 2 – PRODUCTS

2.01 GENERAL PURPOSE DRY TYPE TRANSFORMERS

- A. Unless otherwise specified, dry type transformers shall be in accordance with NEMA, NEC and as shown on the drawings. Transformers shall be UL listed or labeled.
- B. Dry type transformers shall have the following features:
 - 1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers will not be accepted.

2. Rating shall be as shown on the drawings. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
3. Transformers shall have copper windings.
4. Insulation systems:
 - a. Transformers 30 KVA and larger: UL rated 220 degrees C system having an average maximum rise by resistance of 150 degrees C in a maximum ambient of 40 degrees C.
 - b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degrees C system having an average maximum rise by resistance of 115 degrees C in a maximum ambient of 40 degrees C.
5. Core and coil assemblies:
 - a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
 - b. Cores shall be grain oriented, non-aging, and silicon steel.
 - c. Coils shall be continuous windings without splices except for taps.
 - d. Coil loss and core loss shall be minimum for efficient operation.
 - e. Primary and secondary tap connections shall be brazed or pressure type.
 - f. Coil windings shall have end fillers or tie downs for maximum strength.
6. Certified sound levels determined in accordance with NEMA, shall not exceed the following:

| Transformer Rating | Sound Level Rating |
|--------------------|--------------------|
| 0 - 9 KVA | 40 dB |
| 10 - 50 KVA | 45 dB |
| 51 - 150 KVA | 50 dB |
| 151 - 300 KVA | 55 dB |
| 301 - 500 KVA | 60 dB |

7. Nominal impedance shall be as per NEMA.
8. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2-1/2 percent full capacity taps above, and four, 2-1/2 percent full capacity taps below normal rated primary voltage.
9. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
10. Enclosures:
 - a. Not less than code gage steel.
 - b. Outdoor enclosures shall be NEMA 3R stainless steel.
 - c. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
 - d. Ventilation openings shall prevent accidental access to live components.

- e. Thoroughly clean and paint enclosure at the factory with manufacturer's prime coat and standard finish.
- 11. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.
- 12. Dimensions and configurations shall conform to the spaces designated for their installations.
- 13. Transformers shall meet the minimum energy efficiency values per NEMA TP1 as listed below:

| kVA Rating | Output efficiency (%) |
|------------|-----------------------|
| 15 | 97 |
| 30 | 97.5 |
| 45 | 97.7 |
| 75 | 98 |
| 112.5 | 98.2 |
| 150 | 98.3 |
| 225 | 98.5 |
| 312 | 98.6 |

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.
- B. Install the transformers with adequate clearance at a minimum of 4 inches from wall and adjacent equipment for air circulation to remove the heat produced by transformers.
- C. Install transformers on vibration pads designed to suppress transformer noise and vibrations.
- D. Use flexible metal conduit to enclose the conductors from the transformer to the raceway systems.

END OF SECTION

SECTION 26 23 00

METAL-ENCLOSED COMPARTMENTALIZED DRAWOUT SWITCHGEAR

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install, where indicated on the drawings, a deadfront type, low voltage metal-enclosed switchgear assembly utilizing compartmentalized drawout insulated case power circuit breakers, as specified herein and as shown on the contract drawings. Provide all switchgear with insulated isolated bus for enhanced arc flash mitigation. The switchgear shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.
- B. Provide EPA class-one reliable switchgear; double ended and sectionalized main-tie-main gear.

1.02 RELATED SECTIONS

- A. Section 26 43 00 Surge Protection Devices
- B. Section 26 32 13 Standby Power System
- C. Section 26 08 00 Electrical Testing
- D. Section 26 05 00 Basic Electrical Materials And Methods
- E. Section 26 28 11 Circuit Breakers & Fused Switches

1.03 REFERENCES

- A. The low voltage metal-enclosed switchgear assembly and all components shall be designed, manufactured, and tested in accordance with the following latest applicable standards:
 - 1. ANSI-C37.20 – Switchgear assemblies
 - 2. ANSI-C37.13 – Low voltage power circuit breakers
 - 3. ANSI-C37.17 – Trip devices
 - 4. NEMA SG-5 – Switchgear assemblies
 - 5. NEMA SG-3 – Low voltage power circuit breakers
 - 6. UL 1558
 - 7. ANSI: Z55.1, Gray Finishes for Industrial Apparatus and Equipment.
 - 8. NFPA : 70, National Electrical Code. (NEC)

1.04 QUALIFICATIONS

- A. The equipment must be purchased from the manufacturers authorized representative authorized to represent the manufacturer in the projects territory.

- B. The manufacturer of the automatic transfer switch shall be the manufacturer of the major components within the assembly.
- C. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- E. The automatic transfer switches shall be suitable for Service Entrance.

1.05 SUBMITTALS

- A. Shop Drawings
 - 1. Itemized Bill-of-Material
 - 2. Master drawing index
 - 3. Dimensional drawings; Front view and plan view of the assembly.
 - 4. Anchoring instructions and details.
 - 5. One-line, three-line, wiring diagrams and control schematic drawings.
 - 6. Connection and interconnection drawings.
 - 7. Incoming line section equipment data. Conduit entrance locations.
 - 8. Nameplate schedule
 - 9. Component list
 - 10. Ground Fault protection: Relay time-current characteristics.
 - 11. Circuit Breakers: Copies of time-current characteristics.
 - 12. Conduit space locations within the assembly
 - 13. Assembly ratings including:
 - 14. Short-circuit rating
 - 15. Voltage
 - 16. Continuous current rating
 - 17. Major component ratings including:
 - 18. Voltage
 - a. Continuous current rating
 - b. Interrupting ratings
 - 19. Cable terminal sizes
 - 20. Product data sheets.
 - 21. TVSS data
 - 22. Bus data; Busway connections
 - 23. Key interlock scheme drawing and sequence of operations
 - 24. Mimic bus size and color.
 - 25. Operational description.
- B. Quality Control Submittals:
 - 1. Manufacturer's installation instructions.
 - 2. Certified Factory Test Report.
 - 3. Operations and Maintenance Manual.

1.06 SUBMITTALS – OPERATION AND MAINTENANCE MANUALS:

- A. Equipment operation and maintenance manuals shall be provided, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component. O&M manuals shall include site specific layout and assembly drawings with complete module and device information.
- B. The following information shall be included for record purposes:
 - 1. Final as-built drawings and information for all items listed above.
 - 2. Wiring diagrams
 - 3. Certified production test reports
 - 4. Installation information
 - 5. Seismic certification.
- C. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.07 REGULATORY REQUIREMENTS

- A. The switchgear and switchboards shall bear a UL 1558 label.
- B. Provide ATS system that meets the requirements of NEC-2011 section 225-31 and 225-36. Provide service entrance rated equipment suitable for disconnecting means.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 SPARE PARTS

- A. Furnish tag, and box for shipment and storage the following spare parts:
 - 1. Fuses: One complete set of spare fuses of each current rating, both power and control.
 - 2. Lights: One complete box (minimum 12) of each type indicating lights.
 - 3. Paint: One pint, to match enclosure exterior finish in color and quality.
 - 4. Indicating Lamp Pullers: Two each.
 - 5. Indicating Lamp Resistors and Sockets: Two each.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Provide equipment by Square D with arc flash maintenance mode for increased arc flash mitigation for maintenance personnel. Equipment provided by integrated equipment manufacturers, Cummins Onan, utilizing the approved manufacturers breakers and structures will be considered equal.

- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer twenty (20) days prior to bid date.

2.02 RATINGS

- A. Voltage rating shall be as indicated on the drawings. The entire assembly shall be suitable for 600 volts maximum AC service.
- B. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of minimum 65,000 amperes symmetrical at rated voltage or higher as shown on the drawings.
- C. The bus system shall have a minimum ANSI 4-cycle short-circuit withstand rating of 100,000 amperes symmetrical.
- D. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes. To ensure a fully selective system, all circuit breakers shall have 30 cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
- E. All ratings shall be tested to the requirements of ANSI C37.20.1, C37.50 and C37.51 and UL witnessed and approved.

2.03 DRAWOUT CONSTRUCTION

- A. The switchgear shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide ventilators located on the top of the switchgear over the breaker and bus compartments to ensure adequate ventilation within the enclosure. The switchgear rear access shall be through full size hinged swing doors. Doors shall be secured using captive hardware. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills. Provisions shall be made for jacking of shipping groups, for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids. The base shall be equipped with slots in the base frame members to accommodate the use of pry bars for moving the equipment to its final position. Provide a breaker trolley winch capable of lifting breakers in and out for service.
- B. Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized bus compartment and a rear cable compartment. Each individual circuit breaker compartment, or cell, shall be segregated from adjacent

compartments and sections by means of steel barriers to the maximum extent possible. All protective devices shall be compartmentalized with line and load bus connections. Devices shall be front removable and load connections rear accessible. Insulated rigid copper bus connections shall extend from the load side of over-current feeder devices into rear compartment where outgoing cable connections may be made without reaching into the main horizontal or vertical bus compartment. Distribution sections shall be sectionalized to provide a front device section, an intermediate bus section and a rear feeder cable section. It shall be equipped with drawout rails and primary and secondary disconnecting contacts. Current transformers for feeder instrumentation shall be located within the appropriate breaker cells and be front accessible and removable.

- C. The stationary part of the primary disconnecting devices for each power circuit breaker shall be breaker mounted and consist of a set of contacts extending to the rear through glass polyester insulating support barrier; corresponding moving finger contacts, suitably spaced, shall be furnished on the power circuit breaker studs which engage in only the connected position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include three-phase bus connections between the section bus and the breaker line side studs. Load studs in the rear cable compartment of each structure shall be equipped with insulated copper load extension buses terminating in two hole long barrel hypress crimp lugs (Burndy, no equal). Bus extensions shall be silver or tin-plated where outgoing terminals are attached.
- D. The circuit breaker door design shall be such that the following functions may be performed without the need to open the circuit breaker door: lever circuit breaker between positions, operate manual charging system, close and open circuit breaker, examine and adjust trip unit, and read circuit breaker rating nameplate.
- E. The secondary disconnecting devices shall consist of floating terminals mounted on the stationary unit and engaging mating contacts at the front of the breaker. The secondary disconnecting devices shall be gold-plated and engagement shall be maintained in the "connected" and "test" positions.
- F. The removable power circuit breaker element shall be equipped with disconnecting contacts and interlocks for drawout application. It shall have four positions, "connected," "test," "disconnected" and "removed." The breaker drawout element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Levering shall be accomplished via the use of conventional tools. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering "in" or "out" of the cell. The breaker shall include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall provide for securing the breaker in the connected, test, or disconnected position by preventing levering.
- G. The switchgear mains, utility and paralleling breakers, shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

- H. Provide a rear compartment steel barrier between the cable compartment and the main bus to protect against inadvertent contact with main or vertical bus bars.
- I. Provide in the cell when the circuit breaker is withdrawn, a safety shutter which automatically covers the line and load stabs and protects against incidental contact.
- J. Provide a metal barrier full height and depth between adjacent vertical main utility and emergency breakers and the paralleling breaker structures in the cable compartments.
- K. Provide individual breaker compartmentalization.

2.04 BUS

- A. All bus bars shall be insulated tin or silver-plated copper and be density rated at maximum of 1000amps/sq-in. Temperature rated bus is not acceptable. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane.
- B. Provide a neutral bus in the main ATS and emergency main sections for connection of the genset neutral cables to the common neutral to ground connection. The neutral is not required in the distribution sections.
- C. A 1/4 x 4 inch copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchgear. The ground bus short-time withstand rating shall meet that of the largest circuit breaker within the assembly. Bus shall be braced for peak symmetrical amperage available from all generator sets plus motor contributions and shall be rated at 100,000 amps RMS, minimum.
- D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with Belleville-type washers. Provide all switchgear with insulated isolated bus for enhanced arc flash mitigation.

2.05 WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the switchgear shall be furnished as required. Control components mounted within the assembly shall be suitably marked for identification corresponding to the appropriate designations on manufacturer's wiring diagrams.
- B. Provide a front accessible, isolated vertical wireway for routing of factory and field wiring. Factory provisions shall be made for securing field wiring without the need for adhesive wire anchors.
- C. Front access to all circuit breaker secondary connection points shall be provided for ease of troubleshooting and connection to external field connections without the need of removing the circuit breaker for access.

- D. All control wire shall be type SIS. Control wiring shall be 14 ga for control circuits and 12 ga for shunt trip and current transformer circuits. Wire bundles shall be secured with nylon ties and anchored to the assembly with the use of pre-punched wire lances or nylon non-adhesive anchors. All current transformer secondary leads shall first be connected to conveniently accessible shorting terminal blocks before connecting to any other device. Shorting screws with provisions for storage shall be provided. All groups of control wires leaving the switchgear shall be provided with terminal blocks with suitable numbering strips and provisions for #10 AWG field connections. Each control wire shall be marked to the origin zone/wire name/destination zone over the entire length of the wire using a UV cured ink process. Provide wire markers at each end of all control wiring. Plug-in terminal blocks or spade lug terminal blocks shall be provided for all shipping split wires. Terminal connections to remote devices or sources shall be front accessible via doors above each circuit breaker.
- E. Provide switchgear cable connections with long barrel double crimp insulated two-hole Hi-press compression lugs as manufactured by Burndy, no equal.
- F. Reusable insulating boots shall be provided to cover all power cable terminations.
- G. Switchgear wiring shall be composed of UL listed, 105 degree centigrade rated material, with all wiring labeled at each end. Each wire, device or function shall be suitably identified by silk screen or similar permanent identification corresponding to the same identifiers shown on the shop drawings.

2.06 DRAW OUT POWER CIRCUIT BREAKERS

- A. Provide power circuit devices, type low-voltage power circuit breakers, Square D type MasterPact NW or approved equal. Frame ratings shall be 800, 1600, 2000, 3200, 4000 amperes. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
- B. Breakers shall be electrically operated (EO). Breakers to be operated by an electrically charged, mechanically held and electrically trip free stored energy mechanism. Provide for manual charging of the mechanism.
- C. Electrically operated breakers shall be complete with close/open pushbuttons control switch, plus red and green indicating lights to indicate breaker contact position 120 Vac motor operators; the charging time of the motor shall not exceed 6 seconds. Source voltage shall be taken from a control power transformer internal to the switchgear assembly.
- D. Breakers shall be provided in drawout configuration with rack out mechanisms. Physical frame sizes shall have a common height and depth.
- E. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes or higher where shown on the drawings. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.

- F. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standards. The circuit breakers shall carry a UL label.
- G. Provide Arc Flash Reduction Maintenance Remote accessory. The Arc Flash Reduction Maintenance Remote shall allow the operator to enable a maintenance mode with a preset accelerated instantaneous override trip to reduce arc flash energy.
- H. Breaker shall be 120VAC charging, with DC shunt trip system. Provide system with an individual control power transformer for the generator and stand-by mains, on the generator side of the breaker; and the utility main breaker, on the utility side of the breaker. The tie breaker shall have control power for charging from both sides. Provide surge voltage isolation and voltage sensors on all phases of both sources.
- I. Provide interlocks to prevent withdrawal of the breaker unless it is open.
- J. To facilitate lifting, the power circuit breaker shall have integral handles on the side of the breaker. Provide trolley hoist system with rails on top of the gear.
- K. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.
- L. The power circuit breaker shall have three windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be plug and lock type and UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.
- M. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.
- N. The current sensors shall have a back cover window that will permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.
- O. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be Connect (Red), Test (Yellow), and Disconnect (Green). The levering door shall be interlocked so that when the breaker is in the closed position, the breaker levering-in door shall not open.
- P. Each power circuit breaker shall offer sixty (60) front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will

accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.

- Q. Include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall secure the breaker in the connected, test or disconnected position by preventing levering

2.07 TRIP UNITS

- A. Each low-voltage power circuit breaker and insulated case circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall Square D Micrologic P with MODBUS communication module.
- B. The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.
- C. The trip unit shall be provided with a display panel, including a representation of the time/current curve that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.
- D. The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.
- E. Trip unit shall have selectable thermal memory for enhanced circuit protection.
- F. The trip unit shall provide zone interlocking for the short-time delay and ground fault delay trip functions for improved system coordination. The zone interlocking system shall restrain the tripping of an upstream breaker and allow the breaker closest to the fault to trip with no intentional time delay. In the event that the downstream breaker does not trip, the upstream breaker shall trip after a preset time delay. Factory shall wire for zone interlocking for the power circuit breakers within the switchgear.
- G. The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.

- H. The trip unit shall be equipped to permit communication via Modbus to the Square D CM 4400 power monitors provided in the equipment for remote monitoring and control. All monitored parameters shall be transmitted via Modbus TCP to the existing plant power monitoring and control system network.
- I. The trip unit shall include a power/relay module, which shall supply control power to the readout display. Following an automatic trip operation of the circuit breaker, the trip unit shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. An internal relay shall be programmable to provide contacts for remote ground alarm indication.
- J. The trip unit shall include a voltage transformer module, suitable for operation up to 600V, 50/60 Hz. The primary of the power relay module shall be connected internally to the line side of the circuit breaker through a dielectric test disconnect plug.
- K. The display for the trip units shall be a 24-character LED display.
- L. Metering display accuracy of the complete system, including current sensors, auxiliary CTs, and the trip unit, shall be +/- 1% of full scale for current values. Metering display accuracy of the complete system shall be +/- 2% of full scale for power and energy values.
- M. The unit shall be capable of monitoring the following data:
 - 1. Instantaneous value of phase, neutral and ground current
 - 2. Instantaneous value of line-to-line voltage
 - 3. Minimum and maximum current values
 - 4. Watts, vars, VA, watthours, varhours, and VA hours, Peak demand, Present demand, Energy consumption.
 - 5. Crest factor, power factor, percent total harmonic distortion, and harmonic values of all phases through the 31st harmonic.
- N. An adjustable high load alarm shall be provided, adjustable from 50 to 100% of the long delay pickup setting.
- O. The trip unit shall contain an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.
- P. Programming may be done via a keypad at the faceplate of the unit or via the communication network.
- Q. System coordination shall be provided by the following microprocessor-based programmable time-current curve shaping adjustments. The short-time pickup adjustment shall be dependant on the long delay setting.
 - 1. Programmable long-time setting
 - 2. Programmable long-time delay with selectable I^2t or I^4t curve shaping
 - 3. Programmable short-time setting
 - 4. Programmable short-time delay with selectable flat or I^2t curve shaping, and zone selective interlocking

5. Programmable instantaneous setting
 6. Programmable ground fault setting trip or ground fault setting alarm
 7. Programmable ground fault delay with selectable flat or I^2t curve shaping and zone selective interlocking
- R. The trip unit shall have the following advanced features integral to the trip unit:
1. Adjustable undervoltage release
 2. Adjustable overvoltage release
 3. Reverse load and fault current
 4. Reverse sequence voltage alarm
 5. Underfrequency
 6. Overfrequency
 7. Voltage phase unbalance and phase loss during current detection
- S. The main breakers fitted with trip units shall be provided with an Arcflash Reduction Maintenance System. Alternate Maintenance Setting (AMS) switch. The switch will enable temporary arc-flash incident energy reduction during maintenance activities.
1. For each utility main circuit breaker, provide a manual switch on the compartment door to switch the circuit breaker short time tripping characteristics to instantaneous with minimum pick-up setting, in order to reduce the danger from potential arc-flash at downstream equipment.
 2. Provide a lock feature for the AMS switch so that it may be locked in either the Off or On maintenance mode position.
 3. Provide a blue LED indicating light to indicate AMS switch is in the maintenance mode.
 4. Wire contacts on all AMS switches to a common alarm input to plant control system.
 5. Provide for remote AMS switches or indication, as needed.
 6. If circuit breaker integral trip unit cannot be controlled as specified, provide discrete relay with shunt-trip or equivalent to provide specified performance.

2.08 MICROPROCESSOR CONTROLS

- A. The logic of the transfer switch shall function via a microprocessor. Programmable Logic Controllers are not acceptable. Provide dedicated microprocessor based electronic transfer device for each transfer pair equal to
1. Cummins-Onan MCM3320 Control
- B. The set points shall be field adjustable without the use of special tools. LED lights shall be included on the exterior of the switch to show:
1. Normal Source Available
 2. Emergency Source Available
 3. Normal Source Connected
 4. Emergency Source Connected
 5. Load Energized.
 6. System not in Auto
 7. Generator Test active
- C. Provide 16 point Aux 101, slot 102 I/O expansion module to provide hardwired generator and ATS monitoring points to plant SCADA system.

1. The expansion module shall indicate the following status/alarm and shutdown signals to the plant SCADA system
 - a. Generator Running
 - b. Generator Common Fault
 - c. MCM 3320 Common Fault
 - d. Generator Not in Auto

- D. A digital readout shall display each option as it is functioning. Readouts shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the microprocessor shall display the timer counting down. All set points can be re-programmed from the front of the switch when the switch is in the program mode. A genset test pushbutton shall be included as part of the microprocessor. The switch shall include the following:
 1. Provide a time delay transfer from the normal power source to the emergency power source (0 seconds to 30 minutes). This option does not effect the engine start circuit.
 2. Provide a timer to override a momentary power outage or voltage fluctuation (0 seconds to 120 seconds).
 3. Provide a time delay transfer from the emergency power source to the normal power source (0 seconds to 30 minutes).
 4. Provide a timer to allow the generator to run unloaded after re-transfer to the normal power supply (1 second to 30 minutes).
 5. Provide single-phase under voltage and under frequency sensing on the emergency power source. Voltage shall be factory set at 90% pickup and 80% dropout. Frequency sensing shall be set at 58-hertz pickup and 56-hertz dropout.
 6. Provide a pilot light to indicate that the switch is in the normal position as an integral part of the microprocessor.
 7. Provide a pilot light to indicate that the switch is in the emergency position as an integral part of the microprocessor.
 8. Provide a pilot light to indicate that the normal power is available as an integral part of the microprocessor.
 9. Provide a pilot light to indicate that the emergency power is available as an integral part of the microprocessor.
 10. Provide auxiliary relay contacts that are energized when the power is available on the normal source.
 11. Provide auxiliary relay contacts that are energized when the power is available on the emergency source.

- E. The following features shall be provided:
 1. Time delay normal to emergency, adjustable
 2. Time delay emergency to normal, adjustable
 3. Green pilot light to indicate switch in normal position and red pilot light to indicate switch in emergency position
 4. White pilot lights marked "Normal Source" and "Emergency Source" to indicate that respective source voltages are available
 5. Tripped position indicating lights for both sources
 6. Relay auxiliary contacts (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.
 7. Time delay engine start, adjustable
 8. Time delay engine cool off, adjustable
 9. Engine start contact

10. Frequency/voltage relay for emergency source, frequency adjustable from 45 to 60 Hz and voltage fixed at 90% pickup, 70% dropout
 11. Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive
 12. Remote start and transfer to standby power from plant controls contact closure.
 13. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
 14. "Reset" push button that will clear any faults present in the control.
 15. "LAMP TEST" push button to test all lamps on the panel by lighting them.
 16. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Provide one set Form C auxiliary contacts for each power breaker, operated by transfer switch position, rated 10 amps 250 VAC. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.
- F. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions: Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level). Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation and phase sequence (phase angle). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

2.09 SWITCHGEAR CONTROL SYSTEM

- A. Sequence of Operation
1. Under normal operating conditions, utility power is provided to the load through the normal (utility) circuit breaker. The emergency (Genset) circuit breaker is open and the Genset is stopped. The standby-power circuit breaker is open. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of its normal or preferred source. Open transition will provide a load break transfer between sources.
 2. Upon loss of phase-to-phase voltage of the normal source to 80% of nominal, and after a time delay, adjustable from 0.5 to 15 seconds, to override momentary dips and/or outages, a 10-ampere, 30-Vdc contact shall close to initiate starting of the emergency or standby source power plant. Transfer to the alternate source shall take place immediately upon attainment of 90% of rated voltage and frequency of that source.

3. When the normal source has been restored to 90% of rated voltage, and after a time delay, adjustable from 0.5 to 32 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.
4. The transfer switch shall have an adjustable time delay to control the operation time from source to source (program transition operation).
5. A time delay, adjustable from 0.5 to 32 minutes, shall delay shutdown of the emergency or standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.
6. If the emergency or standby power should fail while carrying the load, transfer to the normal power supply shall be initiated immediately upon restoration of the normal source to satisfactory conditions.
7. Return to Normal Power, Open Transition: Once the normal power returns the PowerCommand ATS controller will respond according to the mode that has been selected by the operator. If open transition is selected, the PowerCommand ATS controller will wait for the retransfer time delay and then issue the generator breaker open signal. It will verify that the generator breaker is open, wait for the program transition time delay and then initiate a stand-by breaker open signal, it will verify that the stand-by breaker is open then initiate a normal (utility) breaker close signal. The ATS controller will remove its start signal from the GenSet, the GenSet will continue to run for a cool down period and then shut down.
8. Test Mode: A test signal is received from plant SCADA to start the genset and transfer the load. The test mode is continued until the test signal is removed by the operator from the SCADA screen. Provide an individual test and load signal per bus.
9. FPL Load Shed: A load shed signal is received from FPL to start the genset and transfer the load. The load shed is continued until the signal is removed by FPL.

2.10 POWER MONITORING

- A. Provide Square D CM4000 power monitors with optional Ethernet card, ECC21 and remote mounted display.
- B. Mount power monitors to switchgear face. Mount easily accessible and visible to the operator without requiring a step stool or bending over to read display.
- C. The power monitors shall act as the control system “switch” between the Modbus RTU circuit breaker trip units and the plant Ethernet power monitoring system.

2.11 DEVICES AND MISC HARDWARE

- A. All control components shall be industrial type heavy duty oil tight devices. Indicator lamps shall be high intensity LED type devices. Toggle switches and other light duty and durability limited control devices are not acceptable.
- B. Protect AC control circuits with fuses in safety fuse blocks, with visible fuse blown indication for each fuse. Potential transformers shall be protected on line and load side. All Current Transformers shall include shorting type terminal blocks.

- C. Provide each switchboard section with a minimum of two infrared windows. Place the infrared windows to allow infrared scans of all cable terminations. Where required provide additional infrared windows for adequate field of view to all cable terminations.
- D. Provide key interlocks as shown on the single line drawing.
- E. Control power for the transfer switch shall be derived from both the utility and generator set sources. Control power for charging each breaker in the power transfer switch shall be derived from the source it is connected to. The tie breaker shall have control power for charging from both sides.
- F. The transfer switch metering and control equipment shall be provided with a 24VDC battery based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition contact closure to indicate low battery condition. The generator battery shall act as a backup 24VDC source through a best battery logic circuit.

2.12 ENCLOSURES

- A. NEMA 12 Enclosure for indoor installation.

2.13 NAMEPLATES

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16-inch high, minimum.
- B. Furnish master nameplate giving switchgear designation, voltage ampere rating, short-circuit rating, and manufacturer's name.
- C. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's drawings.

2.14 FINISH

- A. All exterior and interior steel surfaces of the switchgear shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchgear shall be ANSI 61.

2.15 ACCESSORIES

- A. Provide a traveling type circuit breaker lifter, rail-mounted on top of drawout switchgear.
- B. Provide a microprocessor trip unit functional tester.

- C. Provide a nwnprrt portable remote racking device kit with factory installed brackets designed specifically for the mastrpact nw breaker. Kit will be complete with motorized racking device, controller with 30 foot cable and all control and power wiring.

PART 3 – EXECUTION

3.01 FACTORY TESTING

- A. The switchgear shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchgear shall be tested to ensure the accuracy of the wiring and the functioning of all equipment. The main bus system shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities.
- B. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute, or 1800 volts for one second, between live parts and ground, in accordance with ANSI C37.20.1.
- C. A certified test report of all standard production tests shall be shipped with each assembly.
- D. Include attendance of up to 2 County employees to witness Factory testing at the switchgear manufacturers plant.

3.02 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.
- B. The manufacturer shall provide three (3) copies of the manufacturer's field start-up reports direct to the engineer with copies to the contractor. Assume a minimum of 3 separate site visits for off-loading and assembly, installation, testing and initial energization and startup. Cost shall be included in bid price.

3.03 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations prior to energization.

3.04 TRAINING

- A. The Contractor shall provide a training session for owner's operation and maintenance staff for two separate days at the jobsite or location determined by

the owner. Training session will not be scheduled the same day as the manufacturers field checkout and start-up.

- B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation and maintenance of the assembly, circuit breakers, and major components within the assembly.
- C. Training dates shall be coordinated with the facility owner at least 2 weeks prior to proposed training date.
- D. Contractor shall record training session and provide (2) copies on DVD with the project O&M Manuals.

3.05 INSTALLATION

- A. The Contractor shall install all equipment under the supervision of the manufacturer and in conformance to manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- C. Install in each section a minimum of two infrared windows. Place infrared windows to allow infrared scans of all cable terminations. Field-install additional infrared windows as required for adequate field of view to all cable terminations. Route cable so it does not affect infrared scanning of adjacent terminations.
- D. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:
 - 1. Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction.
 - 2. Checking to ensure that all bus bars and structure assembly hardware is torqued to the manufacturer's recommendations.
 - 3. Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections.
 - 4. Securing assemblies to foundation or floor channels.
 - 5. Coordinating with the testing sub-contractor for proper testing of the equipment.
 - 6. Inspecting and installing all circuit breakers in their proper compartments.

3.06 FIELD ADJUSTMENTS

- A. The factory technician shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the unit. The equipment vendor shall coordinate with the generator manufacturer for proper settings.

3.07 FIELD TESTING

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer. The Engineer shall be notified in advance and shall have the option to witness the tests.
- B. Provide for FPL required testing.

3.08 PLANT SCADA INTEGRATION

- A. Work Included
 - 1. Furnish and install digital control system hardware and software to completely integrate all proposed generator and switchgear control, monitoring and alarm signals, including a fully functional HMI power system graphic screen. The power system graphic screen will depict the switchgear single line diagram, similar to ED1. Centered above Bus-1, show the information related to Bus-1; the same for Bus 2. Clicking on each individual breaker will bring up a pop up window with information related to that breaker. Provide the following indications for status:
 - a. Breaker Closed=green
 - b. Breaker Open=red
 - c. Breaker Tripped=yellow
 - d. Status of utility and generator power:
 - 1. Energized=green
 - 2. Not energized=red
 - 3. Faulted=yellow
 - 2. The hardware included but is not limited to, modifying 2 existing Square D Modicon Programmable Logic Controllers (PLC), updating and creating new HMI graphic, software and accessory equipment.
 - 3. Provide new digital input and output card as required for full integration of specified generator status, control and alarm points.
 - 4. The control system integrator will completely integrate the proposed field monitoring and control points into the existing Citect HMI system. System Integrator shall use LCU Citect standard library for all controls. Current installed version of Citect is Version 7.2 SP2 with 15000 I/O point Citect license installed on the primary and stand-by servers.
 - 5. Create internal registers and signals as required to link real signals to 3-dimensional graphics for monitoring and keyboard for control. Each new signal shall be individually defined and assigned to a new device file.
 - 6. Modify existing 3-dimensional graphics for the proposed system and add to them. Screen modification presentation shall be comparable to the existing 3-dimensional graphics screens with full use of dynamic colors, levels and numeric values and tied to real time data. All analog values shall be displayed in engineering units. Graphic levels shall be animated in blue with levels that raise or lower in proportion to their signal values.
 - 7. Incorporate all required signals into the database and set limits and alarm values based on owner requests and operational testing.
 - 8. Create and modify reports for all proposed totals, level, and other analog values.
 - 9. Create two generator runtime counters. One counter to log generator runtime while utility power is available, the second will log generator runtime while utility is not available. Create total runtime and monthly runtime values. Monthly runtime

to reset the 1st of every month. Create a monthly runtime report that can be printed and used for FDEP reporting.

B. Systems Integrator Qualifications

1. The approved system integrator shall demonstrate specialty-programming expertise for 3-dimensional graphic screen HMI Citect programming functions. The engineer and owner shall approve the PLC/HMI Citect Certified Programmer. The system integrator shall maintain complete responsibility for the work of the HMI Citect Certified programmer.
2. The system integrator shall be a certified Citect Silver Level or better integrator. The system integrator's on-site project manager shall be a Citect Certified Programmer.
3. References: Provide a list of ten (10) professional references of owners or clients of previous work. Include references from a minimum of three (3) governmental agencies that have contracted for similar type and size services, and three (3) engineering consultants whose design was incorporated or undertaken by the Contractor within the last five (5) years. The list shall include: Company name and address. Contracting officer and telephone number. Technical representative and telephone number. A written description of the project. Project value quoted for integration services work for each project. Include only projects utilizing the type and make of PLC (Modicon or Allen Bradley) and HMI programming (Citect) used on this project.

D. Operations and Maintenance Manuals

1. Provide O&M Manuals in accordance with other sections of Division 26.
2. Existing Plant PLC and Citect operations and maintenance manuals are required to be completed updated. Assume electronic files are not available to be modified.
3. Electronic copy of the O&M manual shall contain a copy of the most current SCADA system project back up. It will also include a back up of any include projects and the "citect.ini" file for all the automation computers.

3.09 WARRANTY

- A. The complete electrical transfer power system; controls, switchgear and accessories, and ancillary equipment shall be warranted by the manufacturer against defects in materials and workmanship for a period of two years from the date of system startup and substantial acceptance of the completed system. Coverage shall include parts, labor, travel expenses and labor to remove reinstall defective equipment. No deductibles shall be applied to the warranty except for switchgear batteries being warranted for one year.

END OF SECTION

Lee County Utilities Fiesta Village Switchgear and Generator Replacement
Switchgear I/O List

| DESCRIPTION | SOURCE | TYPE | STATUS |
|---------------------------------|--------------|------|-------------------------|
| GENERATOR 1 RUNNING | GEN/ATS | DI | RUNNING/NOT RUNNING |
| GENERATOR 1 COMMON FAULT | GEN/ATS | DI | NORMAL/FAULTED |
| FUTURE GENERATOR 2 RUNNING | GEN/ATS | DI | RUNNING/NOT RUNNING |
| FUTURE GENERATOR 2 COMMON FAULT | GEN/ATS | DI | NORMAL/FAULTED |
| MCM 3320 BUS 1 COMMON FAULT | GEN/ATS | DI | NORMAL/FAULTED |
| MCM 3320 BUS 2 COMMON FAULT | GEN/ATS | DI | NORMAL/FAULTED |
| GENERATOR 1 NOT IN AUTO | GEN/ATS | DI | IN AUTO/NOT IN AUTO |
| FUTURE GENERATOR 2 NOT IN AUTO | GEN/ATS | DI | IN AUTO/NOT IN AUTO |
| SWITCHGEAR NOT IN AUTO | GEN/ATS | DI | IN AUTO/NOT IN AUTO |
| ATS BUS 1 IN TEST MODE | PLANT PLC | DO | IN TEST/NOT IN TEST |
| ATS BUS 1 IN TEST MODE | PLANT PLC | DO | IN TEST/NOT IN TEST |
| GENERATOR FUEL TANK LEVEL | LIT | AI | % FULL |
| START GENERATOR & TRANSFER BUS1 | PLANT PLC | DO | START AND TRANSFER LOAD |
| START GENERATOR & TRANSFER BUS2 | PLANT PLC | DO | START AND TRANSFER LOAD |
| | | | |
| BUS-1 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| BUS-1 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| BUS-1 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| BUS-1 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| BUS-1 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| BUS-1 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| BUS-1 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| BUS-1 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52G1 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52G1 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52G1 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52G1 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52G1 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52G1 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52G1 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52G1 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52G1 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52G1 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52SM1 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52SM1 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52SM1 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52SM1 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52SM1 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52SM1 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52SM1 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52SM1 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52SM1 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52SM1 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |

Lee County Utilities Fiesta Village Switchgear and Generator Replacement
Switchgear I/O List

| | | | |
|----------------------------|--------------|------|---------------------|
| 52UM1 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52UM1 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52UM1 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52UM1 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52UM1 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52UM1 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52UM1 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52UM1 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52UM1 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52UM1 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52FB1 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52FB1 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52FB1 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB1 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB1 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB1 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52FB1 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52FB1 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52FB1 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52FB1 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52FB3 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52FB3 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52FB3 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB3 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB3 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB3 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52FB3 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52FB3 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52FB3 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52FB3 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52FB5 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52FB5 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52FB5 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB5 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB5 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB5 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52FB5 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52FB5 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52FB5 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52FB5 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| 52FB7 BREAKER STATUS | BUS-1 CM4000 | SOFT | OPEN/CLOSE |
| 52FB7 BREAKER STATUS | BUS-1 CM4000 | SOFT | TRIPPED/NOT TRIPPED |

Lee County Utilities Fiesta Village Switchgear and Generator Replacement
Switchgear I/O List

| | | | |
|----------------------------|--------------|------|---------------------|
| 52FB7 L-N VOLTAGE PHASE A | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB7 L-N VOLTAGE PHASE B | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB7 L-N VOLTAGE PHASE C | BUS-1 CM4000 | SOFT | VOLTS |
| 52FB7 AMPERAGE PHASE A | BUS-1 CM4000 | SOFT | AMPS |
| 52FB7 AMPERAGE PHASE B | BUS-1 CM4000 | SOFT | AMPS |
| 52FB7 AMPERAGE PHASE C | BUS-1 CM4000 | SOFT | AMPS |
| 52FB7 POWER CONSUMPTION KW | BUS-1 CM4000 | SOFT | KW |
| 52FB7 POWER FACTOR | BUS-1 CM4000 | SOFT | PF |
| | | | |
| BUS-2 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| BUS-2 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| BUS-2 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| BUS-2 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| BUS-2 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |
| BUS-2 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| BUS-2 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| BUS-2 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |
| | | | |
| 52G2 BREAKER STATUS | BUS-2 CM4000 | SOFT | OPEN/CLOSE |
| 52G2 BREAKER STATUS | BUS-2 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52G2 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| 52G2 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| 52G2 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| 52G2 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| 52G2 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |
| 52G2 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| 52G2 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| 52G2 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |
| | | | |
| 52SM2 BREAKER STATUS | BUS-2 CM4000 | SOFT | OPEN/CLOSE |
| 52SM2 BREAKER STATUS | BUS-2 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52SM2 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| 52SM2 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| 52SM2 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| 52SM2 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| 52SM2 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |
| 52SM2 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| 52SM2 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| 52SM2 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |
| | | | |
| 52UM2 BREAKER STATUS | BUS-2 CM4000 | SOFT | OPEN/CLOSE |
| 52UM2 BREAKER STATUS | BUS-2 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52UM2 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| 52UM2 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| 52UM2 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| 52UM2 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| 52UM2 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |

Lee County Utilities Fiesta Village Switchgear and Generator Replacement
Switchgear I/O List

| | | | |
|----------------------------|--------------|------|---------------------|
| 52UM2 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| 52UM2 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| 52UM2 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |
| 52FB2 BREAKER STATUS | BUS-2 CM4000 | SOFT | OPEN/CLOSE |
| 52FB2 BREAKER STATUS | BUS-2 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52FB2 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB2 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB2 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB2 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| 52FB2 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |
| 52FB2 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| 52FB2 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| 52FB2 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |
| 52FB4 BREAKER STATUS | BUS-2 CM4000 | SOFT | OPEN/CLOSE |
| 52FB4 BREAKER STATUS | BUS-2 CM4000 | SOFT | TRIPPED/NOT TRIPPED |
| 52FB4 L-N VOLTAGE PHASE A | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB4 L-N VOLTAGE PHASE B | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB4 L-N VOLTAGE PHASE C | BUS-2 CM4000 | SOFT | VOLTS |
| 52FB4 AMPERAGE PHASE A | BUS-2 CM4000 | SOFT | AMPS |
| 52FB4 AMPERAGE PHASE B | BUS-2 CM4000 | SOFT | AMPS |
| 52FB4 AMPERAGE PHASE C | BUS-2 CM4000 | SOFT | AMPS |
| 52FB4 POWER CONSUMPTION KW | BUS-2 CM4000 | SOFT | KW |
| 52FB4 POWER FACTOR | BUS-2 CM4000 | SOFT | PF |

SECTION 26 24 14

PORTABLE GENERATOR QUICK CONNECT SWITCHBOARD

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install, where indicated, a free-standing, dead-front type low voltage Generator Quick Connection Switchboard, utilizing circuit protective devices, generator lug and receptacle connections as specified herein, and as shown on the Contract Drawings.

1.02 RELATED SECTIONS

- A. Section 26 43 00, Surge Protective Devices.
- B. Section 26 28 11, Circuit Breakers and Fusible Switches – Low Voltage.

1.03 REFERENCES

- A. The low voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
 - 1. NEMA PB-2.
 - 2. UL Standard 891.

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Master drawing index.
 - 2. Front view elevation.
 - 3. Floor plan.
 - 4. Top view.
 - 5. Single line.
 - 6. Schematic diagram.
 - 7. Nameplate schedule.
 - 8. Component list.
 - 9. Conduit entry/exit locations.
 - 10. Assembly ratings including:
 - a. Short-circuit rating.
 - b. Voltage.
 - c. Continuous current.
 - 11. Major component ratings including:
 - a. Voltage.
 - b. Continuous current.
 - c. Interrupting ratings.
 - 12. Cable terminal sizes.
 - 13. Product data sheets.
 - 14. Connection details between close-coupled assemblies.

15. Composite floor plan of close-coupled assemblies.
16. Key interlock scheme drawing and sequence of operations.

1.04 GENERAL

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly and be the same manufacturer as the main switchboard systems.
- B. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
- C. The low-voltage switchboard shall be UL labeled.
- D. Equipment shall be handled and stored in accordance with manufacturer's instructions. Instructions shall be included with the equipment at time of shipment.
- E. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The switchboard shall be Square D type Generator Quick-Connect or equal by Eaton and be the same manufacturer as the main switchboard systems. Equal products in compliance with the specification and manufactured by others will be considered only if pre-approved by the Engineer twenty (20) days prior to Bid date.

2.02 RATINGS

- A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current 65,000 amperes symmetrical at rated voltage.

2.03 CONSTRUCTION

- A. Generator Quick Connect Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front and rear hinged panels shall be formed. Provide adequate ventilation within the enclosure.
- B. All sections of the switchboard shall be front and rear aligned with depth as shown on Drawings. All protective devices shall be individually and compartmentalized mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided
- C. The switchboard shall be provided with bussed load connection of outgoing cable terminations, which shall be suitable for copper. Lugs shall be two hole long barrel double crimp type; Burndy no equal. The assembly shall be provided with adequate lifting means.

2.04 BUS

- A. All bus bars shall be silver-plated copper. Bus ampacity of 3,000 amps shall be density rated and be based on 1000A/square-in. Provide a full capacity neutral bus.
- B. A copper ground bus (minimum 1/2 by 2 inch), shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
- C. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.05 WIRING/TERMINATIONS

- A. The switchboard shall be provided with mechanical hi-press crimp lugs on the load power connections and the line side of the permanent generator breaker connections. Provide a cam-type receptacle assembly for connection of portable generator power: phases (A, B, C), neutral and grounding conductors. All connections for phases, neutral, ground, etc., shall be clearly marked via labeling and color code.
- B. Each single pole cam-type receptacle shall be rated for no less than 400 amps at 90 degrees C. Multiple receptacles per phase, neutral, and ground shall be utilized when amperages over 400 are requested. Contact material of the receptacle shall be composed of brass.
- C. Cam-type receptacles must be suitable for use in outdoor environments.
- D. Single pole Cam-type receptacles shall be UL 498 listed for Attachment Plugs and Receptacles and UL 1691.
- E. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- F. Where applicable all control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.06 MAIN PROTECTIVE DEVICES:

- A. See main switchboard section power circuit breaker specification.
- B. Provide two main circuit breakers; one for portable generator connection through the cam lock receptacles and one for the future permanent generator set through a bussed lug compartment. Provide key interlock on each breaker so that only one breaker at a time can be closed.
- C. Provide key interlock switches as indicated.

2.07 MISCELLANEOUS DEVICES

- A. The switchboard shall be provided with a space heater. Power for the space heaters shall be obtained from a control power transformer within the switchboard. Supply voltage shall be 120-volts ac.

2.08 ENCLOSURES

- A. Outdoor 3R SS Enclosure:
 - 1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements.
 - 2. Enclosure shall have sloping roof downward toward rear.
 - 3. Provide hinged cable entry trap door to allow cable access to portable generator connection receptacles and lugs while maintaining Type 3R Enclosure integrity.
 - 4. The enclosure shall be provided with rear hinged doors for each section.
 - 5. Doors shall have provisions for padlocking.
 - 6. Ventilating openings shall be provided complete with replaceable fiberglass air filters.
 - 7. Enclosure finish shall be powder coated white.

2.09 NAMEPLATES

- A. Engraved nameplates, mounted on the face of the assembly. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.
- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.10 FINISH

- A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be white.

2.11 SURGE PROTECTIVE DEVICE

- A. Provide surge protective device as specified in Section 26 43 00, Surge Protective Devices.

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. The standard factory tests shall be in accordance with the latest version of ANSI and NEMA standards. The manufacturer shall provide certified copies of factory test reports.

3.02 TRAINING

- A. The Contractor shall provide a training session at a jobsite location.
- B. A manufacturer's qualified representative shall conduct the training session. The training program shall consist of instruction on operation of the assembly, circuit breakers and major components within the assembly.

3.03 INSTALLATION

- A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and National Electrical Code.
- B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.04 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study and protective device coordination study.
- B. Necessary field settings of devices, adjustments and modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study, shall be carried out by the Contractor at no additional cost to the Owner.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.01 SCOPE:

- A. The CONTRACTOR shall provide panelboards and general purpose dry-type transformers, complete and operable, in accordance with the Contract Documents.
- B. Single Manufacturer: Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.02 REFERENCES: The latest edition of the following codes or standards shall apply.

- A. NEC (NFPA 70) National Electrical Code
- B. NEMA 250 Enclosure for Electrical Equipment (1,000 Volts Maximum)
- C. UL 50 - Standard for Safety for Enclosures for Electrical Equipment
- D. UL 67 - Panelboards

1.03 SUBMITTALS: General: Submittals shall be in accordance section 26 05 00 Basic Materials and Methods.

- A. Breaker layout drawings with dimensions and nameplate designations
- B. Drawings of conduit entry/exit locations.
- C. Assembly ratings including: Short circuit rating, Voltage; Continuous current
- D. Cable terminal sizes
- E. Descriptive bulletins
- F. Product sheets

PART 2 – PRODUCTS

2.01 GENERAL: Provide panelboards by Square-D, Cutler Hammer or GE .

- A. Panelboard shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Panelboards. Panelboards used for service equipment shall be UL labeled for such use. Lighting panelboards shall be rated for 120/208-volt, 3-phase operation or 120/240-volt for single phase operation as indicated. Power panelboards shall be rated for 480 volts, 3-phase, 3 wire operation as indicated.
- B. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.
- C. Panelboards rated 240 VAC or less shall have short circuit ratings not less than 10,000 amperes RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.

- D. Panelboards rated 480 VAC shall have short circuit ratings not less than 42,000 amperes RMS symmetrical or as indicated by the Short Circuit Study, whichever is greater.
- E. Panelboards shall be labeled with a UL short circuit rating. Series ratings are not acceptable.

2.02 CONSTRUCTION

- A. All lighting and power distribution panels shall have copper bus bars density rated for maximum of 1000amps/sq-in. Enclosures for panelboards shall be galvanized and painted steel except enclosures for panelboards located in corrosive, damp or wet locations shall be stainless steel and NEMA-3R
- B. Breakers shall be one, two, or three pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position. Double and triple pole breakers shall be of the common trip, single handle type.
- C. The panels shall have hinged doors with combination catch and latch. The front panels shall be so arranged that when the plates are removed, the gutters, terminals and wiring will be exposed and accessible. The doors shall have inner doors within the plates to have only the breaker operating mechanism exposed when they are opened. Live conductors and terminals shall be concealed behind the plates.
- D. All circuit breakers shall be interchangeable and bolt on type capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units. Plug-in circuit breakers are not acceptable.
- E. Panelboards shall be UL listed.
- F. Size of wiring gutters and gauge of steel shall be in accordance with NEMA Standards Publication No. PBI 57 and UL Standards No. 67. Cabinets shall be minimum 20" wide for all panels.

PART 3 – EXECUTION

3.01 GENERAL

- A. Surface mount panelboards on wall, as indicated on project drawings, at an elevation convenient for operation and as required in the latest NEC.
- B. Install typewritten or computer generated circuit directory in panelboards. The directory shall coordinated with the identification of equipment as shown on the contract drawings and clearly indicating the serving load.

END OF SECTION

SECTION 26 27 13

ELECTRIC SERVICE

PART 1 - GENERAL

1.01 Description of System:

- A. The Electrical Utility Company will provide the electrical service of the characteristics as shown on the Drawings. This Contractor's work will begin where the Utility Company's work ends.
- B. The Contractor shall furnish all labor, materials, etc., necessary for a complete approved electrical service as required for this project, including inspection and approval by the Utility and local Inspection Departments (if any) and inform the Engineer prior to energizing power lines.
- C. This Contractor shall notify the Utility Company in writing, with two copies to the Engineer, no later than ten (10) days after signing contracts as to when this Contractor anticipates the building power service will be required.
- D. The contractor is responsible for complete application, coordination and scheduling of the electrical service with FPL. Contractor is required to complete all service applications and deliver to County project manager to acquire proper signatures.

1.02. Construction Facilities:

- A. The facilities and equipment required to provide all electrical power for construction, lighting and balancing and testing consumed prior to final acceptance of the project shall be provided under this section of the specifications. All wiring, outlets and other work required to provide this power at the site and within the building for all trades shall be arranged for, furnished and installed under this section of the specifications including any fee, charge or cost due the utility company for temporary power installation or hook-ups.
- B. Facilities shall be furnished in a neat and safe manner in compliance with governing codes, good working practices and OSHA regulations.

1.03. Underground Electrical Service:

- A. Furnish and install underground 480V/277 volt 3ph, 4 wire service from power company pad-mount transformers or pole base handholes to main service equipment. Seal conduit with duct-seal where entering building.
- B. The underground service shall comply with all the requirements of the NEC, local Utility Company and local enforcing authority.

1.04. Utility Company Fees, Charges and Costs

- A. It is the contractor's responsibility to contact the required Utility Company to
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determine if any fees, charges or costs will be due the Utility Company, as required by the Utility Company for temporary power, installations, hook-ups, etc. This fee, charge or cost shall be turned over to the County Project manager for payment.

1.05 Submittals

- A. Submit product data on:
 - 1. Meter base and CT, cabinet if applicable.
 - 2. Copy of Contractors notice to FPL
 - 3. Copy of Contractors transmittal of FPL invoice to County

PART 2 – PRODUCTS

2.01 Metering:

- A. Meter bases shall be furnished and installed by this contractor. Provide aluminum meter bases. Metering bases and conduits must be installed in accordance with the Utility Company requirements.
- B. FP&L requirements. Work to be completed under this section shall be in accordance with FP&L documentation and standards.

PART 3 – EXECUTION

Not used

END OF SECTION

SECTION 26 28 11

CIRCUIT BREAKERS AND FUSIBLE SWITCHES – LOW VOLTAGE

PART 1 – GENERAL(NOT USED)

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Provide Cutler Hammer, Square-D or GE circuit breakers to match equipment provided. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions..

2.02 POWER CIRCUIT BREAKERS

- A. Provide power circuit devices, type low-voltage power circuit breakers, Square D type MasterPact NW or approved equal. Frame ratings shall be 800, 1600, 2000, 3200, 4000 amperes. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.
- B. Breakers shall be manually operated (MO) or electrically operated (EO) as indicated on the drawings.
- C. Electrically operated breakers shall be complete with close/open pushbuttons control switch], plus red and green indicating lights to indicate breaker contact position 120 Vac motor operators; the charging time of the motor shall not exceed 6 seconds. Source voltage shall be taken from a control power transformer internal to the switchgear assembly.
- D. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000amperes or higher where shown on the drawings. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
- E. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standards. The circuit breakers shall carry a UL label.
- F. Provide units Arc Flash Reduction Maintenance Remote accessory as specified in Paragraph 2.03. The Arc Flash Reduction Maintenance Remote shall allow the operator to enable a maintenance mode with a preset accelerated instantaneous override trip to reduce arc flash energy.
- G. To facilitate lifting, the power circuit breaker shall have integral handles on the side of the breaker. The power circuit breaker shall have a closing time of not more than 3 cycles. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.

- H. The power circuit breaker shall have three windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be plug and lock type and UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.
- I. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.
- J. The current sensors shall have a back cover window that will permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.
- K. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be Connect (Red), Test (Yellow), and Disconnect (Green). The levering door shall be interlocked so that when the breaker is in the closed position, the breaker levering-in door shall not open.
- L. Each power circuit breaker shall offer sixty (60) front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.
 - 1. include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall secure the breaker in the connected, test or disconnected position by preventing levering

2.03 TRIP UNITS

- A. Each low-voltage power circuit breaker and insulated case circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall Square D Micrologic P with MODBUS communication module.
- B. The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.

- C. The trip unit shall be provided with a display panel, including a representation of the time/current curve that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.
- D. The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.
- E. Trip unit shall have selectable thermal memory for enhanced circuit protection.
- F. The trip unit shall provide zone interlocking for the short-time delay and ground fault delay trip functions for improved system coordination. The zone interlocking system shall restrain the tripping of an upstream breaker and allow the breaker closest to the fault to trip with no intentional time delay. In the event that the downstream breaker does not trip, the upstream breaker shall trip after a preset time delay. ⚡Factory shall wire for zone interlocking for the power circuit breakers within the switchgear.
- G. The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.
- H. The trip unit shall be equipped to permit communication via Modbus to the switchgear Allen Bradley compactlogix PLC system provided in the equipment for remote monitoring and control. All monitored parameters shall be transmitted.
- I. The trip unit shall include a power/relay module, which shall supply control power to the readout display. Following an automatic trip operation of the circuit breaker, the trip unit shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. An internal relay shall be programmable to provide contacts for remote ground alarm indication.
- J. The trip unit shall include a voltage transformer module, suitable for operation up to 600V, 50/60 Hz. The primary of the power relay module shall be connected internally to the line side of the circuit breaker through a dielectric test disconnect plug.
- K. The display for the trip units shall be a 24-character LED display.
- L. Metering display accuracy of the complete system, including current sensors, auxiliary CTs, and the trip unit, shall be +/- 1% of full scale for current values. Metering display accuracy of the complete system shall be +/- 2% of full scale for power and energy values.
- M. The unit shall be capable of monitoring the following data:
 - 1. Instantaneous value of phase, neutral and ground current

2. Instantaneous value of line-to-line voltage
 3. Minimum and maximum current values
 4. Watts, vars, VA, watthours, varhours, and VA hours, Peak demand, Present demand, Energy consumption.
 5. Crest factor, power factor, percent total harmonic distortion, and harmonic values of all phases through the 31st harmonic.
- N. An adjustable high load alarm shall be provided, adjustable from 50 to 100% of the long delay pickup setting.
- O. The trip unit shall contain an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.
- P. Programming may be done via a keypad at the faceplate of the unit or via the communication network.
- Q. System coordination shall be provided by the following microprocessor-based programmable time-current curve shaping adjustments. The short-time pickup adjustment shall be dependant on the long delay setting.
1. Programmable long-time setting
 2. Programmable long-time delay with selectable I^2t or I^4t curve shaping
 3. Programmable short-time setting
 4. Programmable short-time delay with selectable flat or I^2t curve shaping, and zone selective interlocking
 5. Programmable instantaneous setting
 6. Programmable ground fault setting trip or ground fault setting alarm
 7. Programmable ground fault delay with selectable flat or I^2t curve shaping and zone selective interlocking
- R. The trip unit shall offer a three-event trip log that will store the trip data, and shall time and date stamp the event.
- S. The trip unit shall have the following advanced features integral to the trip unit:
1. Adjustable undervoltage release
 2. Adjustable overvoltage release
 3. Reverse load and fault current
 4. Reverse sequence voltage alarm
 5. Underfrequency
 6. Overfrequency
 7. Voltage phase unbalance and phase loss during current detection
- T. The main breakers fitted with trip units shall be provided with an Arcflash Reduction Maintenance System Technology capability. The Arcflash Reduction Maintenance System shall allow the operator to enable a maintenance mode using a remote control which enables a preset accelerated instantaneous override trip to reduce arc flash energy. A blue LED on the trip unit shall indicate the trip unit is in the maintenance mode

2.04 MOLDED CASE CIRCUIT BREAKERS – 800 A AND BELOW

LEE COUNTY UTILITIES

Fiesta Village WWTP

Switchgear and Generator Replacement

TECHNICAL SPECIFICATIONS

Section 262811

CIRCUIT BREAKERS & FUSED SWITCHES

Page 4 of 5

- A. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Eaton or approved equal.
- B. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- C. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
- D. Circuit breakers 400ampere frame and below shall be have thermal-magnetic trip units and inverse time-current characteristics.
- E. Circuit breakers 800ampere through 1200-ampere frame shall have microprocessor-based rms sensing trip units.

2.05 QUICK-MAKE/QUICK-BREAK FUSIBLE SWITCHES

- A. Protective devices shall be quick-make/quick-break fusible switches. Fusible switches 30 amperes through 600 amperes frames shall be furnished with rejection Class "R" or "J" type fuse clips unless otherwise scheduled. Fusible switches 800 amperes through 1200 amperes shall be furnished with Class L fuse clips. Switches shall incorporate safety cover interlocks to prevent opening the cover with the switch in the ON position or prevent placing the switch in the ON position with the cover open. Provide defeater for authorized personnel. Handles shall have provisions for padlocking and shall clearly indicate the ON or OFF position. Front cover doors shall be padlockable in the closed position.

PART 3 – EXECUTION(NOT USED)

END OF SECTION

SECTION 26 32 13

DIESEL ENGINE DRIVEN GENERATOR SETS

PART I - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install, put into operation, and field test the diesel engine driven generator unit, and controls as shown on the Drawings and specified herein. The equipment installation shall be coordinated in detail by the Genset distributor. The distributor shall supervise the installation of the equipment from off loading to startup. The supplying vendor shall also supply the service entrance switchgear, automatic load transfer, paralleling and complete system controls for a complete coordinated standby power system package specified in other sections.
- B. The installation, supervision, and the coordination of testing and startup of the system shall be provided by the installing contractor. The installing contractor shall be responsible for the complete coordination of the installation. The installing contractor shall be responsible to include all necessary equipment and services into the base bid for installation. Where shown on the drawings, accessory materials include but are not limited to sub-base tank, sound attenuated enclosure, exhaust muffler system, battery charger, ETC.
- C. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these Specifications or not.
- D. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. The genset supplier is responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.
- E. Provide per the project scope all equipment as shown on the drawings including but is not limited to supplying engine generator sets complete, Automatic transfer switch(es) complete, sub-base fuel tank, sound attenuated enclosure, muffler, line circuit breakers, etc.
- F. The generator Unit shall be as manufactured by Cummins-Onan no equals, with a standby rating of 1000kw, 1250kva, 1800RPM, 0.8 power factor, 277/480Volt, 3 phase, 60 Hertz, 4 wire including radiator fan and all parasitic loads.
- G. The generator unit shall bear a UL 2200 label.
- H. Furnish remote mounted generator annunciator to be mounted on switchgear face.

1.02 RELATED SECTIONS

- A. Section 26 23 00-Metal Enclosed Compartmentalized Drawout Switchgear
- B. Section 26 05 00-Basic Materials and Methods
- C. Section 26 05 19-Low Voltage Wire and Cables
- D. Section 26 05 26-Grounding and Bonding for Electrical Systems

1.03 DESCRIPTION OF SYSTEMS

- A. A complete package shall be provided by the generator set distributor, maintaining single source responsibility. The Contractor shall utilize the authorized distributor, who shall be responsible to furnish, document, instruct and supervise installation, adjust, and test the complete system as shown on the plans and specified herein.
- B. The Contractor shall furnish and install all interconnecting wiring as show on the authorized distributor's shop drawings, accessories, and the like whether or not specifically detailed on the plans or in the specifications. It shall be the responsibility of the contractor to ascertain such items from the authorized distributor and include these costs in his bid. No additional payment will be made for items not specifically shown or detailed in the contract documents but needed for a complete installation.
- C. The equipment must be purchased from the manufacturers authorized representative authorized to represent the manufacturer in the projects territory. The unit shall be shipped to the jobsite by an authorized engine distributor having a parts and service facility within a 150 mile radius of the jobsite. In addition, and in order not to penalize the Owner for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than eighty percent (80%) of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the Engineer upon request.
- D. Emergency warranty service response shall be guaranteed to be a maximum of four-hours between the time of emergency notification and arrival of service personnel on site. An emergency service condition shall be considered to exist when any failed standby power system hardware or software prevents or threatens to prevent the facility from fulfilling its intended purpose as determined by the owner or engineer. Non-emergency service requests shall be responded to within 2 business days. Telephone support for operating procedures and non-hardware problems shall be provided on an unlimited basis during the warranty period.
- E. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein.

1.04 SUBMITTALS

- A. Submit to the Engineer for review in accordance with division 26 Sections of the specifications, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, including foundation drawing showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment.
- B. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.
- C. The submittal data for each unit shall include, but not necessarily be limited to, the following:
 - 1. Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; fuel tank; and all other items requiring space for installation. Layout and stub-up locations of electrical and fuel systems.
 - 2. Interconnect wiring diagram of complete emergency system, including generator, switchgear, fuel tank level monitor/transmitter, battery charger, remote alarm indications.
 - 3. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
 - 4. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
 - 5. Engine Data:
 - a. Manufacturer
 - b. Model
 - c. Number of cylinders
 - d. RPM
 - e. Bore x stroke
 - f. Piston speed, RPM
 - g. Make and model and descriptive literature of electric governor
 - h. Fuel consumption rate curves at 25,50,75,100% loads
 - i. Engine continuous pump drive duty rating
 - j. Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads).
 - k. Manufacturer's and dealer's written warranty.
 - l. Emissions data
 - 6. Generator Data:
 - a. Manufacturer
 - b. Model
 - c. Rated KVA
 - d. Rated kw
 - e. Voltage
 - f. Temperature rise above 40 degree C ambient
 - g. Generator efficiency including excitation losses and at 80 percent power factor
 - h. Generator resistances, reactances and time constants.
 - i. Generator current decrement curve.
 - j. Generator motor starting capability.

- k. Generator thermal damage curve.
- l. Line circuit breaker.
- 7. Generator Unit Control Data:
 - a. Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Control panel schematics
 - b. Legends for all devices on all diagrams
 - c. Sequence of operation explanations for all portions of all schematic wiring diagrams
- 8. Generator Unit and Accessories:
 - a. Weight of skid mounted unit
 - b. Overall length
 - c. Overall width
 - d. Overall height
 - e. Exhaust pipe size
 - f. CFM of air required for combustion and ventilation
 - g. Heat rejected to jacket water and lubricating oil...BTU/hr
 - h. Heat rejected to room by engine and generator...BTU/hr
 - i. Jacket water heater connection diagram.
 - j. Automatic load transfer switch(es).
- D. Submit to the Engineer operating and maintenance data as specified in 26 05 00 Basic Materials and Methods of this specification. Submit to the Engineer the equipment Manufacturer's Certificate of Installation, Testing and Startup Report.

1.05 SPARE PARTS

- A. The Manufacturer shall furnish one (1) complete spare replacement sets of all filter elements required for the generator unit.

PART 2 - PRODUCTS

2.01 RATINGS

- A. The rating of the generator set shall not exceed the Manufacturer's published standby rating. The gross engine horsepower required to produce the standby rating shall not exceed the Manufacturer's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS5514 or DIN6271 but in no case shall it exceed the Manufacturer's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1800 rpm.
- B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the Manufacturer for the actual unit supplied.
- C. The generator set shall operate at 1800 rpm and at a voltage of: 277/480, 3-Phase, 4-wire, 60 hertz. The complete generator set shall be rated per ISO8528 standby rating, based on site conditions of: Altitude 100 meters, ambient temperatures of 50

degrees C, based on temperature measured at the alternator inlet. The generator set rating shall be based on stationary emergency/standby service and marked as applicable per NFPA110.

D. Performance:

1. Voltage regulation shall not exceed one percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. Generator sets shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition.
4. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
5. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
6. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
7. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.
8. The generator set shall share real and reactive load proportionally within plus or minus 3% with all other generator sets in the system.
9. The time required to automatically start, accelerate to rated speed and voltage, synchronize and parallel all generator sets to the system bus on a normal power failure shall not exceed 15 seconds, assuming that the water jacket heaters are operating properly.
10. The generator set and complete sound attenuated enclosure sound levels shall be tested by the manufacturer per ANSI S1.13. Data documenting performance shall be provided with submittal documentation.

2.02 CONSTRUCTION

- A. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
- B. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.
- C. All outdoor equipment shall be enclosed with corrosion-protected materials. Steel components used in enclosures shall be powder coated and baked, and shall provide fade and corrosion resistance in compliance to Dry film thickness shall be SHD3363 of 2H+ all a minimum of 1.8 Mils, gloss at 60degrees per ASTMD523 of 80+/- 10, pencil hardness per ASTM D3363

2.03 CONNECTIONS

- A. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept two hole compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
- B. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.04 ENGINES

- A. The engine shall be full compression ignition, four cycle, single acting, solid injection engines, either vertical or "V" type. Speed shall not exceed 1800 revolutions per minute at normal full load operation. The engine governor shall be +/- 0.25 percent accuracy electronic type governor.
- B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.
- C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.
- D. The engine shall be radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable.
- E. A digital electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states. The governor control logic shall be based in the engine ECM and must communicate with the alternator and set control. Third party and private labeled governors are not acceptable.
- F. The engine shall be equipped with spin on fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, engine driven water pump, and unit mounted instruments. The engine shall be provided with low oil pressure, high water temperature, low coolant level and overspeed safety shutdowns.
- G. Injection pumps shall be pressure time common rail type. The system shall be self bleeding and self priming in design. The fuel system shall provide redundant overspeed protection with one governor having a dual flywheel fuel limiting mechanical control and the other fail safe electric control. The governors shall be located within the fuel pump body without external linkages or adjustments. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and

valves shall be of heavy seamless tubing. Digital Electronic fuel injection systems shall be considered equal to common rail type pressure injection systems.

- H. The fuel system shall be equipped with spin on fuel filters having replaceable elements. Filter elements shall be spin on canister elements, easily accessible and removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure. The engine shall be provided with a Racor type fuel water separator, sized as determined by engine manufacturer, to filter fuel continuously while unit is in operation.
- I. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one piece stress relieved grey iron casting.
- J. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be spin on canister elements , easily accessible, easily removed and cleaned and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler and dipstick oil level indicator.
- K. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit. The air cleaner shall be replaceable, easily accessible with restriction indicators.
- L. Provide fuel ramping control to limit black smoke and frequency overshoot.
- M. Provide fuel cooler, suitable for operation of the generator set at full rated load in ambient temperature.
- N. Provide Racor Crankcase Ventilation System.

2.05 COOLING SYSTEMS

- A. The engine shall be furnished with a unit mounted radiator type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature of 122 degrees , based on 0.5 in H₂O external static head.. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions.

- B. Radiator shall be sized based on a core temperature which is 10 degrees C higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
- C. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine Manufacturer.
- D. A unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 70 degrees F.
 - 1. Heater shall be UL499 listed and labeled.
 - 2. Install on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches.
 - 3. Installation shall be specifically designed to provide proper venting of the system.
 - 4. Install using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
 - 5. Provide a thermostat, installed at the engine thermostat housing. Provide for a single AC power connection to the coolant heater system.

2.06 EXHAUST SYSTEMS

- A. The engine exhaust silencer shall be a critical grade and provided by the genset manufacturer. Silencer shall be sized and approved by the engine manufacture and supported by acoustical and pressure loss calculation not to exceed 55db max at the property line.
- B. All exhaust equipment must be rated to withstand temperatures of approximately 1,000 degrees F. A flexible stainless steel pipe connection shall be provided between the engine exhaust stack and exhaust piping. One silencer raincap with counter weight shall be provided for each silencer. The exhaust system shall be mounted inside genset enclosure. Provide heat wrap on exhaust system piping.

2.05 AUTOMATIC STARTING SYSTEM

- A. A DC electric starting system with positive engagement shall be furnished. The starting motor voltage shall be as recommended by the engine Manufacturer.
- B. An engine control shall be furnished as an integral part of the electric set to start and stop the engine as signaled by the automatic transfer controls on the generator control unit. The control shall start the engine by adjustable timed cranking cycles for a total period of not less than one minute. The crank and rest cycles shall be individually adjustable. The starting circuit shall open, and the control shall activate an alarm circuit if the engine does not start. The control shall be equipped with automatic safety shutdowns so that upon signal of a low oil pressure, high water temperature, low coolant level or overspeed condition of the engine, the control shall immediately stop the engine. The control shall be equipped with digital display to indicate any of the engine failures and also with a 3-position control switch identified for "automatic-off-manual" externally mounted.

- C. Engine Cranking Batteries: The batteries shall be of the lead acid type, and shall be of domestic manufacture. The battery shall be rated S.A.E. type "D", diesel engine starting type and of sufficient size and capacity in a fully charged condition to crank start the engine generator for the maximum allowed crank cycle, (minimum 20-second cranking periods) six consecutive times at 20 degrees F with out recharging between cranks. The batteries shall be mounted in suitable covered racks. Battery rack location will be as shown on the Shop Drawings. The electrical Contractor shall provide the required lengths of all interconnecting battery cables. Minimum wire size and type shall be 2/0 welding cable.
- D. Battery Chargers:
1. Provide a 10amp battery charger. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications. The charger shall be compliant with UL991 requirements for vibration resistance.
 2. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.
 3. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charge battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.
 4. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.
 5. The charger shall include the following features:
 - a) Two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;
 - b) LED indicating lamp(s) to indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);
 - c) AC input overcurrent, over voltage, and undervoltage protection;
 - d) DC output overcurrent protection;
 - e) Alarm output relay;
 6. Locate Charger in the generator enclosure.

2.07 ALTERNATOR, EXCITER AND ACCESSORIES

- A. Rating: The alternator shall be rated 1000KW, 1250KVA at 0.8 p.f., 1800 RPM 3 phase, 60 Hertz, 277/480 volts, at a maximum temperature rise of 80 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The alternator shall be wound for 2/3rds pitch for harmonic mitigation. The alternator shall conform to NEMA Standard MG-1. It shall be synchronous, four pole, revolving field, single pre-lubricated sealed bearing, and directly connected to the engine with flexible drive disc. As an alternate to the 80 degree C rise alternator (if not a standard option), the manufacturer shall upsize the diesel generator such that at the derated capacity of 1000kw, the heat rise on the alternator will be 80 degree C rise or better.

B. Performance:

1. The instantaneous voltage dip shall not exceed 25 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 1 second. Steady state modulation shall not exceed +/- 1/2 percent. Provide documentation of submitted unit meeting performance criteria with shop drawing submittals.
2. The alternator shall be supplied with a dedicated, independent power source for the voltage regulation system, which provides sufficient excitation for the alternator to supply 300% of rated output current for 10 seconds.
3. The sub transient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

C. The alternator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage up to 5 percent above or below rated voltage.

D. Construction:

1. The alternator and exciter shall be dripproof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.
2. The alternator design shall prevent shaft current from flowing and eliminate the need for insulated bearings. Alternator shall be provided with protection to prevent damage due to any external fault or overload condition, including short circuit, ground fault, or overload.
3. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.
4. Alternator stator and exciter stator windings shall be a full Class H insulated system (generator rated for class B temperature rise of 80 degrees) vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air.
5. Alternator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Alternator windings shall be braced for full line to ground fault currents, on a solid grounded neutral system.
6. Provide an anti-condensation heater for the alternator for generator sets installed outdoors or in unheated environments.

2.08 ACCESSORIES AND ATTACHMENTS

A. Terminal boxes: The unit shall contain a controls terminal box properly sized and provided with terminal strips and interposing relays and devices to properly interface genset controls with remote controls and instrumentation. The generator shall have

separate AC and DC low voltage terminal boxes with suitably marked terminal strip for required connections.

- B. All required P.T.'s, C.T.'s and protective relays shall be supplied by the engine-generator Manufacturer.
- C. Vibration isolation: Provide spring type vibration isolation.

2.09 GENERATOR ASSOCIATED CONTROLS:

- A. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at 300% of rated current for not more than 10 seconds.

2.10 GENERATOR SET INSTRUMENTATION

- A. The generator set shall be provided with a microprocessor-based control system which is designed to provide automatic starting, monitoring, and control functions, both local and remote, for the generator set. The control shall be mounted on the generator set. Controls shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The control shall be UL508 listed, and meet IEC8528 part 4. All switches, lamps, and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. The entire control shall be tested and meet the requirements of IEEE-587 for voltage surge resistance.
- B. The front display of the genset control panel unit shall include the following:
 - 1. 1% accuracy generator set AC output instruments; The generator set shall be provided with a metering set including the following features and functions:
 - a. Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
 - b. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
 - c. Selector switches to allow viewing of voltage and amperes for each phase shall be provided.
 - d. Running Time Meter and Start Counter.
 - 2. Generator Set Mode Select Switch: The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
 - 3. Control Reset push-button switch with indicating lamp: Lamp shall flash to indicate that generator set is locked out due to a fault condition.

4. Emergency Stop switch: Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting. The switch shall include a lockout provision for use in safely disabling the generator set for necessary service.
5. Rest switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
6. Lamp Test Push-button Switch. Operating the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is operated, or after the switch is operated a second time.
7. Voltage and Frequency Adjustment: The genset mounted control shall include digital raise/lower switches for adjustment of voltage and frequency. The control system shall lock out these adjustments when the paralleling breaker is closed. Operator adjustment of the voltage and frequency shall not impact on the load sharing function or settings for kW and kVAR load sharing.
8. Provide an alarm and status indicating panel to indicate the genset conditions to the operator via LED display; provide the following alarm condition indicators:
 - Low DC Voltage
 - High DC Voltage
 - Weak Battery
 - Low Oil Pressure Alarm
 - Low Fuel - main tank
 - Fuel tank leak
 - High Engine Coolant Temp Alarm Amber
 - Ground Fault
 - Overcurrent Alarm
 - Overload
 - Low Coolant Temperature
 - Oil Pressure Sender Failure
 - Engine Temperature Sender Failure
9. The alarm and status indicating panel shall indicate the following genset shutdown conditions to the operator:
 - Breaker Failure
 - Not in Auto-
 - High Engine Coolant Temp
 - Low Oil Pressure
 - Overcurrent
 - Short Circuit
 - Loss of Excitation
 - Reverse Power
 - Overcrank(Fail to Start)
 - Overspeed
 - Under Frequency
 - Under Voltage
 - Over Voltage
 - Low Coolant Level
 - Emergency Stop
 - Fail to Crank
10. The alarm and status indicating panel shall indicate the following genset status conditions to the operator:
 - Genset Ready (in auto and ready)

- Generator Running (ready to load)
Generator Breaker Open/Closed
11. The alarm and status indicating panel shall indicate the following status/alarm and shutdown conditions to the plant SCADA system.
 - Low Fuel - main tank
 - Fuel tank leak
 - Not in Auto
 - Emergency Stop
 - Generator Running (ready to load)
 - Generator Fault
 12. In addition, provisions shall be made for indication of three (3) customer-specified alarm or shutdown conditions Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions.
 13. The non-automatic indicating lamp shall be red and shall flash to indicate that the generator set is not able to automatically respond to a command from a remote location.
- C. The generator set control shall annunciate all alarm and shutdown conditions from the engine electronic control.
- D. Engine Status Monitoring. The following information shall be available from a digital status panel on the generator set control :
- engine oil pressure (psi or kPA)
 - engine coolant temperature (degrees F or C)
 - engine oil temperature (degrees F or C)
 - engine speed (rpm)
 - number of hours of operation (hours)
 - number of start attempts
 - battery voltage (DC volts)
- E. The control system shall also incorporate a data logging and display provision to allow logging of a minimum of the last 20 warning or shutdown indications on the generator set, the time of the last fault of each type, and the number of faults of each type, and total time of operation at various loads as a percent of the standby rating of the generator set.
- F. Engine Control Functions.
1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
 2. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
 3. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
 4. The control system shall include sender failure monitoring logic for oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.
 5. The control system shall include all interfaces necessary for proper operation with the paralleling equipment provided under this contract.

- G. Internal Controls. The following internal control functions shall be provided for each generator set in the system.
1. Electronic isochronous kW load sharing control to operate the engine governors during synchronizing and to provide isochronous load sharing when paralleled. The control system shall allow sharing of real kW load between all generator sets in the system to within 1% of equal levels, without introduction of frequency droop into the system. The control system shall include all equipment required for kW load sharing with an infinite bus. The infinite bus governing controls shall allow the generator set to synchronize to an infinite bus, parallel, and ramp up to a preset load level on the generator set. Additional controls shall be provided to cause the generator set to ramp up to a kW load level signaled by the system master control. The isochronous load sharing module and engine governor shall be a coordinated system designed and built by the manufacturer of the engine.
 2. Load demand governing controls shall be provided to cause the generator set to ramp down to zero load when signaled to shut down in a load demand mode. On a signal to re-start, the load demand governing controls shall cause the generator set to synchronize to the system bus, close, and ramp up to its proportional share of the total bus load. The ramp rate of the generator set shall be operator-adjustable.
 3. Electronic kVAR load sharing control to operate the alternator excitation system while the generator set is paralleled. The control system shall allow sharing of reactive load between all generator sets in the system to within 1% of equal levels, without introduction of voltage droop into the system. The control system shall include all equipment required for VAR load sharing with an infinite bus in either a constant VAR or constant power factor mode for future application flexibility. (Mode and adjustments selectable by the operator)
 4. Equipment shall be provided to monitor the generator set as it is starting, and verify that it has reached at least 90% of nominal voltage and frequency before closing to the bus. The equipment provided shall positively prevent out-of-phase paralleling if two or more engine-generator sets reach operating conditions simultaneously by providing a lockout signal to disable breaker closure for generator set(s) in the system which have not been selected to be the first units to close to the bus. Controls to recognize the failure of the first breaker signaled to close, and allow system operation to proceed in spite of this failure shall also be provided (breaker failure alarm). Systems using dead bus relay schemes without a disable signal to positively prevent out-of-phase paralleling shall not be acceptable under this specification. System shall include an independent backup to automatically operate in the event that the primary system fails.
 5. Synchronizer to electronically adjust the engine governor to match the voltage, frequency and phase angle of the bus. Synchronizer shall maintain the engine-generator voltage within 1% of bus voltage and phase angle within 20 electrical degrees of the bus for 0.5 seconds before circuit breaker closing. Each unit shall have its own synchronizer; systems using a switching scheme to utilize a single system synchronizer will not be approved. Synchronizers and systems which utilize a motor driven pot for control of AC voltage during the synchronizing process will not be accepted. The system shall be provided with a fail to synchronize time delay that is adjustable from 10-120 seconds. Control logic for fail to synchronize function shall allow field adjustment of function for either alarm or shutdown of the generator set on failure condition. The synchronizer shall be designed and built by the engine manufacturer.

6. Controls shall include a permissive relay function to assure that the generator set does not attempt to close out of phase with the bus, due to errant operation of the synchronizer.
7. Control equipment shall contain a system of diagnostic LED's to assist in analyzing proper system function.
8. Controls shall include three phase sensing reverse power equipment, to prevent sustained reverse power flow into the generator set. When the reverse power condition exceeds 10% of the generator set kW for 3 seconds, the paralleling circuit breaker shall be tripped open and the generator shut down.
9. Controls shall be provided to verify generator set and bus phase rotation match prior to closing the paralleling breaker.
10. Electronic alternator overcurrent alarm and shutdown protection. This protection is required in addition to the overcurrent trip on the paralleling breaker, and shall sense current flow at the generator set output terminals. The overcurrent alarm shall be indicated when the load current on the generator set is more than 110% of rated current for more than 60 seconds. The overcurrent shutdown shall match to the thermal damage curve of the generator set, and shall not have an instantaneous function.
11. Electronic alternator short circuit protection. This protection is in addition to the overcurrent trip on the paralleling breakers. The short circuit shall occur when the load current on the generator set is more than 175% of rated current and an aggregate time/current calculation indicates that the system is approaching the thermal damage point of the alternator. The equipment used shall not have an instantaneous function and shall be selectively coordinated with the feeder circuit breakers. This protective function shall be provided by equipment that is a 3rd party recognized UL-listed utility grade protective relay made integral to the generator controller. Basis of design and performance is Amp-Sentry by Cummins Power Systems.
12. Provide overcurrent and short circuit protection for the conductors connecting the generator set to the paralleling switchgear. This protection may be integrated with alternator protection but must be positively coordinated to prevent tripping of the paralleling breaker prior to the operation of the alternator protective equipment. Basis of design is Amp-Sentry by Cummins Power Systems.
13. Controls shall be provided to sense reverse var conditions on the alternator while paralleled to the system bus. Reverse Var protection shall be set to operate at not less than 20% of the kVAR rating of the alternator at standby conditions. A reactive capability curve shall be provided to allow proper setting of this protection.
14. Generator set start contacts rated 10 amps at 32 VDC. A redundant network-based starting system shall also be provided.
15. Cooldown time delay, adjustable: 0-600 seconds. The control panel shall indicate the time remaining in the time delay period when the generator set is timing for shutdown.
16. Start time delay, adjustable: 0-300 seconds. The control panel shall indicate the time remaining in the time delay period when the generator set is timing for start.
17. The control system shall monitor the future paralleling breaker auxiliary contacts, and initiate a fault signal if the breaker fails to close within an adjustable time delay period after the control has signaled it to close (0.5-15 seconds). Breaker failure alarm shall cause the paralleling breaker to trip open, and lock out until manually reset.
18. Controls shall be provided to shut down generator set and initiate alarm when the generator set is at less than 85% of nominal voltage for more than 15 seconds,

- more than 110% of nominal voltage for more than 10 seconds, or more than 130% of nominal.
19. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
 20. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds.
 21. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC (24VDC nominal) or less than 8VDC or more than 16 VDC (12VDC nominal). During engine cranking (starter engaged), the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated. A fused 20 amp 24VDC power supply circuit shall be provided for switchgear backup power use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
 22. The control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.
 23. The voltage regulation system shall include provisions for reactive load sharing without voltage droop and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.
 24. The generator set shall be provided with a network communication module to allow real time communication with the automatic transfer switch microprocessor. The control shall communicate all engine and alternator data; alarm, shutdown and status conditions.
 25. The generator controller shall control the opening and closing of the switchgear generator breaker.
 26. Proprietary network language along a network cable shall be permitted between the generator controller and the transfer switch only.
 27. Generator start/load shall be a separate 2 wire hardwired signal from the plant SCADA system to the transfer switch and on to the generator controller. An individual start/load signal shall be provided per bus.

2.11 GENERATOR ENCLOSURE

- A. Where shown on the drawings, provide a sound attenuated weatherproof enclosure for use with a sub-base fuel tank base. The enclosure shall be designed to reduce source noise to an average 55 dBA at the property line including exhaust noise contribution. Enclosure shall be constructed of pre-painted white formed aluminum panels. The enclosure shall be sized to adequately house the genset and all accessories, minimum size shown on plans. Enclosure shall be certified for a wind load rating of 170 mph. The tank/enclosure package shall be pre-wired by the supplier including instrumentation and alarm systems. All fasteners, hinges and other hardware to be 316 stainless steel. The enclosure is to be in complete compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) with regard to clearances around electrical equipment specified herein.
- B. Enclosure shall be manufactured by Advanced Manufacturing & Power Systems, Inc., DeLand, FL. (AMPS), or by TAW Power Systems, Tampa FL. Substitutions must be submitted in writing to the engineer and be accepted as an approved equal prior to bid date.
- C. The Generator enclosure shall be designed in accordance with ASCE 7-98 "minimum design for building and other structure" and shall conform to the latest edition of the Florida Building Code FBC with all applicable amendments by Lee County Building Department. The enclosure/tank system shall be designed for the following parameters:
 - Ultimate wind speed = 170 mph (3-second gust).
 - Risk category = III.
 - Exposure category = C.
 - Rain Test equal to 4" per hour
 - Roof Load as Required by Florida Building Code

Generator enclosure/tank anchorages to concrete foundation shall be designed for the wind conditions specified above. All anchors shall be designed by a professional engineer registered in the State of Florida. All anchors shall be Type 316 stainless steel. Enclosure manufacturer shall provide shop drawings and design calculations signed and sealed by a professional engineer registered in the State of Florida for the enclosure, components and enclosure/tank anchorages. Generator enclosure/building complements and cladding shall be designed for the conditions specified in ASCE 7-98, Florida Building Code (FBC), and Lee County building Department Requirements. Components and Cladding shall be designed for the following parameters for internal wind pressures coefficients in accordance of ASCE 7-98 provision for "components and cladding", Condition I, ($G C_{pi} = +0.18, -0.18$).

- D. Walls shall be constructed of marine grade 0.090" type 5052 formed aluminum panels. Roof shall be constructed of marine grade mill finish 0.04 minimum thickness formed aluminum panels using an interlocking standing seam design capable of supporting 50 pounds per square foot. All external attaching hardware shall be stainless steel screw type mechanical fasteners. Provide acoustic insulation and a perforated aluminum liner in the walls and roof as needed to achieve the sound reduction specified.
- E. Enclosure shall consist of a roof, two (2) sidewalls, two (2) end walls, and be manufactured of formed aluminum components. The enclosure is to be provided

with a means for securely attaching the entire structure to the base/fuel tank as specified within. Roof, sidewalls and end walls shall be of formed 0.090 marine grade aluminum. The roof is to be bolted to both side and end walls to form a complete weather and wind resistance assembly.

- F. A minimum clearance of 36" shall be allowed for walkway space between the generator frame and interior sidewalls. A minimum walkway clearance of 36" shall be allowed between the generator end frame and the interior rear wall of the enclosure. The radiator front face shall be sealed to the front wall utilizing and 2" minimum rubber gasket material to minimize recirculation of radiator air discharge and prevent the transmission of vibration from the packaged generator set to the enclosure. Wall framing shall be incorporated in the panels by forming an open back box structure. Skin material shall be minimum thickness .090" marine grade aluminum. Enclosure shall have a baked on powder-coat finish for maximum corrosion resistance. Exterior skin panels shall be integral to the wall structure and not separate pieces riveted onto framing members. Wall panels shall be no wider than 36" each and shall be removable without the use of special tools. Wall and roof panels shall be designed so that field replacement can be accomplished without disassembly of the entire structure if damage should occur.
- G. Standard enclosure exterior color is WHITE unless otherwise specified.
- H. Roof assembly shall be peaked to aid in rainwater runoff. Cambered roof designs and roofs with thicknesses of less than 0.090" nominally shall not be considered. Roof assemblies are to be mechanically fastened to the vertical wall sections. Glued or crimped roofs shall not be allowed.
- I. Air handling shall be as follows: Air will enter the enclosure through a Hood, Plenum or Sound Attenuated Louvers/Baffles, as determined by the specific application and shall allow for the airflow demand for proper cooling to generator set package. The cooling air Inlet system shall prevent water intrusion into the enclosure with the generator set operating at full rated load while allowing for a maximum air restriction of less than 0.25" H₂O. Radiator Discharge shall be through a gravity operated extruded aluminum back-draft type damper and into a vertical discharge plenum or hood. Discharge plenum/hood shall discharge air upward and be provided with a means to positively drain any and all water entering the discharge device. Air discharge devices shall in no event restrict airflow by more than 0.25" H₂O. To ensure adequate airflow for cooling and combustion the static restriction over the entire system shall not exceed 0.50" H₂O. Both Intake and Discharge hoods and plenums shall be provided with removable bird/rodent screening to prevent the entrance of debris, birds, rodents and other vermin.
- J. Acoustical insulation materials shall consist of a UL Classified Thermofiber insulation material with a heat/fire resistance rating up to 2400° F and provide superior sound attenuation performance. Acoustical insulation material on interior roof and walls is to be mechanically held in place by 0.032" mill finished perforated aluminum with tuned engineered hole diameter for optimum sound attenuation at 1000 Hz. Interior perforated aluminum material shall protect the insulation material as well as allow noise to permeate the absorptive material.

- K. Four-point lifting provisions shall be provided and have sufficient capacity suitable for rigging the entire Enclosure assembly.
- L. A minimum of two (2) single personnel access doors shall be provided. Doors shall be manufactured of the same material as enclosure. Doors shall be fully gasketed to form a weather tight perimeter seal. Door hinges shall be full length stainless steel piano type and shall be attached with stainless steel hardware. Door handles shall be of a corrosion resistant material and shall provide for a lockable, secure entry point into the enclosure. Doors shall be insulated with no less insulation than is provided in the enclosure walls for sound attenuation. Provide at each door access a set of hot dip galvanized, OSHA approved access steps.
- M. Enclosure manufacturer shall provide all necessary hardware to internally mount the exhaust silencer(s) specified herein. Silencer mounting hardware shall maintain the Weather Resistant integrity of the enclosure system. If the silencer is mounted internally it should discharge upward into the radiator discharge plenum or hood where possible, otherwise the enclosure manufacturer shall provide an aluminum rain collar and rain dress shield. Rain Collar and Dress Shield shall be manufactured of aluminum or stainless steel.
- N. Provide for enclosure lights with light switch and duplex receptacle.
- O. Provide minimum 100A main circuit breaker, 208/120V branch circuit panelboard mounted to service enclosure loads and generator heater, battery charger and other ancillary loads.
- P. The enclosure must bear the Florida Department of Community Affairs Modular Building Insignia.
- Q. Provide additional requirements as indicated on drawings.

2.12 SUB-BASE FUEL TANK

- A. Provide where shown on the drawings, a UL listed Double Wall diesel fuel storage tank. The fuel tank shall be an integral part of the enclosure/generator mounting frame. Fuel tank shall have a capacity of no less than 4000 usable gallons. Fuel tank provided shall comply with and be constructed in accordance with the requirements of Underwriters Laboratories UL-142 "Special Purpose Protected Secondary Containment Generator Base Tank"; N.F.P.A. 30, 37 & 110; Florida Department of Environmental Protection (FDEP) and the Steel Tank Institute. Fuel tank venting in compliance with NFPA and UL
- B. Complete assembly shall be manufactured using minimum 3/16" thick sheet steel for the inner tank and 3/16" thick 304 Stainless Steel for outer tanks. Fuel tank and containment basin are to be leak tested at 3-PSI air as outlined in UL-142 standards. The interstitial space shall be monitored using a float type level switch and shall indicate the presences of fuel in the annular space by use of normally open contacts that are to be wired back to the generator set control panel for visual/audible indication.

- C. Fuel tank provided shall have the following devices but by no means be limited to those as specified. A 2" Manual fuel fill cap, with means to padlock fill cap, mechanical fuel level gauge, rupture basin alarm with normally open contacts, fuel supply and return ports with full length pick-up tubes. A foot or check valve shall be installed on the generator supply to prevent loss of prime during idle conditions. A rectangular double-walled electrical stub-up area is to be provided and located directly under the generator circuit breaker to provide a pass-through for field installation of electrical load conductors. Tank color shall match the generator enclosure.
- D. The tank shall be elevated off the concrete pad with integral tank supports that provide a 2 inch air space to control moisture accumulation. The tank supports shall be arranged so that moisture is not trapped in the channel of the supports. Provide 3/8"TH x 6"W continuous neoprene pads between the tank supports and the concrete pad. The tank shall include the hurricane tie down restraint points and drillings for grounding attachments.
- E. The tank shall be equipped with a listed and labeled 10-gauge stainless steel overspill containment box welded and permanently affixed to the top of the tank and shall include a handle pull overfill drain to allow fuel to return to the tank. The fill box shall be installed in an outside location on the tank top. Install a mechanical fill limiter with tight fill connection inside the spill containment box to shut off the flow of fuel at 95% of tank capacity. Provide a Rochester magnetic level gauge near the fill location. Provide one set of hot dip galvanized, OSHA approved access steps at the fill location.
- F. Provide an audible and visual high level alarm station at the fill location set to alarm at 90% of tank capacity. The alarm station shall be housed in a NEMA 3R enclosure. Provide a high level alarm float switch in the tank and wire to the generator controller and remote annunciation alarm console.
- G. Provide Ohmart Vega or equal Vegaflex 81 Fuel level measurement system with fuel level transmitter (4-20ma) output wired to the plant PLC-1.
- H. The contractor shall coordinate with the owner and provide all tank permit applications and reviews as required by the FDEP and proper fire district regulating authority and properly permitted.
- I. All tanks shall be labeled by product, capacity and manufacturer pre NFPA requirements.
- J. Provide a CO2 fire extinguisher as required by the fire marshal.

PART 3 - EXECUTION

3.01 SERVICES

- A. Furnish the services of a competent and experienced Manufacturer's field service technician who has complete knowledge of proper operation and maintenance of the equipment to inspect the installed equipment, supervise the initial test run, coordinate checkout of the interlocks between ATS and the Genset and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.

- B. Provide instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the Owner and shall take place prior to final acceptance and after substantial completion by the Owner.
- C. The final copies of operation and maintenance manuals specified in division 1 Sections must be delivered to the Engineer prior to scheduling the instruction period with the Owner.
- D. The distributor of the Genset shall provide installation coordination services to insure a properly installed and coordinated system including all coordination with the electrical and instrumentation contractor for proper interfacing. As a minimum the Genset Distributor shall coordinate the installation with factory trained technicians with weekly site visits from the time the genset arrives on site to the time it is fully operational. Also the technician shall provide on site coordination of all conduit stub ups, fuel line stub-ups, pad dimensions, embedment etc prior to slab pour. It is the intent of these specifications that the Distributor of the Genset provide complete system coordination including but not limited to; fuel system with venting and filling requirements; exhaust system requirements; cooling and ducting system; power; control, battery and grounding systems, switchgear system; testing and acceptance certification. The site technician shall submit written reports of the coordination efforts weekly to the engineer and meet with the engineer as requested. The technician shall certify the units installed per manufacturers recommendation prior to test runs or functional testing.

3.02 INSTALLATION

- A. The genset installer shall install suitable jacket water additives as furnished by the engine Manufacturer and approved by the Engineer, for prevention of both scale formation and corrosion in the water jackets and cooling system components which are in contact with the engine jacket water. These additives shall be added to the cooling system prior to running the field acceptance test.
- B. The Contractor shall install the complete exhaust system, together with the silencer, the piping and insulation, and the complete supporting system. Where the exhaust passes through the roof or side wall, furnish and install suitable thimble and "rain skirt".
- C. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the Manufacturer's standard practice prior to shipment. An adequate supply of touch-up paint shall be supplied by the Manufacturer.
- D. Neoprene pads shall be installed to isolate the fuel tank bottom from making direct contact with the concrete equipment pad. Provide a neoprene pad or strip-for all points that come in contact with the concrete equipment pad.

3.03 TESTING

- A. The engine-generator set shall be given the Manufacturer's standard load bank test at full rated load and power factor at the factory.
- B. Prior to final acceptance of the generator set, all equipment furnished under this Section shall be field tested to show it is free of any defects and that the generator

set can operate satisfactorily under full load test using resistance type load banks. The genset testing shall be for four (4) continuous hours. Any defects which become evident at this time shall be corrected before acceptance.

- C. During the field tests, readings will be taken at thirty (30) minute intervals of the following: oil temperature, exhaust temperature, water temperature, volts, amps, frequency, fuel pressure, manifold pressure, and oil pressure, KW, KWH.
- D. The owner shall provide fuel for start-up and testing of the generator system.

3.04 WARRANTY

- A. The complete electrical standby power system; generator set, controls, and associated switches, and accessories, as provided by the factory distributor including the ancillary equipment shall be warranted by the manufacturer against defects in materials and workmanship for a period of five years or 1500 genset run hours, whichever occurs first from the date of system startup. Coverage shall include parts, labor, travel expenses and labor to remove and reinstall defective equipment under terms of the Manufacturer's comprehensive standard warranty. No deductibles shall be applied to the warranty except for starting batteries and water jacket heater being warranted for one year.

END OF SECTION

SECTION 26 36 13

SAFETY SWITCHES AND DISCONNECTS

PART 1 – GENERAL (NOT USED)

PART 2 – PRODUCTS

2.01 GENERAL

- A. All single throw disconnect switches and double throw manual transfer switches shall be heavy-duty horsepower rated type. Safety switches shall be rated for the available fault current where installed. Provide enclosed molded case switch type disconnects where required to meet high available fault current areas (above 10kaic). Switches shall be fusible only where required to meet equipment nameplate requirements.
- B. Switches shall be 240 volt rated on systems up to and including 120/208V and 600V rated on higher voltage systems. All switches for motors shall be horsepower rated. All switches shall be NEMA 4X stainless steel enclosure except switches mounted in air-conditioned spaces. As an alternate to NEMA 4X stainless steel enclosure provide NEMA 4X switches with aluminum enclosure as manufactured by Bryant. As an alternate to NEMA 4X stainless steel enclosures provide polyglass enclosures for 30amp (10hp) switches in the chemical areas equal to Hubbell Circuit-Lock.
- C. Provide and install lugs on disconnect switch as required to accept conductors called for on drawings.
- D. Provide Switches with an externally operated handle; quick make quick break mechanism; the handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position with a padlock. Switches shall have arch suppressors, pin hinges and be horsepower rated at 600 volts.
- E. All disconnect switches shall be furnished from the manufacturer with (2) normally open and (2) normally closed interlock contacts. Motor space heater shall be wired through one set of contacts. The other contact shall be wired through the local off/remote motor switch at the disconnect location.
- F. Double throw non-fused safety switches may be used for manual power transfer where shown on the drawings and in areas up to 10,000A available short circuit current. In areas above 10k amps use double throw molded case manual transfer switches rated for the available fault currents.

2.02 SUBMITTALS

- A. Submit product data on all major types of disconnects.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. All three phase motors shall be provided with field mounted disconnects if they are not mounted within site of the three phase feeder breaker or control device they are wired from.
- B. With the safety switch in the open position, both the motor heater and power circuits shall be open as well.
- C. Provide all motor disconnects with an auxillary Off/Remote maintained hand switch to disable the control power circuit.

END OF SECTION

SECTION 264100

LIGHTNING PROTECTION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION

A. Description of Systems:

1. A Lightning Protection System shall be placed on the structures by experienced installers in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters' Laboratories. Intent of the lightning protection systems shall be to protect the structures against damage by lightning. All equipment to that result shall be included whether or not specifically called for herein. Installers shall be Underwriters Laboratories certified as Master Label installers or of equal qualifications as approved by Engineer.
2. Provide complete and upgraded lightning protection systems as noted on the drawings. Provide bonding and grounding systems and interconnection to the site lightning protection and grounding systems as shown on the drawings and as specified. All systems shall be in conformance to NFPA-780, UL-96, UL96-A and as shown on the contract drawings.
3. Materials shall comply in weight, size and composition with the requirements of Underwriters' Laboratories and the National Fire Protection Code relating to this type of installation, and shall be U.L. labeled.
4. All installations shall be performed to meet Underwriters Laboratories Master Label standards. Provide a UL Master Label for all protected structures to the extent the structures are eligible under the standards of UL 96A. If the structure is not eligible under the standards of UL 96A, provide a Letter of Findings for the installation at completion of work.

1.02 SUBMITTALS

A. Shop Drawings and Product Data:

1. Shop Drawings: Shop drawings shall be submitted before work is started. Drawings shall include full layout of cabling and points, and connections. The drawing shall show the type, size and location of all equipment, grounds and cable routing. The drawing shall show all grounds and air terminals that are shown on the contract drawings. See additional requirements for shop drawings in section 260500.
2. Product Data: Product Data shall be submitted on all equipment to show compliance with this section of the specifications and shall include manufacturer's written recommendations for installation. Provide a sample of the air terminal to be used with the shop drawing submittal.

1.03 SYSTEM DESIGN

- ###### **A.**
- The system shall be an effective, aesthetically acceptable streamer-delaying lightning protection system to the standards of Underwriters Laboratories UL 96 & UL96A. The purpose of the system shall be to reduce the likelihood of a direct strike to the protected structure by delaying the formation of streamers from that structure.

Secondarily the system shall be designed in such a manner that it affords protection to the structure upon which it is installed in the event a direct lightning strike to the structure does occur.

- B. The system components shall not require mounting in a specific configuration or impose any other mounting limitations which may interfere with utility use of structure space or otherwise preclude or limit the intended use of the structure.
- C. All components shall be attached to the structure in such a manner as to reduce the possibility of corrosion between dissimilar metals. If installed on a metallic or otherwise electrically conductive structure, the system shall be electrically bonded to the structure upon which it is installed through mounting clamps and brackets, with additional bonding to grounded objects and to the structure, as required or as indicated on the drawings.
- D. The system shall be composed of components that meet the requirements of Underwriters Laboratories UL 96. Aluminum and Stainless Steel components shall be employed on structures and portions of structures subject to corrosive elements, where the use of copper components could be rendered ineffective, due to the surrounding environment. No dissimilar metals shall be allowed to be in contact.
- E. Air Terminals shall be mounted on all outside corners of each structure, around the perimeter of each structure at intervals not to exceed twenty (20) feet, and on the interior of each structure in such a manner that no two Air Terminals are separated by a distance of more than fifty (50) feet. In the event this is not practical, such as on a large open tank, Air Terminal spacing around the perimeter shall be decreased to not more than fifteen (15) feet, with a total number around the perimeter not less than the total of the normally required perimeter Air Terminals, plus the additional number of Air Terminals if Air Terminals had been installed on the interior at intervals not greater than fifty (50) feet.
- F. Each Air Terminal shall be provided with two (2) contiguous paths to ground. On structures with handrails, exposed structural members, or other conductors, provide a bond to structural conductors from the lightning protection system. Handrails shall not be used as a main lightning protection conductor. Provide a continuous lightning protection conductor parallel with handrails and bond from it to each handrail section and a minimum of 10' on center. In the case of a structure or a portion of the structure where the structure itself is electrically conductive, such as a light pole, tower, etc, that structure or portion of the structure itself may be employed as part of the lightning protection system, provided it meets the minimum requirements of UL 96 or UL 96A, and down conductors are specifically not required on such structures.

PART 2 - PRODUCTS AND INSTALLATION

2.01 AIR TERMINALS

- A. Air Terminals shall be of the streamer delaying type. Each air terminal shall have a minimum of five hundred dissipater electrode wires, none of which exceed ten thousands of an inch diameter. Electrode material shall be high quality 316 series stainless steel and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface. Terminals shall project a

minimum of 18" above top of object to which attached.

- B. Streamer-delaying Air Terminals shall be manufactured by Lightning Master Corporation.

2.02 CONDUCTORS

- A. Roof conductors shall consist of rope lay tinned copper conductor complying with the weight and construction requirements for Class II lightning protection systems (115,000 CM). Conductors shall be coursed to interconnect with air terminals, and in general, provide a two-way minimum path to ground. The angle of any turn shall not exceed 90 degrees, and shall provide an approximately horizontal or downward course. Down conductors shall be copper, and shall be installed in PVC conduit and hidden within the structure. Approved bi-metal transitions from aluminum conductors for bonding of aluminum roof structures (exhaust fans, etc.) to copper down conductors shall be provided.
- B. Only in the case where aluminum building flashing, aluminum handrails, aluminum catwalks is specified, will aluminum roof conductors be acceptable; otherwise provide copper system throughout. All down conductors shall be copper. Radius of bends shall not be less than 8 inches.
- C. Counterpoise loop ground conductors shall be tinned copper and be a minimum size equal to the main roof conductor size (115,000cm) or 2/0.

2.03 FASTENER

- A. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- B. All fasteners shall be of a heavy-duty bolted type typically used for Class II lightning protection systems. Conductor to conductor connections shall be through heavy-duty pressure type bolted fasteners. Splice and bimetal connections shall be through four bolt pressure type heavy-duty connectors. Crimp fasteners shall not be used.
- C. Dissimilar metals shall not be allowed to be in contact. Aluminum fittings shall be mounted on aluminum where necessary, and bonded to the main system using bi-metal connectors. Lead coating shall not be acceptable as a bi-metal transition.
- D. All mechanical termination points and lugs shall have an anti-corrosive coating applied. In areas subject to chemical corrosion (odor control, degasifiers, chem. Rooms, etc.) apply Glyptal 1201 red enamel coating after termination is made. In other less corrosive areas apply Permatex battery protector sealer (SA-9) or Glyptal 1201 or equal.
- E. Lugs for copper cable shall be high copper alloy terminals or stainless steel equal to Burndy type QDA Qiklug. Lugs of aluminum alloy are not acceptable.

2.04 GROUND CONNECTIONS

- A. Ground rods shall be installed in the quantities as indicated on the drawings and as required by NFPA-780. Ground rods shall be placed a minimum of two (2) feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path system shall be connected to water piping system with approved water pipe type strap connector. All ground rods shall be 5/8" X 20' copperweld type. All connections made below grade shall be exothermically welded (cadweld) connection and placed in a ground rod inspection well as detailed.
- B. Soil type in the area is primarily sand with rock layer below. The rock layers on site will require drilling of ground rod holes. All ground rods shall be installed vertically. After drilling and installation of rod, back fill with sand and hydro compact around rod to provide low resistance to ground.

2.05 GROUND ROD & GROUND SYSTEM TESTING

- A. The contractor shall utilize a clamp on ground loop tester during construction to check the system for high resistance connections. The resistance at any point below the air terminal shall be less than 5 ohms. The resistance at grade level on the down conductors should be less than 2 ohms. The contractor shall investigate and correct high resistance readings within the system. Demonstrate to the engineer's satisfaction with witness testing, provision of a low resistance installation meeting this specification.
- B. Provide three point fall of potential ground testing on a minimum of one ground rod on each facility prior to connection to the counterpoise system. As an alternate provide ground rod selective method testing with appropriate ground testers. The complete ground system shall be three point fall of potential tested after completion of work. The system shall be tested at a minimum of three points spaced around the site using the "Tagg Slope" technique. Total grid system grounds should be less than one ohm.

2.06 INSTALLATION

- A. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" PVC conduit. Surface mount down conductors to existing structures in a neat and workmanlike manner. All metallic equipment within 6 feet of any lightning conductor shall be bonded to conductor. System shall also be tied to the main service electrical ground and other ground systems in the area.

2.07 COORDINATION

- A. The installer shall coordinate the lightning protection work to insure a correct, neat, and unobtrusive installation. In normally accessible areas, catwalks, equipment platforms, etc., provide installation without trip hazard. Provide embedded conduit sleeves across access ways for ground conductors. In retrofit projects provide flat copper strap to ground or bond across access ways.
- B. Any electrical service grounding system and metallic water service piping to the structure shall be electrically bonded to the lightning protection system.
- C. The contractor shall coordinate his work in such a manner as to not interfere with the

normal operation of the structure upon which the installation is performed.

2.08 MATERIAL MANUFACTURERS

- A. Equipment shall be as manufactured by Thompson Lightning Protection, Inc. Independent Protection Company, Inc., Heary Brothers Lightning Protection, Harger Lightning Protection, Robbins Lightning Protection or Lightning Master Corporation.

END OF SECTION

SECTION 26 43 00

SURGE PROTECTIVE DEVICES (SPDs)

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers. Refer to related sections for surge requirements in:

1.02 RELATED SECTIONS

- A. Control Panels
- B. Instrumentation and Controls Systems

1.03 REFERENCES

- A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.04 SUBMITTALS

- A. The following information shall be submitted to the Engineer:
 1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_N).
 2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.
- B. Where applicable the following additional information shall be submitted to the engineer:
 1. Descriptive bulletins
 2. Product sheets
- C. The following information shall be submitted for record purposes:
 1. Final as-built drawings and information for items listed and shall incorporate all changes made during the manufacturing process

1.05 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. Operation and maintenance manuals shall be provided with each SPD shipped.

1.07 MANUFACTURERS

- A. Eaton / Cutler-Hammer products
- B. Square-D products
- C. General Electric products
- D. EDCO
- E. APT

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

1.08 SYSTEM APPLICATION

- A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.
- B. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

| Minimum surge current capacity based on ANSI / IEEE C62.41 location category | | | |
|--|---|-----------|----------|
| Category | Application | Per Phase | Per Mode |
| C | Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance) | 450kA | 225 kA |
| B | High Exposure Roof Top Locations (Distribution Panelboards) | 250 kA | 125 kA |
| A | Branch Locations (Panelboards, MCCs, Busway) | 250kA | 125 kA |

- C. SPD Type – all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

PART 2 - PRODUCTS

2.01 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 115% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

| Configuration | Protection Modes | | | |
|--------------------|------------------|-----|-----|-----|
| | L-N | L-G | L-L | N-G |
| Wye | • | • | • | • |
| Delta | N/A | • | • | N/A |
| Single Split Phase | • | • | • | • |
| High Leg Delta | • | • | • | • |

5. Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

| Modes | 208Y/120 | 480Y/277 | 600Y/347 |
|---------------|----------|----------|----------|
| L-N; L-G; N-G | 700 | 1200 | 1500 |
| L-L | 1200 | 2000 | 3000 |

B. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as

replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV.
3. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.
4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
 - a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
 - i. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
 - ii. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
 - iii. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
 - b. Surge Counter – The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of $50 \pm 20A$ occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
 - i. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge

counter's memory shall not require a backup battery in order to achieve this functionality.

6. Overcurrent Protection
 - a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Safety Requirements
 - a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free.
 - b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit.
 - c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.02 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

- A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
 1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
 2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
 3. The panelboard shall be capable of re-energizing upon removal of the SPD.
 4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.
 5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
 6. The SPD shall be of the same manufacturer as the panelboard.
 7. The complete panelboard including the SPD shall be UL67 listed.
- B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
 1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.
- C. Switchgear, Switchboard, MCC and Busway Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.03 ENCLOSURES

- A. All enclosed equipment mounted for indoor application shall be NEMA 1 general purpose enclosures. Provide NEMA 4X enclosures for all outdoor applications.
 1. NEMA 1 – Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
 2. NEMA 4X – Constructed of stainless steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, splashing water, and hose directed water).

2.04 POWER SUPPRESSORS FOR ELECTRONIC EQUIPMENT

- A. Each item of electronic equipment provided under this contract and connected by line cord or direct wired to the building electrical system shall be provided with a three-stage single or multi-phase hybrid suppressor. Fusing shall be provided which removes the protective elements from the circuit upon failure. Visual indication or loss of output power shall be used to notify the user of device failure.
- B. Suppressors shall be rated for a minimum of 125% of their continuous electrical load. Suppressors for cord connected equipment shall be equipped with standard NEMA cordsets one of which includes a molded grounding receptacle and the other, a molded grounding plug. Suppressor shall be installed in series with the power cord for the protected equipment. Where several items of equipment are grouped within the same cluster of equipment, one suppressor may be used in conjunction with properly sized grounding plugstrip to serve the equipment.

- C. Suppressors for direct wired equipment shall be identical in internal design to the unit described for cord connected applications, however, protected screw terminals suitable for termination of solid copper wire shall be used for wiring terminations. One suppressor may be used to support several equipment cabinets provided all cabinets are located within the same equipment cluster and the maximum connected load shall not exceed eighty percent of the rated suppressor capacity.
- D. Suppressors shall be constructed with a phenolic non-flammable exterior housing with provisions for mounting to the interior of equipment racks, cabinets, or to the exterior of free-standing equipment. Suppressors shall be constructed as three-stage devices. The first stage shall include a high-energy varistor clamp between line and neutral and from neutral to ground. The second stage shall consist of series air-core inductor installed in the line conductor(s) to properly coordinate the action of the first and third stages. The third, fast acting, hard clamping stage shall consist of a network of silicon avalanche bipolar surge suppression diodes between the neutral and line conductor(s).
- E. Minimum suppressor performance characteristics shall be as follows:
 1. Maximum single impulse line-to-neutral current withstand: 15,000 Amperes (8 x 20 us waveform)
 2. Maximum single impulse neutral-to-ground current withstand: 10,000 Amperes (8 x 20 us waveform)
 3. Pulse lifetime rating Category B worst case current waveform (8 x 20 us @ 3000 Amperes): 1200 occurrences
 4. Pulse lifetime rating for 200 Ampere (8 x 20 us waveform): 10,000 occurrences
 5. Worst case response time: Five Nanoseconds
 6. Worst case (Maximum Single Impulse Current Conditions) clamping voltage: 400% of nominal phase-to-ground RMS voltage.
 7. Initial breakdown voltage: 200% of nominal phase-to-ground RMS voltage.

2.05 SUPPRESSORS FOR CONDUCTOR PAIR PROTECTION

- A. Suppression devices for conductor pair protection shall be provided in multi-circuit pluggable packages suitable for the circuitry to be protected. Units for protection of data circuits which utilize standard connector configurations shall be equipped with connectors which install in series with the data cable to the protected equipment. Units intended for use with multiple wiring pairs shall be equipped with an accessory terminal blocks or strips suitable for the type of wiring being used. Single pair units shall be configured as encapsulated units with wire leads or screw-terminal wiring terminations. Suppressors installed outside of terminal or equipment cabinets (except at designated terminal boards) shall be provided with a housing to afford physical protection for the surge suppression modules.
- B. Suppression for each pair shall consist of a three-element gas tube first stage, an

isolating element in series with each conductor of the pair, and a silicon avalanche second stage. Second stage clamping shall be provided across the pair for differential mode protection and from each side of the pair to ground for common mode protection. Resistive limiting elements may be used on low current circuits where the effect of voltage drop across the series resistance has no effect on circuit operation. Inductive series elements shall be used on higher current circuits to effectively pass direct or low frequency alternating currents while limiting passage of fast risetime surge waveforms. Silicon avalanche devices shall be designed for surge suppressor applications and shall be polarized or bipolar as appropriate for each circuit.

- C. Minimum performance criteria (each circuit) shall be as follows:
1. Maximum single impulse conductor-to-ground or conductor to conductor current withstand: 10,000 Amperes (8 x 20 us waveform)
 2. Pulse lifetime rating Category B worst case current waveform (8 x 20 us @ 3000 Amperes): 10 occurrences
 3. Pulse lifetime rating for 100 Ampere (10 x 1000 us waveform): 1,000 occurrences
 4. Worst case response time: Five Nanoseconds
 5. Worst case (Maximum Single Impulse Current) clamping voltage: 200% of normal operating voltage amplitude and polarized or bipolar as appropriate for each circuit type.
 6. Initial breakdown voltage: 150 percent of normal operating voltage peak amplitude plus or minus five percent.
 7. Capacitance: Capacitance for DC or low frequency lines shall not exceed 2000 picofarads measured line to line or line to ground at the rated diode breakdown voltage. Suppressors intended for use on high frequency or high baud rate circuits shall be designed for use on such lines. Capacitance of such units shall be equated to equivalent cable feet based on the type of cabling used for the particular circuit. The sum of equivalent cable feet for suppressors and actual cable footage shall not exceed manufacturers recommended maximum values for the system on which these devices are installed.
 8. Circuit compensation: Any additional circuit compensation (gain or equalization) required to compensate for the insertion of surge suppression devices shall be provided as part of this contract.

PART 3 - EXECUTION

3.01 BONDING AND GROUNDING CONDUCTORS AND MATERIALS

- A. Conductors utilized for surge suppressor bonding shall be a minimum of #6 AWG solid insulated copper unless otherwise specified.
- B. Ground bus or strip material shall be copper, a minimum of 26 gauge in thickness and three inches wide unless otherwise specified. Bus materials may be secured to surfaces with an appropriate mastic material or mechanical fasteners. Bus connections shall be bolted or brazed and reinforced as necessary on thin bus material to provide a permanent and secure connection.
- C. Unless otherwise specified, all surge suppression grounding electrodes shall be 5/8" diameter copperweld rods, twenty feet in length.

- D. Connectors, splices, and other fittings used to interconnect grounding conductors, bond to equipment or ground bars, shall comply with requirements of the National Electric Code and be approved by Underwriters Laboratories for the purpose.
- E. Connectors and fittings for grounding and bonding conductors shall be of the compression or set-screw type in above grade locations. Connections below grade shall be exothermically welded or brazed.
- F. Bonding connections between electrically dissimilar metals shall be made using exothermic welds or using bi-metal connectors designed to prevent galvanic corrosion.

3.02 SEGREGATION OF WIRING

- A. All system wiring shall be classified into protected and non-protected categories. Wiring on the exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.
- B. All wiring between surge suppressors and protected equipment shall be considered protected. Isolated circuitry exempted from surge suppression requirements in part one of this section shall also be considered protected.
- C. A minimum of three inches of separation shall be provided between parallel runs of protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.

3.03 INSTALLATION OF SUPPRESSORS

- A. Suppressors shall be installed as close as practical to the equipment to be protected consistent with available space. Where space permits and no code restrictions apply, suppressors may be installed within the same cabinet as the protected equipment. Suppressors installed in this manner shall utilize the equipment chassis as a medium for bonding of their ground terminals. Bonding jumpers not exceeding two inches in length shall be installed between the chassis and suppressor ground terminals. Bolted connections with star washers shall be used to insure electrical and mechanical integrity of connections to the equipment chassis.
- B. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.
- C. Bonding between ground terminals for power and signal line suppressors serving a particular item or cluster of equipment shall be kept as short as possible. Where practical, suppressors shall be installed in a common location for the cluster with their ground terminals bonded closely together. For installations requiring separation between the various suppressor grounds and equipment chassis within an equipment cluster, the following table shall be used to determine bonding conductor requirements (distances are measured between most distant suppressor or chassis grounds):

BONDING DISTANCE MATERIAL

| | |
|--------------|--------------------------------|
| 0 - 10 feet | #6 AWG Bare Copper (Solid) |
| 10- 25 feet | 1-1/2" Copper Strip 26ga. Min. |
| 25- 50 feet | 3" Copper Strip 26ga. Min. |
| Over 50 feet | 6" Copper Strip 26ga. Min. |

Care shall be exercised to avoid connection of incidental grounds to the bonding bus system.

- D. Where terminal cabinets are used to house surge suppressors, painted steel backboards shall be used to serve as a low impedance ground plane for bonding surge suppressor leads together. Terminal boards used for the same purpose shall be laminated with a single sheet of 14 ga. galvanized steel to serve as a ground plane for suppressors. Suppressors with ground terminals not inherently bonded to the ground plane through their mounting shall be bonded to this plane using a two-inch maximum length of #12AWG copper wire and suitable lug. Ground planes and backboards shall be drilled to accept self tapping screws, any paint in the area of the bond shall be removed and star washers shall be used.
- E. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG bare copper conductors and approved connections unless otherwise noted.

3.04 WARRANTY

- A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

SECTION 26 50 00

LIGHTING FIXTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Description of System
 - 1. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the drawings.
 - 2. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures. See special mounting requirements as detailed on the drawings.
 - 3. Lamps shall be included in the system guarantee for a period of ninety (90) days after final acceptance of the building.

1.02 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes
 - 1. National Electrical Code (NEC), NFPA 70
 - 2. Florida Building Code (FBC)

1.03 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section
 - 1. UL Underwriters Laboratories
 - 2. CBM Certified Ballast Manufacturer's Association

1.04 SUBMITTALS

- A. Shop Drawings and manufacturers data shall be submitted for the following items
 - 1. Luminaire data shall show full-size cross sections. Indicate finished dimensions, metal thickness, U.L. Label, finish, lens/louver thickness and materials.
 - 2. Show mounting details, including hung ceiling construction.
 - 3. Indicate type of ballast and manufacturers and ballast quantity and location. Include information as to power factor, input watts and ballast factor.
 - 4. Indicate lamps to be utilized and quantity.
 - 5. Include a complete listing of all luminaries on a single sheet. This listing shall contain the luminaire type, manufacturer's catalog number, applied voltage, lamps, ballast type and luminaire quantities.
 - 6. The Engineer reserves the right to require submittal of a complete sample fixture for any fixture type.
 - 7. For exterior post/pole mounted light fixtures, clearly indicate hand hole and lightning protection ground lug mounted to post/pole at hand hole inside post/pole.
 - 8. Signed and sealed shop drawings and calculations shall be submitted for all exterior pole mounted fixtures. The seal must be of a registered professional engineer certifying that the foundation and pole/fixture

assembly meets or exceeds the wind load criteria of the most current Florida Building Code. The foundation details shown on the plans are for bidding purposes only; the contractor shall provide the foundation and pole assembly necessary for compliance as submitted at no additional cost to owner.

9. Product data shall be submitted showing manufacturer's written recommendations for storage and protection, and installation instructions.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Luminaires

1. Acceptable manufacturers are listed in the lighting fixture schedule shown on the Drawings.
2. The designations indicated on the lighting fixture schedule are a design series reference (not necessarily a complete catalog number) and do not necessarily represent the number, size, voltage, wattage, type of lamp, ballast, finish trim, ceiling type, mounting hardware of special requirements as specified hereinafter on as required by the particular installation(s) and code. Contractor shall verify these requirements and order fixtures as required to give proper installation per the contract documents and per codes.

B. Ballasts

1. It is preferred that all ballasts shall be of the same manufacturer. Every effort shall be made to eliminate ballasts from multiple manufacturers. Ballasts within luminaires of a given type must however be of the same manufacturer. Multiple manufacturers will not be permitted.
2. Approved Manufacturers:
 - a) Motorola
 - b) Advance Transformer Co.
 - c) Magnetek
 - d) General Electric

C. Lamps

1. All lamps shall be of the same manufacturer. Multiple manufacturers are not permitted.
2. Approved Manufacturers:
 - a) General Electric
 - b) Philips
 - c) Osram Sylvania

2.02 MATERIALS

- A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding brackets, concrete bases, anchor bolts, and all necessary fittings and accessories for a complete installation.
- B. Plastic Lenses and diffusers:
 1. Virgin acrylic unless otherwise noted. Install and leave with no finger prints or dirt marks on the lens or diffuser. Lenses shall be provided on all

- recessed metal halide luminaires.
 - 2. Minimum unpenetrated thickness for Parabolic or conical element diffuser: 0.085 inch.
 - 3. Minimum nominal thickness: 0.125 inch.
- C. Parabolic Luminaire Care: Parabolic luminaires to be installed with mylar cover over louvers. Cover shall be U.L. listed for temporary lighting. Upon completion of work, remove mylar cover with white gloves and blow clean reflectors.
- D. Finish: Porcelain or baked enamel finish matte white on interiors with minimum tested reflectance of 90 percent matte white finish or as specified in visible exterior. Thoroughly clean base metal and painted after fabrication.
- E. Sockets: Incandescent lamp sockets - porcelain housings over copper screw shells, with medium base sockets rated at 660 watts and 250 volts. Insulating joint in pull chains. Fluorescent lampholder - white, rotor lock, heat-resistant plastic rated 660 watts and 600 volts. Fluorescent industrial sockets - heavy-duty, multi-socket, metal-clad, spring-loaded. Provide heavy-duty sockets for H.I.D. luminaires where mounted less than 8'-0" AFF.
- F. Luminaire Wiring: Minimum individual luminaire wiring - number 18 gauge with insulation at rated operating temperature of 105 degrees Centigrade or higher. Terminate wiring for recessed luminaires, except fluorescent units, in an external splice box.
- G. Ballasts
- 1. Ballasts for F32T8 lamps shall be:
 - a) High frequency solid state electronic.
 - b) Electronic Program start
 - c) 50 F minimum starting temperature unless otherwise noted
 - d) Minimum 1.15 ballast factor
 - e) Maximum total harmonic distortion (THD) less than 10%
 - f) High power factor, minimum 95 %
 - g) Sound rated A
 - 2. High-power factor (over 90 percent). Certified Ballast Manufacturers' Certification, ballast case temperature not to exceed 90 degrees Centigrade during normal operation in 30 degrees Centigrade ambient temperature. Ballast voltage: 120 or 277 volts, as required by circuiting. Ballast shall be provided with the best sound rating available.
 - 3. Built-in self-resetting thermal actuated device will remove ballast from line when excessive ballast temperature is reached. U.L. Class P, CBM certified 100% output.
 - 4. The conductors between ballasts and lampholders shall have an approved insulation for 1,000 volts. This includes conductors to and from remote ballasts.
 - 5. High-intensity discharge ballasts shall be constant wattage autotransformer type with built-in thermal protection, minimum power factor of 80%. 12" min. leads.
 - 6. Provide ballasts with voltage characteristics to match that of all related circuitry indicated on the Drawings. No extra compensation will be allowed for failure to properly coordinate ballast voltage with circuitry.
 - 7. Ballasts for control of lamps in one housing or fixture unit may control lamps of an adjoining unit, except as otherwise noted.
 - 8. Guarantee ballast for one full year and one year prorated as per standard

manufacturer's warranty against defects for a period of 2 years.
Guarantee to include replacing defective ballast with new ballast.

9. Provide dimming ballasts as shown on the drawing for fixtures controlled by individual dimming or dimming systems.
10. LED drivers for interior luminaires shall employ an auto resetting thermal management system to turn off the LED array when normal operating temperatures are exceeded. Exterior drivers shall employ a step reduction circuit to reduce lumen output in order to maintain proper operating temperatures, but will not allow an "off" condition for thermal management.

H. Lamps

1. Provide a complete set of new lamps in each fixture.
2. Unless noted otherwise lamps must conform to the following:
 - a) Fluorescent: T-8, 41k color. Minimum of 80 CRI and 3100 lumens.
 - b) Incandescent: "A" lamps to be inside frosted rated at 130 volts.
 - c) Compact Fluorescent: triple Twin tube, 4-pin
 - d) HID: Metal Halide, clear, universal base, open rated.
 - e) LED: Minimum of 50,000 hrs life at no less than 70% initial lumen rating. 40k color. Minimum of 80 CRI. Color variation shall not exceed a 3 step MacAdam ellipse.

I. Luminaires installed recessed in a metal pan ceiling shall have a flange type trim to overlap abutment of adjacent pans.

J. Where utilized as raceways, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary.

K. Where ceiling mounted fixtures are called for in the Light Fixture Schedule and on the drawings, this contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written approval of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling frame member(s) and fixture(s) shall also be permitted. Where fixtures are supported by the suspended ceiling system; the ceiling system shall have a minimum (2) opposite corners tied to structure at each fixture location; this contractor shall be responsible for doing this work or for having the ceiling contractor perform it. All supports shall meet current FBC standards.

L. All exterior post/pole mounted light fixtures shall have a hand hole at the base, lightning protection in hand hole and ground conductor connected to ground rod at base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide and install ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts to be galvanized.

M. All interior and exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturers name or logo shall appear on the exterior of any light fixtures unless approved in writing by engineer.

- N. All light fixtures shall adhere to U.L. Test Standard #1571 and Section #410-65C of the National Electric Code. All manufacturers shall provide the required thermal protection as required.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install luminaires in mechanical and unfinished areas after ductwork and piping installation. Adjust fixture locations to provide the best lighting for equipment access and service locations. Locate fixtures 8 feet 6 inches above floor, or at suitable locations within space on walls but not lower than 7'-0" AFF.
- B. The Contractor shall protect luminaires from damage during installation of same and up to time of final acceptance. Any broken luminaires, glassware, plastics, lamps, etc., must be replaced by the Contractor with new parts, without any additional expense to the Owner.
- C. The contractor shall verify prior to ordering fixtures that each fixture scheduled has correct type trim and support arrangement for the proposed ceiling construction.
- D. Install all fixtures in accordance with manufacturer's written instructions and the NEC.
- E. Pendant mounted units shall comply with the following:
 - 1. Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Engineer. The entire luminaire mounting (hickey, aligner, swivel, stem, etc.) shall be submitted to and approved by the Engineer before installation.
 - 2. An insulated malleable iron bushing shall be placed at luminaire end of stem through which wire passes.
 - 3. A pendant support using an approved sliding clevis bracket which firmly grips an indentation in rigid sides of the wiring channel will be acceptable.
 - 4. Connections between outlet boxes and luminaires shall be by means of approved flexible raceways. The application of raceways directly between luminaires is unacceptable.
- F. Where luminaires are mounted upon surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a luminaire canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaire manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.
- G. Ceiling surface mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from ceiling structure with all-thread rods and 1-1/2"x1-1/2" Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.
- H. Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.
- I. Install exit light as indicated on the drawings but not higher than 10'0" AFF. Size

and color of lettering shall comply with local codes.

- J. Outdoor lighting shall be aimed in periods of darkness in front of the owner/engineer.

3.02 COORDINATION WITH AMBIENT CONDITIONS

- A. The Contractor is responsible for coordinating the characteristics and the U.L. labeling of the luminaires and their components with the ambient conditions which will exist when the luminaires are installed. No extra compensation will be permitted for failure to coordinate the luminaires with their ambient conditions. These areas of coordination include but are not limited to the following:
 1. Wet location labels
 2. Damp location labels
 3. Low temperature ballasts
 4. Dimming ballasts
 5. Very low heat rise ballasts
 6. Explosion proof
 7. Plenums and air handling spaces
 8. Fire rated ceilings
 9. Low density ceilings
 10. Insulated ceilings

3.03 CLEAN-UP

- A. Luminaires:
 1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per mfr's recommendations being careful to remove finger prints and smudges.
 2. It is the contractor's responsibility to remove any U.L. labels or manufacturer's labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

PART H
TECHNICAL SPECIFICATIONS

ELECTRICAL

SECTION 26 23 00

ADD / DELETE

SECTION 26 23 00

METAL-ENCLOSED COMPARTMENTALIZED DRAWOUT SWITCHGEAR

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install, where indicated on the drawings, a deadfront type, low voltage metal-enclosed switchgear assembly utilizing compartmentalized drawout insulated case power circuit breakers, as specified herein and as shown on the contract drawings. Provide all switchgear with insulated isolated bus for enhanced arc flash mitigation. The switchgear shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.
- B. Provide EPA class-one reliable switchgear; double ended and sectionalized main-tie-main gear.

1.02 RELATED SECTIONS

- A. Section 26 43 00 Surge Protection Devices
- B. Section 26 32 13 Standby Power System
- C. Section 26 08 00 Electrical Testing
- D. Section 26 05 00 Basic Electrical Materials And Methods
- E. Section 26 28 11 Circuit Breakers & Fused Switches

1.03 REFERENCES

- A. The low voltage metal-enclosed switchgear assembly and all components shall be designed, manufactured, and tested in accordance with the following latest applicable standards:
 - 1. ANSI-C37.20 – Switchgear assemblies
 - 2. ANSI-C37.13 – Low voltage power circuit breakers
 - 3. ANSI-C37.17 – Trip devices
 - 4. NEMA SG-5 – Switchgear assemblies
 - 5. NEMA SG-3 – Low voltage power circuit breakers
 - 6. UL 1558
 - 7. ANSI: Z55.1, Gray Finishes for Industrial Apparatus and Equipment.
 - 8. NFPA : 70, National Electrical Code. (NEC)

1.04 QUALIFICATIONS

- A. The equipment must be purchased from the manufacturers authorized representative authorized to represent the manufacturer in the projects territory.

- B. The manufacturer of the automatic transfer switch shall be the manufacturer of the major components within the assembly.
- C. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.
- D. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- E. The automatic transfer switches shall be suitable for Service Entrance.

1.05 SUBMITTALS

- A. Shop Drawings
 - 1. Itemized Bill-of-Material
 - 2. Master drawing index
 - 3. Dimensional drawings; Front view and plan view of the assembly.
 - 4. Anchoring instructions and details.
 - 5. One-line, three-line, wiring diagrams and control schematic drawings.
 - 6. Connection and interconnection drawings.
 - 7. Incoming line section equipment data. Conduit entrance locations.
 - 8. Nameplate schedule
 - 9. Component list
 - 10. Ground Fault protection: Relay time-current characteristics.
 - 11. Circuit Breakers: Copies of time-current characteristics.
 - 12. Conduit space locations within the assembly
 - 13. Assembly ratings including:
 - 14. Short-circuit rating
 - 15. Voltage
 - 16. Continuous current rating
 - 17. Major component ratings including:
 - 18. Voltage
 - a. Continuous current rating
 - b. Interrupting ratings
 - 19. Cable terminal sizes
 - 20. Product data sheets.
 - 21. TVSS data
 - 22. Bus data; Busway connections
 - 23. Key interlock scheme drawing and sequence of operations
 - 24. Mimic bus size and color.
 - 25. Operational description.
- B. Quality Control Submittals:
 - 1. Manufacturer's installation instructions.
 - 2. Certified Factory Test Report.
 - 3. Operations and Maintenance Manual.

1.06 SUBMITTALS – OPERATION AND MAINTENANCE MANUALS:

- A. Equipment operation and maintenance manuals shall be provided, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component. O&M manuals shall include site specific layout and assembly drawings with complete module and device information.
- B. The following information shall be included for record purposes:
 - 1. Final as-built drawings and information for all items listed above.
 - 2. Wiring diagrams
 - 3. Certified production test reports
 - 4. Installation information
 - 5. Seismic certification.
- C. The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.07 REGULATORY REQUIREMENTS

- A. The switchgear and switchboards shall bear a UL 1558 label.
- B. Provide ATS system that meets the requirements of NEC-2011 section 225-31 and 225-36. Provide service entrance rated equipment suitable for disconnecting means.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 SPARE PARTS

- A. Furnish tag, and box for shipment and storage the following spare parts:
 - 1. Fuses: One complete set of spare fuses of each current rating, both power and control.
 - 2. Lights: One complete box (minimum 12) of each type indicating lights.
 - 3. Paint: One pint, to match enclosure exterior finish in color and quality.
 - 4. Indicating Lamp Pullers: Two each.
 - 5. Indicating Lamp Resistors and Sockets: Two each.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Provide equipment by Square D with arc flash maintenance mode for increased arc flash mitigation for maintenance personnel. Switchgear to be NEMA Type 2B Power-Zone® 4 Arc Resistant Low Voltage Draw-out Switchgear assembly constructed to ANSI C37.20.1 and tested to C37.20.7 standards. Equipment provided by integrated equipment manufacturers, Cummins Onan, utilizing the approved manufacturers breakers and structures will be considered equal.

- B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer twenty (20) days prior to bid date.

2.02 RATINGS

- A. Voltage rating shall be as indicated on the drawings. The entire assembly shall be suitable for 600 volts maximum AC service.
- B. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of minimum 65,000 amperes symmetrical at rated voltage or higher as shown on the drawings.
- C. The bus system shall have a minimum ANSI 4-cycle short-circuit withstand rating of 100,000 amperes symmetrical.
- D. . Circuit breakers shall be drawout type MASTERPACT ArcBlok with MICROLOGICElectronic trip units as specified on the associated drawings. Circuit breakers shall have interrupting, close and latch, and 30-cycle withstand ratings that meet the application requirements. Interrupting rating shall be available up to 100 kA RMS amperes without fuses. Close and latch ratings to 65 kA available on all frame sizes. Thirty-cycle withstand rating available up to 100 kA to provide maximum coordination with downstream circuit breakers. Circuit breakers shall be available in 800, 1600, 2000, 3200, and 4000 frame sizes. An adjustable rating plug (range of 0.4 to 1 times the sensor plug value) and a field-replaceable sensor plug (available in standard amperage steps from 50% to 100% of the frame size) shall determine the ampere rating of the circuit breaker
- E. All ratings shall be tested to the requirements of ANSI C37.20.1, C37.20.7, C37.50 and C37.51 and UL witnessed and approved.

2.03 DRAWOUT CONSTRUCTION

- A. The switchgear shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide ventilators located on the top of the switchgear over the breaker and bus compartments to ensure adequate ventilation within the enclosure. The switchgear rear access shall be through full size hinged swing doors. Doors and shall be secured using captive hardware. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills. Provisions shall be made for jacking of shipping groups, for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids. The base shall be equipped with slots in the base frame members to accommodate the

use of pry bars for moving the equipment to its final position. Provide a breaker trolley winch capable of lifting breakers in and out for service.

- B. Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized bus compartment and a rear cable compartment. Each individual circuit breaker compartment, or cell, shall be segregated from adjacent compartments and sections by means of steel barriers to the maximum extent possible. All protective devices shall be compartmentalized with line and load bus connections. Devices shall be front removable and load connections rear accessible. Insulated rigid copper bus connections shall extend from the load side of over-current feeder devices into rear compartment where outgoing cable connections may be made without reaching into the main horizontal or vertical bus compartment. Distribution sections shall be sectionalized to provide a front device section, an intermediate bus section and a rear feeder cable section. It shall be equipped with drawout rails and primary and secondary disconnecting contacts. Current transformers for feeder instrumentation shall be located within the appropriate breaker cells and be front accessible and removable.
- C. The stationary part of the primary disconnecting devices for each power circuit breaker shall be breaker mounted and consist of a set of contacts extending to the rear through glass polyester insulating support barrier; corresponding moving finger contacts, suitably spaced, shall be furnished on the power circuit breaker studs which engage in only the connected position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include three-phase bus connections between the section bus and the breaker line side studs. Load studs in the rear cable compartment of each structure shall be equipped with insulated copper load extension buses terminating in two hole long barrel hypress crimp lugs (Burndy, no equal). Bus extensions shall be silver or tin-plated where outgoing terminals are attached.
- D. The circuit breaker door design shall be such that the following functions may be performed without the need to open the circuit breaker door: lever circuit breaker between positions, operate manual charging system, close and open circuit breaker, examine and adjust trip unit, and read circuit breaker rating nameplate.
- E. The secondary disconnecting devices shall consist of floating terminals mounted on the stationary unit and engaging mating contacts at the front of the breaker. The secondary disconnecting devices shall be gold-plated and engagement shall be maintained in the "connected" and "test" positions.
- F. The removable power circuit breaker element shall be equipped with disconnecting contacts and interlocks for drawout application. It shall have four positions, "connected," "test," "disconnected" and "removed." The breaker drawout element shall contain a worm gear levering "in" and "out" mechanism with removable lever crank. Levering shall be accomplished via the use of conventional tools. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering "in" or "out" of the cell. The breaker shall include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall provide for

securing the breaker in the connected, test, or disconnected position by preventing levering.

- G. The switchgear mains, utility and paralleling breakers, shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.
- H. Provide a rear compartment steel barrier between the cable compartment and the main bus to protect against inadvertent contact with main or vertical bus bars.
- I. Provide in the cell when the circuit breaker is withdrawn, a safety shutter which automatically covers the line and load stabs and protects against incidental contact.
- J. Provide a metal barrier full height and depth between adjacent vertical main utility and emergency breakers and the paralleling breaker structures in the cable compartments.
- K. Provide individual breaker compartmentalization.
- L. Vertical sections shall be equipped with floor damper ventilation covers. These dampers shall cover all ventilation holes during arcing flash event.
- M. Complete lineup shall meet requirements to be certified as NEMA Type 2B Arc Resistant.
- N. Each circuit breaker shall be mounted in its own barriered compartment.
- O. To meet thermal requirements AR/PZ-4 requires a standard roof baffle.

2.04 BUS

- A. All bus bars shall be insulated tin or silver-plated copper and be density rated at maximum of 1000amps/sq-in. Temperature rated bus is not acceptable. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane.
- B. Provide a neutral bus in the main ATS and emergency main sections for connection of the genset neutral cables to the common neutral to ground connection. The neutral is not required in the distribution sections.
- C. A 1/4 x 4 inch copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchgear. The ground bus short-time withstand rating shall meet that of the largest circuit breaker within the assembly. Bus shall be braced for peak symmetrical amperage available from all generator sets plus motor contributions and shall be rated at 100,000 amps RMS, minimum.

- D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with Belleville-type washers. Provide all switchgear with insulated isolated bus for enhanced arc flash mitigation.

2.05 WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the switchgear shall be furnished as required. Control components mounted within the assembly shall be suitably marked for identification corresponding to the appropriate designations on manufacturer's wiring diagrams.
- B. Provide a front accessible, isolated vertical wireway for routing of factory and field wiring. Factory provisions shall be made for securing field wiring without the need for adhesive wire anchors.
- C. Front access to all circuit breaker secondary connection points shall be provided for ease of troubleshooting and connection to external field connections without the need of removing the circuit breaker for access.
- D. All control wire shall be type SIS. Control wiring shall be 14 ga for control circuits and 12 ga for shunt trip and current transformer circuits. Wire bundles shall be secured with nylon ties and anchored to the assembly with the use of pre-punched wire lances or nylon non-adhesive anchors. All current transformer secondary leads shall first be connected to conveniently accessible shorting terminal blocks before connecting to any other device. Shorting screws with provisions for storage shall be provided. All groups of control wires leaving the switchgear shall be provided with terminal blocks with suitable numbering strips and provisions for #10 AWG field connections. Each control wire shall be marked to the origin zone/wire name/destination zone over the entire length of the wire using a UV cured ink process. Provide wire markers at each end of all control wiring. Plug-in terminal blocks or spade lug terminal blocks shall be provided for all shipping split wires. Terminal connections to remote devices or sources shall be front accessible via doors above each circuit breaker.
- E. Provide switchgear cable connections with long barrel double crimp insulated two-hole Hi-press compression lugs as manufactured by Burndy, no equal.
- F. Reusable insulating boots shall be provided to cover all power cable terminations.
- G. Switchgear wiring shall be composed of UL listed, 105 degree centigrade rated material, with all wiring labeled at each end. Each wire, device or function shall be suitably identified by silk screen or similar permanent identification corresponding to the same identifiers shown on the shop drawings.

2.06 DRAW OUT POWER CIRCUIT BREAKERS

- A. Provide power circuit devices, type low-voltage power circuit breakers, Square D type MasterPact NW or approved equal. Frame ratings shall be 800, 1600, 2000, 3200, 4000 amperes. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

- B. Breakers shall be electrically operated (EO). Breakers to be operated by an electrically charged, mechanically held and electrically trip free stored energy mechanism. Provide for manual charging of the mechanism.
- C. Electrically operated breakers shall be complete with close/open pushbuttons control switch, plus red and green indicating lights to indicate breaker contact position 120 Vac motor operators; the charging time of the motor shall not exceed 6 seconds. Source voltage shall be taken from a control power transformer internal to the switchgear assembly.
- D. Breakers shall be provided in drawout configuration with rack out mechanisms. Physical frame sizes shall have a common height and depth.
- E. All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes or higher where shown on the drawings. To ensure a selective system, all circuit breakers shall have 30-cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.
- F. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standards. The circuit breakers shall carry a UL label.
- G. Provide Arc Flash Reduction Maintenance Remote accessory. The Arc Flash Reduction Maintenance Remote shall allow the operator to enable a maintenance mode with a preset accelerated instantaneous override trip to reduce arc flash energy.
- H. Breaker shall be 120VAC charging, with DC shunt trip system. Provide system with an individual control power transformer for the generator and stand-by mains, on the generator side of the breaker; and the utility main breaker, on the utility side of the breaker. The tie breaker shall have control power for charging from both sides. Provide surge voltage isolation and voltage sensors on all phases of both sources.
- I. Provide interlocks to prevent withdrawal of the breaker unless it is open.
- J. To facilitate lifting, the power circuit breaker shall have integral handles on the side of the breaker. Provide trolley hoist system with rails on top of the gear.
- K. The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.
- L. The power circuit breaker shall have three windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage. The accessories shall be plug and lock type and UL listed for easy field installation. They shall be modular in design and shall be common to all frame sizes and ratings.

- M. The breaker control interface shall have color-coded visual indicators to indicate contact open or closed positions as well as mechanism charged and discharged positions. Manual control pushbuttons on the breaker face shall be provided for opening and closing the breaker. The power circuit breaker shall have a "Positive On" feature. The breaker flag will read "Closed" if the contacts are welded and the breaker is attempted to be tripped or opened.
- N. The current sensors shall have a back cover window that will permit viewing the sensor rating on the back of the breaker. A rating plug will offer indication of the rating on the front of the trip unit.
- O. A position indicator shall be located on the faceplate of the breaker. This indicator shall provide color indication of the breaker position in the cell. These positions shall be Connect (Red), Test (Yellow), and Disconnect (Green). The levering door shall be interlocked so that when the breaker is in the closed position, the breaker levering-in door shall not open.
- P. Each power circuit breaker shall offer sixty (60) front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.
- Q. Include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall secure the breaker in the connected, test or disconnected position by preventing levering

2.07 TRIP UNITS

- A. Each low-voltage power circuit breaker and insulated case circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall Square D Micrologic P with MODBUS communication module.
- B. The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.
- C. The trip unit shall be provided with a display panel, including a representation of the time/current curve that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.

- D. The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.
- E. Trip unit shall have selectable thermal memory for enhanced circuit protection.
- F. The trip unit shall provide zone interlocking for the short-time delay and ground fault delay trip functions for improved system coordination. The zone interlocking system shall restrain the tripping of an upstream breaker and allow the breaker closest to the fault to trip with no intentional time delay. In the event that the downstream breaker does not trip, the upstream breaker shall trip after a preset time delay. Factory shall wire for zone interlocking for the power circuit breakers within the switchgear.
- G. The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.
- H. The trip unit shall be equipped to permit communication via Modbus to the Square D CM 4400 power monitors provided in the equipment for remote monitoring and control. All monitored parameters shall be transmitted via Modbus TCP to the existing plant power monitoring and control system network.
- I. The trip unit shall include a power/relay module, which shall supply control power to the readout display. Following an automatic trip operation of the circuit breaker, the trip unit shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. An internal relay shall be programmable to provide contacts for remote ground alarm indication.
- J. The trip unit shall include a voltage transformer module, suitable for operation up to 600V, 50/60 Hz. The primary of the power relay module shall be connected internally to the line side of the circuit breaker through a dielectric test disconnect plug.
- K. The display for the trip units shall be a 24-character LED display.
- L. Metering display accuracy of the complete system, including current sensors, auxiliary CTs, and the trip unit, shall be +/- 1% of full scale for current values. Metering display accuracy of the complete system shall be +/- 2% of full scale for power and energy values.
- M. The unit shall be capable of monitoring the following data:
 - 1. Instantaneous value of phase, neutral and ground current
 - 2. Instantaneous value of line-to-line voltage
 - 3. Minimum and maximum current values
 - 4. Watts, vars, VA, watthours, varhours, and VA hours, Peak demand, Present demand, Energy consumption.
 - 5. Crest factor, power factor, percent total harmonic distortion, and harmonic values of all phases through the 31st harmonic.

- N. An adjustable high load alarm shall be provided, adjustable from 50 to 100% of the long delay pickup setting.
- O. The trip unit shall contain an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.
- P. Programming may be done via a keypad at the faceplate of the unit or via the communication network.
- Q. System coordination shall be provided by the following microprocessor-based programmable time-current curve shaping adjustments. The short-time pickup adjustment shall be dependant on the long delay setting.
 - 1. Programmable long-time setting
 - 2. Programmable long-time delay with selectable I^2t or I^4t curve shaping
 - 3. Programmable short-time setting
 - 4. Programmable short-time delay with selectable flat or I^2t curve shaping, and zone selective interlocking
 - 5. Programmable instantaneous setting
 - 6. Programmable ground fault setting trip or ground fault setting alarm
 - 7. Programmable ground fault delay with selectable flat or I^2t curve shaping and zone selective interlocking
- R. The trip unit shall have the following advanced features integral to the trip unit:
 - 1. Adjustable undervoltage release
 - 2. Adjustable overvoltage release
 - 3. Reverse load and fault current
 - 4. Reverse sequence voltage alarm
 - 5. Underfrequency
 - 6. Overfrequency
 - 7. Voltage phase unbalance and phase loss during current detection
- S. Breakers fitted with trip units shall be provided with an Arcflash Reduction Maintenance System. Alternate Maintenance Setting (AMS) switch. The switch will enable temporary arc-flash incident energy reduction during maintenance activities.
 - 1. For each utility main circuit breaker, provide a manual switch on the compartment door to switch the circuit breaker short time tripping characteristics to instantaneous with minimum pick-up setting, in order to reduce the danger from potential arc-flash at downstream equipment.
 - 2. Provide a lock feature for the AMS switch so that it may be locked in either the Off or On maintenance mode position.
 - 3. Provide a blue LED indicating light to indicate AMS switch is in the maintenance mode.
 - 4. Wire contacts on all AMS switches to a common alarm input to plant control system.
 - 5. Provide for remote AMS switches or indication, as needed.
 - 6. If circuit breaker integral trip unit cannot be controlled as specified, provide discrete relay with shunt-trip or equivalent to provide specified performance.

2.08 MICROPROCESSOR CONTROLS

- A. The logic of the transfer switch shall function via a microprocessor. Programmable Logic Controllers are not acceptable. Provide dedicated microprocessor based electronic transfer device for each transfer pair equal to
 - 1. Cummins-Onan MCM3320 Control

- B. The set points shall be field adjustable without the use of special tools. LED lights shall be included on the exterior of the switch to show:
 - 1. Normal Source Available
 - 2. Emergency Source Available
 - 3. Normal Source Connected
 - 4. Emergency Source Connected
 - 5. Load Energized.
 - 6. System not in Auto
 - 7. Generator Test active

- C. Provide 16 point Aux 101, slot 102 I/O expansion module to provide hardwired generator and ATS monitoring points to plant SCADA system.
 - 1. The expansion module shall indicate the following status/alarm and shutdown signals to the plant SCADA system
 - a. Generator Running
 - b. Generator Common Fault
 - c. MCM 3320 Common Fault
 - d. Generator Not in Auto

- D. A digital readout shall display each option as it is functioning. Readouts shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the microprocessor shall display the timer counting down. All set points can be re-programmed from the front of the switch when the switch is in the program mode. A genset test pushbutton shall be included as part of the microprocessor. The switch shall include the following:
 - 1. Provide a time delay transfer from the normal power source to the emergency power source (0 seconds to 30 minutes). This option does not effect the engine start circuit.
 - 2. Provide a timer to override a momentary power outage or voltage fluctuation (0 seconds to 120 seconds).
 - 3. Provide a time delay transfer from the emergency power source to the normal power source (0 seconds to 30 minutes).
 - 4. Provide a timer to allow the generator to run unloaded after re-transfer to the normal power supply (1 second to 30 minutes).
 - 5. Provide single-phase under voltage and under frequency sensing on the emergency power source. Voltage shall be factory set at 90% pickup and 80% dropout. Frequency sensing shall be set at 58-hertz pickup and 56-hertz dropout.
 - 6. Provide a pilot light to indicate that the switch is in the normal position as an integral part of the microprocessor.
 - 7. Provide a pilot light to indicate that the switch is in the emergency position as an integral part of the microprocessor.
 - 8. Provide a pilot light to indicate that the normal power is available as an integral part of the microprocessor.

9. Provide a pilot light to indicate that the emergency power is available as an integral part of the microprocessor.
 10. Provide auxiliary relay contacts that are energized when the power is available on the normal source.
 11. Provide auxiliary relay contacts that are energized when the power is available on the emergency source.
- E. The following features shall be provided:
1. Time delay normal to emergency, adjustable
 2. Time delay emergency to normal, adjustable
 3. Green pilot light to indicate switch in normal position and red pilot light to indicate switch in emergency position
 4. White pilot lights marked "Normal Source" and "Emergency Source" to indicate that respective source voltages are available
 5. Tripped position indicating lights for both sources
 6. Relay auxiliary contacts (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.
 7. Time delay engine start, adjustable
 8. Time delay engine cool off, adjustable
 9. Engine start contact
 10. Frequency/voltage relay for emergency source, frequency adjustable from 45 to 60 Hz and voltage fixed at 90% pickup, 70% dropout
 11. Delayed transition time delay, adjustable from 0 to 120 seconds, to allow disconnection of the load during transfer in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive
 12. Remote start and transfer to standby power from plant controls contact closure.
 13. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
 14. "Reset" push button that will clear any faults present in the control.
 15. "LAMP TEST" push button to test all lamps on the panel by lighting them.
 16. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Provide one set Form C auxiliary contacts for each power breaker, operated by transfer switch position, rated 10 amps 250 VAC. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.
- F. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions: Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level). Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation and phase sequence (phase angle). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over

voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level). Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

2.09 SWITCHGEAR CONTROL SYSTEM

A. Sequence of Operation

1. Under normal operating conditions, utility power is provided to the load through the normal (utility) circuit breaker. The emergency (Genset) circuit breaker is open and the Genset is stopped. The standby-power circuit breaker is open. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of its normal or preferred source. Open transition will provide a load break transfer between sources.
2. Upon loss of phase-to-phase voltage of the normal source to 80% of nominal, and after a time delay, adjustable from 0.5 to 15 seconds, to override momentary dips and/or outages, a 10-ampere, 30-Vdc contact shall close to initiate starting of the emergency or standby source power plant. Transfer to the alternate source shall take place immediately upon attainment of 90% of rated voltage and frequency of that source.
3. When the normal source has been restored to 90% of rated voltage, and after a time delay, adjustable from 0.5 to 32 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.
4. The transfer switch shall have an adjustable time delay to control the operation time from source to source (program transition operation).
5. A time delay, adjustable from 0.5 to 32 minutes, shall delay shutdown of the emergency or standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.
6. If the emergency or standby power should fail while carrying the load, transfer to the normal power supply shall be initiated immediately upon restoration of the normal source to satisfactory conditions.
7. Return to Normal Power, Open Transition: Once the normal power returns the PowerCommand ATS controller will respond according to the mode that has been selected by the operator. If open transition is selected, the PowerCommand ATS controller will wait for the retransfer time delay and then issue the generator breaker open signal. It will verify that the generator breaker is open, wait for the program transition time delay and then initiate a stand-by breaker open signal, it will verify that the stand-by breaker is open then initiate a normal (utility) breaker close signal. The ATS controller will remove its start signal from the GenSet, the GenSet will continue to run for a cool down period and then shut down.
8. Test Mode: A test signal is received from plant SCADA to start the genset and transfer the load. The test mode is continued until the test signal is removed by the operator from the SCADA screen. Provide an individual test and load signal per bus.
9. FPL Load Shed: A load shed signal is received from FPL to start the genset and transfer the load. The load shed is continued until the signal is removed by FPL.

2.10 POWER MONITORING

- A. Provide Square D CM4000 power monitors with optional Ethernet card, ECC21 and remote mounted display.
- B. Mount power monitors to switchgear face. Mount easily accessible and visible to the operator without requiring a step stool or bending over to read display.
- C. The power monitors shall act as the control system “switch” between the Modbus RTU circuit breaker trip units and the plant Ethernet power monitoring system.

2.11 DEVICES AND MISC HARDWARE

- A. All control components shall be industrial type heavy duty oil tight devices. Indicator lamps shall be high intensity LED type devices. Toggle switches and other light duty and durability limited control devices are not acceptable.
- B. Protect AC control circuits with fuses in safety fuse blocks, with visible fuse blown indication for each fuse. Potential transformers shall be protected on line and load side. All Current Transformers shall include shorting type terminal blocks.
- C. Provide each switchboard section with a minimum of two infrared windows. Place the infrared windows to allow infrared scans of all cable terminations. Where required provide additional infrared windows for adequate field of view to all cable terminations.
- D. Provide key interlocks as shown on the single line drawing.
- E. Control power for the transfer switch shall be derived from both the utility and generator set sources. Control power for charging each breaker in the power transfer switch shall be derived from the source it is connected to. The tie breaker shall have control power for charging from both sides.
- F. The transfer switch metering and control equipment shall be provided with a 24VDC battery based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition contact closure to indicate low battery condition. The generator battery shall act as a backup 24VDC source through a best battery logic circuit.

2.12 ENCLOSURES

- A. NEMA 12 Enclosure for indoor installation.

2.13 NAMEPLATES

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16-inch high, minimum.

- B. Furnish master nameplate giving switchgear designation, voltage ampere rating, short-circuit rating, and manufacturer's name.
- C. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's drawings.

2.14 FINISH

- A. All exterior and interior steel surfaces of the switchgear shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchgear shall be ANSI 61.

2.15 ACCESSORIES

- A. Provide a traveling type circuit breaker lifter, rail-mounted on top of drawout switchgear.
- B. Provide a microprocessor trip unit functional tester.
- C. Provide a nwnprtt portable remote racking device kit with factory installed brackets designed specifically for the mastrpact nw breaker. Kit will be complete with motorized racking device, controller with 30 foot cable and all control and power wiring.

PART 3 – EXECUTION

3.01 FACTORY TESTING

- A. The switchgear shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchgear shall be tested to ensure the accuracy of the wiring and the functioning of all equipment. The main bus system shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities.
- B. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute, or 1800 volts for one second, between live parts and ground, in accordance with ANSI C37.20.1.
- C. A certified test report of all standard production tests shall be shipped with each assembly.
- D. Include attendance of up to 2 County employees to witness Factory testing at the switchgear manufacturers plant.

3.02 FIELD QUALITY CONTROL

- A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under

this section. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

- B. The manufacturer shall provide three (3) copies of the manufacturer's field start-up reports direct to the engineer with copies to the contractor. Assume a minimum of 3 separate site visits for off-loading and assembly, installation, testing and initial energization and startup. Cost shall be included in bid price.

3.03 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations prior to energization.

3.04 TRAINING

- A. The Contractor shall provide a training session for owner's operation and maintenance staff for two separate days at the jobsite or location determined by the owner. Training session will not be scheduled the same day as the manufacturers field checkout and start-up.
- B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation and maintenance of the assembly, circuit breakers, and major components within the assembly.
- C. Training dates shall be coordinated with the facility owner at least 2 weeks prior to proposed training date.
- D. Contractor shall record training session and provide (2) copies on DVD with the project O&M Manuals.

3.05 INSTALLATION

- A. The Contractor shall install all equipment under the supervision of the manufacturer and in conformance to manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- C. Install in each section a minimum of two infrared windows. Place infrared windows to allow infrared scans of all cable terminations. Field-install additional infrared windows as required for adequate field of view to all cable terminations. Route cable so it does not affect infrared scanning of adjacent terminations.
- D. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:

1. Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction.
2. Checking to ensure that all bus bars and structure assembly hardware is torqued to the manufacturer's recommendations.
3. Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections.
4. Securing assemblies to foundation or floor channels.
5. Coordinating with the testing sub-contractor for proper testing of the equipment.
6. Inspecting and installing all circuit breakers in their proper compartments.

3.06 FIELD ADJUSTMENTS

- A. The factory technician shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the unit. The equipment vendor shall coordinate with the generator manufacturer for proper settings.

3.07 FIELD TESTING

- A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer. The Engineer shall be notified in advance and shall have the option to witness the tests.
- B. Provide for FPL required testing.

3.08 PLANT SCADA INTEGRATION

- A. Work Included
 1. Furnish and install digital control system hardware and software to completely integrate all proposed generator and switchgear control, monitoring and alarm signals, including a fully functional HMI power system graphic screen. The power system graphic screen will depict the switchgear single line diagram, similar to ED1. Centered above Bus-1, show the information related to Bus-1; the same for Bus 2. Clicking on each individual breaker will bring up a pop up window with information related to that breaker. Provide the following indications for status:
 - a. Breaker Closed=green
 - b. Breaker Open=red
 - c. Breaker Tripped=yellow
 - d. Status of utility and generator power:
 1. Energized=green
 2. Not energized=red
 3. Faulted=yellow
 2. The hardware included but is not limited to, modifying 2 existing Square D Modicon Programmable Logic Controllers (PLC), updating and creating new HMI graphic, software and accessory equipment.
 3. Provide new digital input and output card as required for full integration of specified generator status, control and alarm points.

4. The control system integrator will completely integrate the proposed field monitoring and control points into the existing Citect HMI system. System Integrator shall use LCU Citect standard library for all controls. Current installed version of Citect is Version 7.2 SP2 with 15000 I/O point Citect license installed on the primary and stand-by servers.
5. Create internal registers and signals as required to link real signals to 3-dimensional graphics for monitoring and keyboard for control. Each new signal shall be individually defined and assigned to a new device file.
6. Modify existing 3-dimensional graphics for the proposed system and add to them. Screen modification presentation shall be comparable to the existing 3-dimensional graphics screens with full use of dynamic colors, levels and numeric values and tied to real time data. All analog values shall be displayed in engineering units. Graphic levels shall be animated in blue with levels that raise or lower in proportion to their signal values.
7. Incorporate all required signals into the database and set limits and alarm values based on owner requests and operational testing.
8. Create and modify reports for all proposed totals, level, and other analog values.
9. Create two generator runtime counters. One counter to log generator runtime while utility power is available, the second will log generator runtime while utility is not available. Create total runtime and monthly runtime values. Monthly runtime to reset the 1st of every month. Create a monthly runtime report that can be printed and used for FDEP reporting.

B. Systems Integrator Qualifications

1. The approved system integrator shall demonstrate specialty-programming expertise for 3-dimensional graphic screen HMI Citect programming functions. The engineer and owner shall approve the PLC/HMI Citect Certified Programmer. The system integrator shall maintain complete responsibility for the work of the HMI Citect Certified programmer.
2. The system integrator shall be a certified Citect Silver Level or better integrator. The system integrator's on-site project manager shall be a Citect Certified Programmer.
3. References: Provide a list of ten (10) professional references of owners or clients of previous work. Include references from a minimum of three (3) governmental agencies that have contracted for similar type and size services, and three (3) engineering consultants whose design was incorporated or undertaken by the Contractor within the last five (5) years. The list shall include: Company name and address. Contracting officer and telephone number. Technical representative and telephone number. A written description of the project. Project value quoted for integration services work for each project. Include only projects utilizing the type and make of PLC (Modicon or Allen Bradley) and HMI programming (Citect) used on this project.

D. Operations and Maintenance Manuals

1. Provide O&M Manuals in accordance with other sections of Division 26.
2. Existing Plant PLC and Citect operations and maintenance manuals are required to be completed updated. Assume electronic files are not available to be modified.

3. Electronic copy of the O&M manual shall contain a copy of the most current SCADA system project back up. It will also include a back up of any include projects and the "citect.ini" file for all the automation computers.

3.09 WARRANTY

- A. The complete electrical transfer power system; controls, switchgear and accessories, and ancillary equipment shall be warranted by the manufacturer against defects in materials and workmanship for a period of two years from the date of system startup and substantial acceptance of the completed system. Coverage shall include parts, labor, travel expenses and labor to remove reinstall defective equipment. No deductibles shall be applied to the warranty except for switchgear batteries being warranted for one year.

END OF SECTION