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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

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and

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CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
 7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
 9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work*—See Paragraph 11.01 for definition.
17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
19. *Engineer*—The individual or entity named as such in the Agreement.
20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. *General Requirements*—Sections of Division 1 of the Specifications.
22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. *PCBs*—Polychlorinated biphenyls.
31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.
37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.
46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work*—Work to be paid for on the basis of unit prices.
50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive 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 Contract Times.

1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on

Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

- A. Standards, Specifications, Codes, Laws, and Regulations
 1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;
2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. 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 Engineer or its consultants, including electronic media editions; or
2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any “technical data” on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer’s Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner’s obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer’s findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor’s cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and

contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

- c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *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 Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents;
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the

consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument 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 or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also

meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

- a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
 2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
 3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
 4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
 5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
 6. include completed operations coverage:
 - a. Such insurance shall remain in effect for two years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors,

members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.
- E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's

interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and “Or-Equals”*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
 - 1. “*Or-Equal*” Items: If in Engineer’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
 - 3) it has a proven record of performance and availability of responsive service.
- b. Contractor certifies that, if approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
 - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

- c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services; and
 - 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be

required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.
- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner,

Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

- 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
- 2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
- 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought

by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and

shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is

required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

- a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
- b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
- c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
- d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. Engineer's Review:

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. Resubmittal Procedures:

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 - 1. observations by Engineer;
 - 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. use or occupancy of the Work or any part thereof by Owner;
 - 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 - 6. any inspection, test, or approval by others; or
 - 7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
1. written notice thereof will be given to Contractor prior to starting any such other work; and
 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 3. the extent of such authority and responsibilities will be provided.

- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

- A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or

continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize 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 Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not

exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
 - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data

shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part;
 2. approve the Claim; or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of

said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not

limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.
- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:*
 1. Contractor agrees that:
 - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance:*
 1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to

the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

- B. 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. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee*: The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or

neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.
- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
 - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or
 2. correct such defective Work; or
 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. Applications for Payments:

- 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an

Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. 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 a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or

- involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
- b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
- a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment:

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling Owner to a set-off against the amount recommended; or
 - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before

final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying

documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due:

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner 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 Paragraph 5.01, 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 Contractor to Engineer with the Application for 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.

14.09 *Waiver of Claims*

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's repeated disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when

so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 - 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 - 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days

to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
 2. agrees with the other party to submit the Claim to another dispute resolution process; or
 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. 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.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 00800

SUPPLEMENTARY CONDITIONS

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SUPPLEMENTARY CONDITIONS

PART I - AMENDMENTS TO GENERAL CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC Document No. C-700, 2007 edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

SC-1.01.A.12

Delete Paragraph 1.01.A.12 in its entirety and replace with the following:

12. *Contract Documents* – The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents), Bidding Documents, Notice to Proceed, the Payment, Performance, and Maintenance Bond, warranties/guarantees, these General Conditions, the Supplementary Conditions, the Specifications, and the Drawings as the same are more specifically identified in the Agreement, together with all written amendments, Change Orders, Work Change Directives, Field Orders, and Engineer’s written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings, other Contractor submittals and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this Paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by Owner to Contractor are not Contract Documents.

SC-1.01.A.29

Add the following sentence to Paragraph 1.01.A.29

The Owner is the Charter County of Wayne, Michigan (“County”). Any references to Owner or County are interchangeable in the Contract Documents, including the General Conditions and Supplementary Conditions.

SC-1.01.A.52 thru 64.

Add the following new definitions after Paragraph 1.01.A.51:

52. Bid Security – The security designated in the Bidding Documents to be furnished by the Bidder as a guaranty of good faith to enter into a Contract for the Work contemplated if it is awarded to Bidder.
53. Disadvantaged Business Enterprise (DBE) – shall mean a business that meets the requirements of 49 CFR § 26, as amended, and is certified as a DBE by the County’s Division of Human Relations.
54. Excusable Delay - Any delay beyond the control and without the fault or negligence of the Contractor, the Owner, or any other contractor caused by events or circumstances such as, but not limited to, acts of God or of the public enemy, acts of interveners, acts of government other than the Owner, fires,

floods, epidemics, quarantine restrictions, freight embargoes, and hurricanes, tornadoes, or new sink holes. Labor disputes and above average rainfall shall give rise only to inexcusable delays.

- 55. Hold Point – A point in the construction sequence when the construction Contractor is required to stop work on that portion of the project until an inspection has been completed.
- 56. Maintenance Bond – The bond executed by Contractor and its Surety, upon forms provided by the Owner, guaranteeing the Work was completed in accordance with the Contract Documents and obligating the protection of Owner against any defect and the correction of any defect resulting from faulty materials, equipment, or workmanship, without expense to the Owner.
- 57. Non-Conformance Report – A report written by the Engineer to document the Contractor's procedure or Work that does not meet requirements of the Specifications or Contract.
- 58. Nonprejudicial Delay - 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.
- 59. Payment Bond – The bond executed by Contractor and its Surety, upon forms provided by Owner, guaranteeing the payment of all labor and material claims in connection with the Work as provided by law.
- 60. Performance Bond – The bond executed by Contractor and its Surety, upon forms provided by the Owner, guaranteeing performance of the Work in accordance with the intent of the Drawings and Specifications and the terms of the Contract as provided by law.
- 61. Performance Specifications - Specifications that require the manufacturer or supplier of equipment, materials, or systems to design, manufacture, deliver, and install products to achieve specific results under stipulated conditions of operation and in environments described in applicable Specifications sections.
- 62. Prejudicial Delay - Any excusable or compensable delay impacting the Work and exceeding the total float available in the progress schedule, thus preventing completion of the Work within the Contract Times unless the Work is accelerated.
- 63. Preoperational Testing - All field inspections, installation checks, water tests, performance tests, and necessary corrections required of Contractor to demonstrate that individual components of the Work have been properly constructed and do operate in accordance with the Contract Documents for their intended purposes.
- 64. Start-Up Testing - A predefined trial period required for achieving substantial completion during which Contractor is to operate the entire Work (or any part thereof agreed to by the Owner) under actual and simulated operating conditions for the purpose (i) of making such minor adjustments and changes to the Work as may be necessary for the Work to comply with the Contract Documents and (ii) to comply with the final test requirements in the Contract Documents.

SC-1.02.D.1.d

Add Paragraph 1.02.D.1.d, which is to read as follows:

- d. has been completed with an unresolved non-conformance report.

ARTICLE 2 - PRELIMINARY MATTERS

SC-2.01.A

Delete Paragraph 2.01.A in its entirety and replace with the following:

A. Within the time specified in the Notice of Award, Contractor shall provide the Owner with the number of original sets of separate Payment, Performance, and Maintenance Bonds and with the number of original sets of Certificates of Insurance meeting the standards found in the Supplementary Conditions, as specified in the Notice of Award. Insurance companies and insurance forms must be standard to the industry and acceptable to the Owner. Failure to submit bonds and/or insurance within the specified time frame will be considered a default and a failure to perform as required by the Bid Bond, which will become the Owner's property.

SC-2.01.B

Delete Paragraph 2.01.B in its entirety.

SC-2.02.A

In Paragraph 2.02.A, delete "ten" in the first line and replace with "three."

SC-2.03.A

Delete Paragraph 2.03.A in its entirety and insert the following in its place:

A. A Notice to Proceed may be given at any time within 90 days after the Effective Date of the Agreement. The Contract Time will commence at the time specified in such notice.

SC-2.05.A.2

Delete Paragraph 2.05.A.2 in its entirety and replace with the following:

2. a separate preliminary schedule of Shop Drawings and Sample Schedule of Submittals which will list each required submittal and the times for submitting, reviewing, and processing each submittal; the schedules specified in this Paragraph 2.05A.2 may be added to from time to time as determined by the Engineer; and

SC-2.07.A

Delete everything in Paragraph 2.07.A before the sentence starting "Contractor shall have an additional 10 days to make corrections. . ." and insert the following at the beginning:

All schedules are to be submitted prior to the preconstruction meeting.

SC-2.07.A.3

Delete Paragraph 2.07.A.3 in its entirety and replace with the following:

3. Contractor's Schedule of Values must be acceptable to the Engineer and provide a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.01.D

Add a new Paragraph 3.01.D which is to read as follows:

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

SC-3.05.A.2

In Paragraph 3.05.A.2 delete everything after “. . . without written consent of Owner. . . .”

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

SC-4.01.B

Delete Paragraph 4.01.B in its entirety.

SC-4.02.A.1

Delete Paragraph 4.02.A.1 in its entirety.

SC-4.06.G

Delete Paragraph 4.06.G in its entirety

ARTICLE 5 - BONDS AND INSURANCE

SC-5.01

Delete Paragraph 5.01 in its entirety and replace with the following:

5.01 *Performance, Payment, Maintenance, and Other Bonds*

- A. Contractor shall furnish Performance, Payment, and Maintenance Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall be furnished in accordance with and subject to the provision of 1963 PA 213, MCL § 129.201, *et seq.*, as amended, and remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

- B. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by the Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated, Contractor shall, within 10 days, furnish another bond and surety, both of which shall comply with the requirements of Article 5.

SC-5.02.A

Delete Paragraph 5.02.A in its entirety and replace with the following:

- A. All bonds required by the Contract shall be executed by sureties acceptable to Owner, licensed to do business in the state of Michigan, and named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570, as amended, by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury.

SC-5.03.B

Delete Paragraph 5.03.B in its entirety.

SC-5.03.E

Delete Paragraph 5.03.E and replace with the following:

- E. The insurance and insurance limits herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and Engineer in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Prior to commencement of the Work, the Contractor shall purchase and maintain and ensure that any Subcontractor hired by the Contractor purchases and maintains, during the term of the Project and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07, such insurance as will protect Contractor, the Owner, and the Engineer from claims, demands and lawsuits arising out of the Work described in this Contract and performed by the Contractor, Subcontractors(s), or Sub-Subcontractors. Nothing contained in these insurance requirements is to be construed as limiting the extent of the Contractor's or any of its Subcontractor(s)'s responsibility for payment of damages resulting from Contractor's operations under this Contract. The Contractor shall advise all insurance companies to familiarize themselves with the conditions and provisions of this Contract dealing with waiver of subrogation, insurance and indemnification, and failure of the Contractor to so notify the aforesaid insurance companies shall in no way relieve these aforesaid insurance companies; from their obligation under this Contract.
- B. The insurance shall provide that the inclusion of more than one corporation, person, organization, firm or entity as a named insured or an additional insured in the policy shall not in any way affect the rights of any such corporation, person, organization, firm or entity either as respects any claim, demand, suit or judgment made or brought by or in favor of any other named insured or additional insured, or by, or in favor of any employee of such other insured or additional insured. This policy

shall insure each such corporation, person, firm or entity in the same manner as though a separate policy had been issued to each; but nothing herein contained shall operate to increase the insurance company's or insurance companies' liability as set forth elsewhere in this policy beyond the amount or amounts for which the insurance company or insurance companies would have been liable if only one person or interest had been named as insured.

C. The Contractor shall purchase and maintain and ensure that any Subcontractor hired by the Contractor purchases and maintains the following insurance:

1. Workers compensation Insurance which meets Michigan statutory requirements.
2. Commercial General Liability: Covering Premises/Operations and Personal Injury , Blanket Contractual Liability, XCU, Independent Contractor and Completed Operations Coverage broad form property damage including Completed Operations in the following minimum limits:
 - a. Bodily Injury & Property Damage:
\$1,000,000 Each Occurrence
\$2,000,000 Personal Injury
\$2,000,000 Products & Completed Aggregate
\$2,000,000 General Aggregate
 - b. Excess/Umbrella Liability:
\$3,000,000 Umbrella Form
 - c. Automobile Liability: Covering all owned, non-owned and hired vehicles:
\$1,000,000 Combined Single Limit
3. Contractual Assumed Liability: Specifically covering Contractor for liability for loss, cost and damages, including attorneys' fees, assumed by Contractor under the provisions of this Contract. It is hereby agreed and understood that Completed Operation Liability will be carried two (2) years after final payment or completion of the Project, whichever occurs last.
4. In the event the Contractor performs or is responsible for any design services, then throughout all phases of the Project and for a period of seven (7) years after final completion of the Work, the Contractor shall keep in force, at its sole cost and expense, a Professional Liability insurance policy approved by Owner with minimum limits of One Million Dollars (\$1,000,000) per occurrence.

Professional errors and omissions coverage shall be endorsed to provide contractual liability coverage. Such policy shall provide that it may not be substantially modified or canceled without thirty (30) days prior written notice to Owner and that the insurance company shall promptly notify Owner of any failure of the Contractor to renew such policy as required hereunder. The Contractor shall do all things necessary to keep the policy in full force and effect throughout all phases of the Project and for a period of seven (7) years from the date of final completion. The Contractor shall deliver to the Owner a copy of the

aforsaid policy at least once a year.

5. If the scope of Work relating to this Contract calls for asbestos remediation or related Work, the Contractor will be required to provide a \$5,000,000 each occurrence/\$5,000,000 aggregate limit of liability on an occurrence based form. Coverage shall include protection for asbestos/pollution exposures. Claims-made coverage is not acceptable. All coverages incorporated in the Commercial General Liability provisions, Paragraph 5.04.C.2 above, shall be included. The Owner reserves the right for approval of the coverages forms.
 6. Each policy shall be specifically endorsed to name the Owner and Engineer and their respective elected officials, officers, directors, partners, employees, agents, servants and representatives, and others as may be specified in the Contract Documents as additional insureds. The additional insured coverage shall be primary, non-contributory coverage, and each policy shall provide for thirty (30) days notice of cancellation to the additional insureds. Contractor shall provide the additional insureds with Certificates of Insurance reflecting the coverages expressly specified herein including, but not limited to, an acknowledgment that the additional insured coverage for the additional insureds is on a primary, non-contributory basis. Contractor must submit certificates of insurance evidencing coverage to Wayne County Risk Management Division, 500 Griswold St., 21st Floor, Detroit, Michigan 48226, at the time the Contractor executes the Contract, and at least thirty (30) days prior to the expiration dates of expiring policies.
 7. Contractor shall be responsible for any desired coverage against damage or loss to its own materials, facilities, tools, equipment scaffolds, bracing and similar items not covered by other insurance maintained by Contractor.
 8. The Contractor shall purchase a Builder's Risk-Installation floater in a form acceptable to the Owner covering property of the Project for the full cost of replacement as of the time of any loss which shall include, as named insured, (a) the Contractor, (b) all Subcontractors, (c) all Sub-Subcontractors, (d) Owner and (e) the Engineer, as their respective interest may prove to be at the time of loss, covering insurable property which is the subject of this Contract, whether in place, stored at the job site, stored elsewhere, or in transit at the risk of the insured(s). The Owner shall be furnished with two (2) originally signed copies of this policy.
- D. Coverage shall be effected on an all-risk form including, but not limited to, the perils of fire, wind, vandalism, collapse, theft, flood and earthquake, with removal of passive design error exclusion. The Contractor may arrange for such deductibles as it deems to be within its ability to self-assume, but Contractor will be held solely responsible for the amount of such deductible and for any co-insurance penalties. Any insured loss shall be adjusted with the Owner and the Contractor and paid to the Owner and the Contractor as trustee for the other insureds.
- E. Insurance coverage shall comply with the requirements of the Flood Disaster Protection Act of 1973, 42 USC § 4002, as amended.
- F. Compliance with the insurance requirements of this Paragraph 5.04 is a continuing condition of Contractor's responsibilities under this Contract. If Contractor fails to procure and maintain such insurance, the Owner shall have the right, but not the obligation, to procure and maintain the insurance for and in the name of Contractor and the Contractor shall pay the cost thereof and shall furnish all necessary information to make effective and maintain such insurance or, at the Owner's option, the Owner may offset the cost incurred by Owner against amounts otherwise payable to

Contractor under this Contract. If the Contractor fails to comply with the insurance requirements specified in the Contract Documents, the same will be deemed a material breach of the Contract and the Owner has the right to terminate the Contract.

G. Insurance - Other Requirements

1. Evidence of Coverage: Owner reserves the right to request complete copies of policies if deemed necessary to ascertain details of coverage not provided by certificates. Such policy copies shall be originally signed copies and so designated. The certificates of insurance shall evidence the required insurance coverages as enumerated above, including coverage required for the Contractor, Owner and any additional named insured.

If, during the term of this Contract, changed conditions or other pertinent factors, should in the reasonable judgment of the Owner, render inadequate the insurance limits, the Contractor will furnish on demand such additional coverage as may reasonably be required and available under the circumstances. The Owner, at its discretion, may pay for the cost of obtaining such increased coverage.

2. Qualification of Insurers: In order to determine financial strength and reputation of insurance carriers, all companies providing the coverage required under this Contract shall be licensed and approved by the Insurance Bureau of the State of Michigan and shall have a financial rating no lower than XI and a policy holder's service rating no lower than [A] as listed in A.M. Best's Key Rating Guide, current edition or interim report.
3. Damage Claims - Acknowledgment and Reports: The Contractor shall furnish to the Owner an acknowledgment of receipt from the insurance carrier for each damage claim against the Project. The receipt shall include the insurance carrier's assigned claim number.

Upon request, the Contractor or its insurance carrier shall also furnish to the Owner a status report of all damage claims. This report shall include inspections made, the disposition of claims, and what action has been taken towards settlement of each claim.

Failure of the Contractor to comply with this Paragraph 5.04 of the Specifications may result in the amount of such damage claims being withheld from the Contractor's progress payment(s). Such withholding shall be reimbursed in the progress payment(s) following compliance.

H. Payment

The cost of the insurance hereinbefore specified will not be a specific Bid item, but the cost of such insurance will be covered in the various unit prices Bid.

SC-5.06

Delete Paragraph 5.06 in its entirety.

SC-5.07

Delete Paragraph 5.07 in its entirety and replace with the following:

5.07 Waiver of Subrogation

- A. The Contractor shall waive any rights of subrogation against the Owner and Engineer and their respective elected officials, officers, directors, partners, employees, agents, servants and representatives, for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. In the event of any payment by any insurer of the Contractor under any policy of insurance, the insurer of the Contractor shall not be subrogated to any of the Contractor's rights of recovery therefore against the Owner and Engineer and their respective agencies, elected officials, employees, agents, servants and representatives, and the Contractor shall neither execute nor deliver instruments and papers nor do anything whatever to secure any such rights for the insurer of the Contractor. The Contractor shall do nothing after loss to secure such rights for the benefit of the insurer against the Owner and Engineer and their respective agencies, elected officials, employees, agents, servants and representatives. The Contractor waives any and all rights of recovery against the Owner and its agencies, elected officials, employees, agents, servants and representatives, for insured losses occurring to any property insured by the Contractor arising from this Contract.

SC-5.08

Delete Paragraph 5.08 in its entirety.

SC-5.09

Delete Paragraph 5.09 in its entirety.

SC-5.10

Delete Paragraph 5.10 in its entirety.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

SC-6.01.C

Add a Paragraph 6.01.C which is to read as follows:

- C. Resident superintendent shall be fluent in English to the level of competency to complete the requirements of Paragraph 6.01.B. Superintendent shall also be fluent in, or have access to a translator for, the primary language of the majority of workers. If a translator is not available, the degree of fluency shall be sufficient to enable the superintendent to complete his/her duties under Paragraph 6.01.A.

SC-6.02.B

Delete Paragraph 6.02.B and replace with the following:

- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Regular working hours are defined as eight (8) hours per day, Monday through Friday, excluding holidays, between the hours of 7:00 a.m. and 5:00 p.m. Requests to work other than regular working hours shall be submitted to Engineer, in

writing, not less than 48 hours prior to any proposed additional daily working hours (including second and third shifts), weekend work, or scheduled extended work weeks. All requests to work other than regular working hours must comply with all applicable Laws or Regulations. Requests will be reviewed by Engineer and Engineer will either (1) deny the request or (2) provide Contractor with terms for additional Engineering and/or inspection costs to be paid for by Contractor as a result of overtime work in excess of the regular working hours. Contractor shall agree to Engineer's terms prior to Engineer approving Contractor's request to work other than regular working hours.

SC-6.02.C thru G

Add Paragraphs 6.02.C thru H which are to read as follows:

- C. Contractor shall reimburse the Owner for additional Engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours stipulated in Paragraph SC-6.02.B. At Owner's option, overtime costs incurred by Owner may either be deducted from the Contractor's progress payment(s) or deducted from the Contractor's retention prior to release of final payment. Overtime costs for the Owner's personnel shall be based on the individual's current overtime wage rate. Overtime costs for personnel employed by the Engineer shall be calculated in accordance with the terms of its contract with the Owner.
- D. Payment for overtime inspection costs will not apply where specific portions of the Work are specified to be performed outside of regular working hours and where, in the sole opinion of the Engineer, the nature of the Work does not require continuous observation by the Engineer of Work in progress. Work which shall invariably be observed shall include all pipe installation, all subgrade preparation and bedding, all reinforcement and cast-in-place concrete placement, and such other Work where the Engineer has limited opportunity to observe important elements of the Work.
- E. Reimbursement of Engineering Cost: The Owner's budget for the Engineer for this Contract is based on the routine duties of the Engineer as generally indicated in the Specifications. Certain actions or lack of actions on the part of the Contractor necessitate additional effort on the part of the Engineer and, hence, Owner costs for engineering above and beyond the costs for routine engineering services. The Contractor shall pay to the Owner the reasonable costs of such additional engineering effort, which shall include the following:
 - 1. Review of Shop Drawings or workings beyond the second submittal.
 - 2. Actions related to Contractor requests for deviations or substitutions from the Contract requirements for the Contractor's benefit or preference.
 - 3. Observations, investigations, research, and communications relating to construction deviations, errors, or contravention of Contract requirements.
 - 4. Observations of suppliers where deviations from the approved Drawings or Contract requirements are found to be taking place or have taken place.
 - 5. Any other circumstance where the Contractor's action or lack of action results in unnecessary additional engineering costs to the Owner.

The Engineer or Owner will notify the Contractor, in writing, when one of the above circumstances exists for which reimbursement of engineering costs is required. The Engineer or Owner will be the sole judge of when such circumstances exist and the level of effort involved.

The standard reimbursement rate shall be the actual rate for engineering time plus any travel costs involved. The amount shall be incorporated into a Contract Change Order or otherwise deducted from payment due to the Contractor.

- F. This Contract is subject to the applicable provisions of the Contract Work Hours and Safety Standards Act, 40 USC § 3701, *et seq.* Contractor or any Subcontractor contracting for any part of the Work shall not require nor permit any laborer or mechanic to be employed on the Work in excess of 40 hours in any Work week unless such laborer or mechanic receives compensation at a rate not less than one and one-half (1 ½) times that person's basic rate of pay for all hours worked in excess of 40 hours in such Work week.
- G. Contractor shall employ only competent persons to do the Work and whenever Owner shall notify Contractor, in writing, that any person on the Work appears to be incompetent, disorderly, or otherwise unsatisfactory, such person shall be removed from the Project and shall not again be employed on it except with the written consent of Owner.

SC-6.03.D and E

Add Paragraphs 6.03 D and E, which are to read as follows:

- D. The Contract Documents may include performance Specifications, which are identified as such. When used, performance Specifications will specify required results for systems, equipment, and/or materials to be incorporated in the Project, without mandating specific means for achieving the required results. The functional requirements for the systems, equipment, and/or materials are defined together with the operating conditions and/or environment in which they must operate and general standards which must be satisfied. Performance Specifications establish minimum standards that must be met.
- E. Under performance Specifications, Contractor, together with its Subcontractors, Suppliers, and manufacturer, are solely responsible for the design, manufacture, and performance of the specified systems, equipment, or materials. Engineer's review of Shop Drawings for such systems, equipment, or materials is solely to determine that appropriate operating conditions and environment have been referenced by Contractor, Subcontractors, Suppliers, and/or manufacturer, and is not intended for the benefit of Contractor or any other entity. Observations or requirements that Engineer may communicate to Contractor or others are for clarification only and shall not alter the responsibility of any party nor be interpreted to impose on Owner or Engineer any liability to Contractor, Subcontractors, Suppliers, or manufacturers related to systems, equipment, or materials supplied pursuant to a performance Specification. Neither Contractor nor anyone claiming rights by virtue of this Contract or any subcontract or order placed hereunder shall seek to recover from Owner or Engineer any losses or damages suffered as a result of any deficiency, defect, or performance problem in any systems, equipment, or materials supplied pursuant to a performance specification.

SC-6.05A.2.d

Replace Paragraph 6.05 A.2.d in its entirety with the following:

1. Contractor shall submit each substitute item with the Substitution Request Application. No substitute item will be reviewed prior to or without this application being submitted.
2. Additional information may consist of completing Engineer's vendor checklist, field mock-ups,

special samples, pilot testing, or other special requirements that Engineer determines necessary to assess if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore.

SC-6.05.E.1. and 2

Add Paragraphs 6.05.E.1 and 2 which are to read as follows:

1. Prior to Engineer's review of a substitute, Engineer will prepare a Work Change Directive to document Engineer's anticipated costs in reviewing Contractor's substitute. The Work Change Directive shall be executed prior to Engineer commencing its review.
2. The Work Change Directive will include Engineer's opinion of the probable hours required to review the substitute. Engineer will notify Contractor if the hours listed on the Work Change Directive are to be exceeded. Engineer's costs for reviewing a substitute shall be in accordance with its contract with Owner.

SC-6.06.A

Delete Paragraph 6.06.A and replace with the following:

- A. Contractor shall not employ any Subcontractor, Supplier or other individual or entity (including those who are to furnish the principal items of materials or equipment), whether initially or as a replacement, against whom Owner may have reasonable objection. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity, to furnish or perform any of the Work against whom Contractor has reasonable objection.

SC-6.06.B

Delete Paragraph 6.06.B in its entirety.

SC-6.06.E

Add a new sentence at the end of Paragraph 6.06.E which is to read as follows:

Owner or Engineer may furnish to any such Subcontractor, Supplier or other individual or entity, to the extent practicable, information about amounts paid on their behalf to Contractor in accordance with Contractor's Applications for Payment.

SC-6.06.G

Delete everything in Paragraph 6.06.G after and including the sentence starting "Whenever any such agreement"

SC-6.07

Delete Paragraph 6.07 in its entirety and replace with the following:

6.07 *Patent Fees and Royalties*

- A. All royalties or other charges for any Contractor provided patent, copyright, trademark, trade

secret, or other proprietary right to be used in the performance of the Work shall be considered as included in the price of the Contract Price. Contractor warrants that any products sold or processes used in the performance of this Contract do not infringe upon or violate any patent, copyright, trademark, trade secret or any other proprietary rights of any third party. If a third party makes a claim against the Owner, the Owner must promptly notify the Contractor. The Contractor must defend the claim in the name of the Owner, at the Contractor's expense. The Owner will cooperate with the Contractor and/or its Suppliers in the defense against the suit. In no event shall Contractor make any admission of guilt or liability on behalf of the Owner without the Owner's prior, written consent. The Contractor must indemnify the Owner against any loss, cost, expense or liability arising out of the claim, whether or not the claim is successful.

If the Owner's use of any portion of the products or documentation provided by Contractor as part of its Services under this Contract is enjoined by a court of competent jurisdiction, Contractor shall at its option and expense and within five (5) days of the enjoinder:

1. Procure for the Owner the right to use such infringing portion;
2. Replace such infringing portion with a non-infringing portion providing equivalent functionality; or
3. Modify the infringing portion so as to eliminate the infringement while providing equivalent functionality.

Contractor may delegate its responsibilities under this Paragraph 6.07 to the manufacturer of the allegedly infringing product, provided Contractor has received the advance, written consent of the Owner. Such consent will not be unreasonably withheld or delayed.

SC-6.13.A

Delete the sentence beginning with "Such responsibility does . . ." in its entirety (the remainder of Paragraph 6.13.A remains unchanged).

SC-6.13.C and D

Delete Paragraphs 6.13.C and D in their entirety.

SC-6.17.A.

Delete the first sentence of Paragraph 6.17.A in its entirety and replace with the following (the remainder of Paragraph 6.17A remains unchanged):

Contractor shall submit Shop Drawings to Engineer for review and approval in accordance with the Acceptable Schedule of Shop Drawings and Sample Submittals including such additional submittals deemed necessary by the Engineer to provide further clarification or due to changes in the Work.

SC-6.18.A

Delete the last sentence of Paragraph 6.18.A beginning with "No Work shall . . ." and replace with the following:

No work shall be delayed or postponed pending resolution of any disputes or disagreements, except if a stop work order in accordance with the Contract Documents has been issued or as Owner and Contractor may otherwise agree in writing.

SC-6.19.D

Add Paragraph 6.19.D which is to read as follows:

D. Manufacturer's Guaranty/Warranty

1. The Contractor shall obtain the following guaranty/warranty from the manufacturer of all major pieces of equipment furnished and installed on this Project. Such guaranty/warranty shall be for the benefit of Owner and be furnished in writing by the manufacturer. The Contractor's and manufacturer's obligations under this provision are in addition to other express or implied warranties under the Contract Documents and under the law and in no way diminish any other right that the Owner may have against the Contractor or manufacturer for faulty material, equipment or work. The warranty period shall not be interpreted as a limitation on the time in which the Owner can enforce such other duties, obligations, rights, or remedies:

The manufacturer warrants and guarantees for a period of one (1) year from the date of Final Completion, or such longer period that may be specified in the Contract Documents, that all materials and equipment furnished and installed shall be free from flaws, defects in material and workmanship and shall be in conformance with the Contract Documents.

SC-6.20.D thru F

Add Paragraphs 6.20.D thru F which are to read as follows:

D. In the event that any claim for damages is made, asserted or threatened against the Owner and/or its officers, agents, employees or elected officials and/or a lien is recorded against the Owner's property as a result of the Contractor's failure to pay for any labor, services, materials, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work to be provided under this Contract, upon written notice, the Owner may withhold from any payments due or to become due to the Contractor under this Contract an amount sufficient, in its judgment, to (1) satisfy, discharge, and/or defend against any such claim or any action which may be brought or judgment which may be recovered thereon, (2) make good any such nonpayment, damage, failure or default, and/or (3) compensate the Owner for and indemnify and hold it harmless against any and all losses, liability, damages, costs and expenses, including legal fees and costs, which may be sustained or incurred in connection therewith. If the amounts withheld under the Contract are insufficient to compensate the Owner for its losses, damages, costs and expenses, the Owner may require the Contractor to make immediate payment of any such deficiency or offset such deficiency against the compensation to be paid the Contractor in any concurrent, successive or future contracts between the parties.

E. In furtherance of but not in limitation of the indemnity provisions in this Contract, the Contractor hereby expressly and specifically agrees that its obligation to indemnify, defend and save the Owner harmless as provided in this Contract shall not in any way be affected or diminished by any statutory or constitutional immunity it enjoys from suits by its own employees or from limitations of liability or recovery under worker's compensation laws. The Contractor further agrees that this indemnity does not constitute or act as a waiver of any governmental immunity the Owner, its agencies, officers, employees,

agents or elected officials enjoy under applicable statutory or common law.

F. The indemnity provisions in this Contract survive the Contract's termination.

ARTICLE 7 – OTHER WORK AT THE SITE

SC-7.04

Add Paragraph 7.04, which is to read as follows:

7.04 Other Unrelated Work

A. Should Contractor cause damage to the work property of any other contractor at the Site or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator or the elected officials, officers, directors, partners, employees, agents, servants, representatives, or other consultants or subcontractors of each, Contractor shall promptly attempt to settle with such other contractor by agreement or to otherwise resolve the dispute by arbitration or at law. The indemnity provisions of Paragraph 6.20 of the General Conditions are applicable to this situation.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, and construction coordinator and the elected officials, officers, directors, partners, employees, agents, servants, representatives, or other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, Engineer's consultants, or the construction coordinator or the elected officials, officers, directors, partners, employees, agents, servants, representatives or other consultants and subcontractors of each and any of them to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other Contractor at the Site give rise to any other claim, Contractor shall not institute any action legal or equitable, against Owner, Engineer, or the construction coordinator or the elected officials, officers, directors, partners, employees, agents, servants, representatives, or other consultants and subcontractors of each and any of them, or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator or the elected officials, officers, directors, partners, employees, agents, servants, representatives or other consultants and subcontractors of each and any of them, on any such damage or claim.

C. If Contractor is delayed at any time in performing or furnishing Work by an act or neglect of another contractor and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a claim for an extension of Contract Times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to the Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor.

SC-7.05

ARTICLE 8 – OWNER’S RESPONSIBILITIES

SC-8.06

Delete Paragraph 8.06 in its entirety.

SC-8.11

Delete Paragraph 8.11 in its entirety.

SC-8.12

Delete Paragraph 8.12 in its entirety.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.01.A

Delete everything in Paragraph 9.01.A after the first sentence.

SC-9.10

Delete Paragraph 9.10 in its entirety.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

SC-10.01.C and D

Add Paragraphs 10.01.C and D which are to read as follows:

C. If Contractor claims (1) that any work it has been ordered to do is not part of the Work required by the Contract Documents, hereinafter referred to as "Extra Work," (2) that it has performed or is going to perform Extra Work, or (3) that any action or omission of Owner or Engineer is contrary to the terms and provisions of the Contract Documents, Contractor shall:

1. Promptly comply with such order;
2. File with Engineer a written notice stating the basis of its claim and a request for a determination thereof, within 14 working days after being ordered to perform the Work claimed by it to be Extra Work, or within 14 working days after commencing performance of the Extra Work, or within 14 working days after the action or omission of the Owner or the Engineer occurred, whichever date shall be the earlier.
3. File with Engineer a verified detailed statement, with documentary evidence of the items and basis of its Claim, within 30 calendar days after said alleged Extra Work was required to be performed or said alleged Extra Work was commenced, or said alleged action or omission by Owner or Engineer, whichever date shall be earlier.
4. Produce for Owner's examination, upon notice from Owner, all of Contractor's books of account, bills, invoices, payrolls, subcontracts, time books, progress records, daily reports, bank deposit books, bank statements, checkbooks and canceled checks showing all of its actions and transactions in connection with or relating to or arising by reason of its Claim, and submit Contractor and its Subcontractors and the officers, directors, partners, employees, agents, servants, representatives, or other consultants of

each for examination under oath by any person designated by Owner to investigate any Claims made against Owner under the Contract, such examination to be made at the offices of Owner or Owner's agent;

5. Proceed diligently, pending and subsequent to determination of Owner with respect to any such disputed matter, with the performance of the Contract and in accordance with all instructions of Owner and Engineer.
- D. Contractor's failure to comply with any or all of the foregoing provisions of Paragraph 10.01.C shall be deemed to be: (1) a conclusive and binding determination that said order, work action or omission is not additional or Extra Work for Contractor and is not contrary to the terms and provisions of the Contract; and (2) a waiver by Contractor of all Claims for additional compensation or damages as a result of said order, work action or omission.
1. Only the Owner may waive or modify any of the foregoing provisions, which must be done so in writing and signed by the Owner. In any action against Owner to recover any sum in excess of the sum certified by Owner to be due under or by reason of the Contract, Contractor must allege in its complaint and prove at trial compliance with the provisions of Paragraph 10.01.C.
2. Nothing in this Paragraph 10.01.C or D shall in any way affect Owner's right to obtain an examination of Contractor before trial or discovery and inspection in any action that might be instituted by or against Owner or Contractor.

SC-10.05.G

Add Paragraph 10.05.G which is to read as follows:

G. If the provisions of Paragraph 10.05 conflict with the provision of Article 15, the provisions of Paragraph 10.05 shall be superseded by the provisions of Article 15 of the General Conditions, as amended by the Supplementary Conditions.

SC-10.06

Add Paragraph 10.06, which is to read as follows:

10.06 *Change in Work Quotation*

A. At any time Engineer may request a quotation from Contractor for a proposed change in the Work. Within 21 calendar days after receipt of a request for a quotation for a proposed change, Contractor shall submit to Engineer a written and detailed proposal for an increase or decrease in the Contract Price or Contract Times for the proposed change. Engineer shall have 21 calendar days after receipt of the detailed proposal to respond in writing. The proposal shall include an itemized estimate of all cost and time for performance that will result directly or indirectly from the proposed change. Unless otherwise directed, itemized estimates shall be in accordance with Articles 11 and 12 and in sufficient detail reasonably to permit an analysis by Engineer of all material, labor, equipment, subcontracts, overhead costs and fees, and shall cover all Work involved in the change, whether such Work was deleted, added, changed, or impacted. Any amount claimed for subcontracts shall be similarly supported. Itemized schedule adjustments shall be in sufficient detail to permit an analysis of impact as required by the Contract Documents. Notwithstanding the request for quotation, Contractor shall carry on the Work and maintain the progress schedule. Delays in the submittal of the written and detailed proposal will be considered non-prejudicial as defined in the Supplementary Conditions.

SC-10.07

Add Paragraph 10.07, which is to read as follows:

10.07 Equitable Adjustment To Contract

A. The adjustment in the Contract Price and/or Contract Times stated in the Change Order shall comprise the total price and/or time adjustment due or owed the Contractor for the Work or changes defined in the Change Order. By executing the Change Order, the Contractor acknowledges and agrees that the stipulated price and/or time adjustments include the costs and delays for all work contained in the Change Order, including costs and delays associated with the interruption of schedules, extended overheads, delay, and cumulative impacts or ripple effect on all other non-affected Work under this Contract. Signing of the Change Order constitutes full and mutual accord and satisfaction for the adjustment in Contract Price or Contract Times as a result of increases or decreases in costs and time of performance caused directly or indirectly from the change, subject to the current scope of the entire Work as set forth in the Contract Documents. Acceptance of this waiver constitutes an agreement between Owner and Contractor that the Change Order represents an equitable adjustment to the Contract, and that Contractor will waive all rights to file a Claim on the Change Order after it is properly executed.

ARTICLE 11 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-11.01.A.1

Delete the second sentence in Paragraph 11.01.A.1 in its entirety and replace with the following:

Such employees shall include foremen and other personnel employed full time at the Site, agreed upon by Owner and Contractor.

SC-11.02.A

Delete Paragraph 11.02.A in its entirety and replace with the following:

A. Contractor agrees that an allowance, if any, is for the sole use of Owner to cover unanticipated costs.

SC-11.02.B thru D

Delete Paragraphs 11.02.B thru D in their entirety.

SC-11.03.D

Delete Paragraph 11.03.D in its entirety and replace with the following:

D. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment under the following conditions:

1. If the total cost of a particular item of Unit Price Work amounts to five percent (5%) or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 15 percent (15%) from the estimated quantity of such item indicated in the Contract; and

2. If there is no corresponding adjustment with respect to any other item of Work; and
3. If Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Unit Price in accordance with Paragraph 10.05 and 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 PRICE; CHANGE OF CONTRACT TIMES

SC-12.01.B.2

Delete Paragraph 12.01.B.2 in its entirety.

SC-12.01.C.1

Delete Paragraph 12.01.C.1 in its entirety.

SC-12.01.C.2.b

In the second line of Paragraph 12.01.C.2.b, before the semicolon add the following words:

" . . .based on Subcontractor's Cost of the Work;"

SC-12.01.D

Add Paragraph 12.01.D which is to read as follows:

A. The Contract Price, including profit or fee, shall be adjusted to exclude any significant sums by which the Owner finds that such price was increased because the Contractor furnished cost or pricing data which was inaccurate, incomplete, or not current as of the date agreed upon between the Owner and Contractor.

SC-12.02.C

Add Paragraph 12.02.C which is to read as follows:

C. Except as otherwise stated in the Contract Documents, the suspension or termination of Work by Contractor on account of weather shall not entitle Contractor to adjustment of Contract Price or Contract Times.

SC-12.03.F

Add Paragraph 12.03.F which is to read as follows:

F. Where Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both Owner and Contractor, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for such delay. In no event shall Owner be liable to Contractor, any Subcontractor, any Supplier, any other person or organization, or to any surety for or officer, director, member, partner,

employee, agent, consultant or subcontractor of any of them, for damages arising out of or resulting from (1) delays caused by or within the control of Contractor, or (2) delays beyond the control of both parties including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts or neglect by utility Owners or other contractors performing other work as contemplated by Article 6.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

SC-13.05.B

Add Paragraph 13.05.B which is to read as follows:

B. If Owner stops Work under Paragraph 13.05.A, Contractor shall be entitled to no extension of Contract Times or increase in Contract Price.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02.A.1.a

Add Paragraph 14.02.A.1.a which is to read as follows:

- a. Contractor shall furnish, with each Application for Payment submitted, the following required documents/items. **Failure to include all required documents/items, satisfactory to Owner, may result in a refusal to recommend the whole or any part of the payment:**
 - a. Contractor's Declaration
 - b. Partial Waivers of Lien
 - c. Sworn Statement

SC-14.02.A.1.b

Add Paragraph 14.02.A.1.b which is to read as follows:

- a. Contractor shall furnish evidence, satisfactory to Owner, that previous progress payments received on account of materials or equipment not incorporated and suitably stored, have in fact been paid to the respective Subcontractor(s) or Supplier(s) within 60 days of payment by Owner to Contractor. Failure of Contractor to provide such evidence of payment may result in Owner's withdrawal of previous approval(s) for payment(s) and deduction of the cost of related materials or equipment from any payments due Contractor.

SC-14.02.A.2

At the end of Paragraph 14.02.A.2 add the following:

The affidavit of Contractor must be signed by the Contractor and shall read as follows: The undersigned Contractor certifies that to the best of its knowledge, information and belief the Work for this Application for Payment has been completed in accordance with the Contract Documents and the current payment shown herein is now due. All previous progress payments received on account of the Work have been

applied on account to discharge Contractor's legitimate obligations for, including, but not limited to, amounts due to Subcontractors and Suppliers, associated with prior Applications for Payment.

SC-14.02.A.3

Delete Paragraph 14.02.A.3 in its entirety and replace with the following:

3. The amount of retainage with respect to progress payments will be as stipulated in the Contract Documents and may be changed from time to time as determined by the Owner and the Engineer.

SC-14.02.B.1

In Paragraph 14.02 B.1 delete the number 10 and replace with the number 14.

SC-14.02.C.1

At the beginning of Paragraph 14.02.C.1 delete the words, "Ten days" and replace with the word, "Promptly."

SC-14.02.C.2 thru 4

Add Paragraphs 14.02.C.2 thru 4 which are to read as follows:

2. Should Contractor neglect to pay any undisputed claims, made in writing to Owner within 30 days after completion of the Work, but continuing unsatisfied for a period of 90 days, Owner may pay such claim and deduct the amount thereof from the balance due Contractor. Owner may also, with the written consent of Contractor, use any monies retained, due, or to become due under this Contract for the purpose of paying for both labor and materials for the Work, for which claims have not been filed.
3. Security is provided both by the Payment Bond and the power of Owner to retain any monies for claims, but payment by one shall in no way impair or discharge the liability of the other.
4. All monies paid by Owner in settlement of claims as aforesaid, with the costs and expenses incurred by Owner in connection therewith, shall be charged to Contractor, shall bear interest at the rate of three percentage points above the rediscount rate then charged by the Federal Reserve Bank, and shall be deducted from the next payment(s) due Contractor under the terms of the Contract Documents.

SC-14.03.B and C

Add Paragraphs 14.03.B and C which are to read as follows:

- B. No materials or supplies for the Work shall be purchased by Contractor or Subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. Contractor warrants that Contractor has good title to all materials and supplies used by Contractor in the Work, free from all liens, claims or encumbrances.
- C. Contractor shall indemnify and save Owner harmless from all claims arising out of the lawful demands of Subcontractors, Suppliers, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. Contractor shall at Owner's request, furnish

satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If Contractor fails to do so, then Owner may, after having served written notice on the said Contractor either pay unpaid bills, of which Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to Contractor shall be resumed, in accordance with the terms of this Contract, but in no event shall the provisions of this Paragraph 14.03.C be construed to impose any obligations upon Owner to either Contractor or Contractor's surety. In paying any unpaid bills of the Contractor, Owner shall be deemed the agent of Contractor and any payment so made by Owner, shall be considered as payment made under the Contract by Owner to Contractor and Owner shall not be liable to Contractor for any such payment made in good faith.

SC-14.05.A.4

Delete Paragraph 14.05.A.4 in its entirety and replace with the following:

4. Owner at any time may request Contractor in writing to permit Owner to take over operation of any part of the Work although it is not substantially complete. A copy of such request will be sent to Engineer, and within a reasonable time thereafter Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to Owner and Engineer that such part of the Work is not ready for separate operation by Owner, Engineer will finalize the list of items to be completed or corrected and will deliver such lists to Owner and Contractor together with a written recommendation as to the division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties, and guarantees for that part of the Work which will become binding upon Owner and Contractor at the time when Owner takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to Substantial Completion of such part of the Work, Owner shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

SC-14.07.A.2

Delete everything in Paragraph 14.07.A.2 after “. . . Contract Documents”

SC-14.07.B.1.

Delete Subsection 14.07.B.1 in its entirety and insert the following in its place:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and all accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. Thereupon Engineer will give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment. If the Application for Payment and accompanying documentation are

appropriate as to form and substance, Owner shall in accordance with applicable Laws and Regulations, pay Contractor the amount recommended by Engineer.

SC-14.07.C.1.

At the beginning of Paragraph 14.07. C.1 delete the words, "Thirty days" and begin with the word, "Promptly."

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

SC-15.02 thru 15.05

Delete everything in Article 15 after Paragraph 15.01 and replace with the following:

15.02 *Owner's Right to Terminate*

A. When in the Owner's best interest, the Owner may unilaterally terminate this Contract, in whole or in part, at any time, whether or not Contractor is in default of any of its obligations under the Contract, by giving written notice to the Contractor. Upon terminating the Contract, Owner shall not incur any further liability to Contractor, except as provided in this Article 15, which sets forth Contractor's exclusive remedies. The termination notice must specify the effective date, at least seven (7) days prior to the effective date of the termination, and the Contract will terminate as if the date were the date originally given for the expiration of the Contract. If the Contract is terminated, Owner will pay Contractor (without duplication of any items) for completed and acceptable Work, executed in accordance with the Contract Documents prior to the effective date of termination, as soon as can be authorized. Owner will compute the amount of the payment on the basis of the services rendered, and other means which, in the judgment of the Owner, represents a fair value of the services provided, less the amount of any previous payments made. Owner shall have no obligation for and shall not be required to make payments to Contractor directly, or on account of claims by Contractor's Subcontractors, for loss of anticipated profit, unabsorbed overhead, interest on claims, unamortized depreciation costs, and general and administrative burden charges, resulting from the termination of the Contract. The final payment constitutes full payment. If the Contractor accepts the payment, the Contract is satisfied. The parties agree that no payments under this Article 15 will exceed the Contract Price.

B. If the Owner terminates this Contract because the Contractor has failed to comply with any of the material terms and conditions of this Contract, including, but not limited to, defective Work, failure to supply sufficient skilled workers or suitable materials or equipment, failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04, disregard of Laws or Regulations, disregard of the authority of Engineer, or failure to perform the Work in such a way that the completed Work will conform to the Contract Documents, then the Owner may procure, upon such terms and in such manner as the Owner may deem appropriate, services similar to those terminated, and the Contractor shall be liable to the Owner for any costs to obtain and transition similar services. In addition to any legal remedies otherwise available to the Owner by law or equity, the Contractor shall be responsible for all additional claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred by the Owner in connection with the completion of the Contract. Such expenses shall be deducted from any monies due or which may become due the Contractor under the Contract. If such expense exceeds the sum which would have been payable under the Contract, then the Contractor shall pay, on demand, such excess amount to the Owner. Should a deficiency exist, the Owner may offset such a deficiency against the compensation to be paid the

Contractor in any concurrent, successive or future contracts between the parties. All excess reprourement costs and damages shall not be considered by the parties to be consequential, indirect or incidental, and shall not be excluded by any other terms otherwise included in the Contract.

When exercising any rights or remedies under this Paragraph 15.02.B, Owner shall not be required to obtain the lowest price for the Work performed.

C. Contractor acknowledges the right of the Wayne County Commission by a two-thirds vote, under circumstances in which the County's Chief Executive Officer is required by the Michigan Standards of Conduct and Ethics Act, MCLA §15.341 *et seq.* to recuse himself or herself from acting on a contract, to terminate the Contract for (a) an egregious breach of the terms and conditions hereof or (b) a violation of the ethics and anti-kickback provisions of Article 12 of Chapter 120 of the Wayne County Code of Ordinances and to debar the Contractor from any further work for or sales to the County for up to three (3) years, pursuant to the terms of Article 6 of the Wayne County Code of Ordinances.

D. Where Contractor's services have been terminated by Owner under Paragraph 15.02, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

15.03 *Contractor's Obligations to Owner upon Receipt of Termination Notice.*

A. After receipt of a notice of termination and irrespective of whether Contractor disputes the Owner's right to terminate this Contract pursuant to said notice, and except as otherwise directed by the Owner, the Contractor must:

1. Stop Work under the Contract on the date and to the extent specified in the notice of termination;
2. Make no further commitments with respect to the Contract or Contract funds, including payroll costs beyond the date the Owner specifies, except as may be necessary for completion of such portion of the Work under this Contract that is not terminated;
3. Immediately take all action as may be necessary or as the Owner may reasonably direct to assure the protection of the property in the Contractor's possession and in which the Owner has or may acquire any interest, the cost of which action shall be paid by the Owner, unless the termination is the result of Contractor's default hereunder;
4. As of the date the termination is effective, present all Contract records and deliver to the Owner the records, data, notes, reports, discs, and documents (hereinafter "Records") as the Owner specifies, all pertinent keys to files, and carry out such directives as the Owner may issue concerning the safeguarding or disposition of files and property;
5. Submit within 30 days a final report of receipts and expenditures of funds relating to this Contract.
6. Place no further orders on subcontracts for materials, services, or facilities, except as may be necessary for completion of such portion of the Work under this Contract as is not terminated;
7. Terminate all orders and subcontracts to the extent that they relate to the portion of Work so terminated;

8. Submit within 30 days a listing of all creditors, Subcontractors, lessors, and other parties with which the Contractor has incurred financial obligations pursuant to the Contract.

15.04 *Records upon Termination*

A. Upon termination of this Contract, all Records prepared by the Contractor under this Contract or in anticipation of this Contract must, at the option of the Owner, become its exclusive property, whether or not in the possession of the Contractor. The Records are free from any claim or retention of rights on the part of the Contractor except as specifically provided.

B. Any intentional failure or delay by the Contractor to deliver the Records to the Owner will cause irreparable injury to the Owner not adequately compensable in damages and for which the Owner has no adequate remedy at law. The Contractor will pay the Owner \$500.00 per day as damages, and not as a penalty, until it delivers the Records to the Owner. The Owner may seek and obtain injunctive relief in a court of competent jurisdiction and compel delivery of the Records which the Contractor consents to as well as all applicable damages and costs. The Owner has unrestricted use of the Records for the purpose of completing the Work.

C. Access to the Records prior to delivery must be restricted to authorized representatives of the Owner and the Contractor. The Contractor has no right to disclose or use any information gathered in the course of its Work without obtaining the written concurrence of the Owner. All the information must be confidential and handled in such a manner at all times as to preserve confidentiality. The Records as well as any related products and materials are proprietary to the Owner, having been developed for the Owner for its own and sole use.

15.05 *Cooperation in Orderly Termination*

A. Each party will assist the other party in the orderly termination of this Contract and the transfer of all assets or property, tangible or intangible, as may be necessary for the orderly, non-disrupted business continuance of each party.

ARTICLE 16 - DISPUTE RESOLUTION

SC-16.01.A.

Add a new sentence at the end of paragraph 16.01.A, which is to read as follows:

Disputes between the Owner and Contractor shall be mediated only if and to the extent agreed to by the parties at the time each dispute rises. Contractor shall carry on the Work and maintain the progress schedule during the dispute resolution proceedings, unless otherwise agreed by Contractor and Owner in writing.

ARTICLE 17 - MISCELLANEOUS

SC-17.01.B thru F

Add Paragraphs 17.01.B thru F to read as follows:

B. All written notices must be delivered to the Owner as follows:

C. All written notices must be delivered to the Contractor as follows:

D. All Notices are deemed given on the day of mailing. Either party to this Contract may change its address for the receipt of written notices at any time by giving written notice to the other as provided, with the exception that Contractor's office at or near the Site of the Work, is hereby designated and shall remain a place of delivery for written notices to Contractor. Any notice given by a party must be signed by an authorized representative of such party.

E. Termination notices and change of address notices are an exception and must be sent by registered or certified mail, postage prepaid, return receipt requested

F. The provisions of this Paragraph survive termination of the Contract.

SC-17.05

Delete Paragraph 17.05 in its entirety and replace with the following:

17.05 Jurisdiction and Law

A. This Contract, and all actions arising from it, must be governed by, subject to, and construed according to the law of the State of Michigan. The Contractor consents to the personal jurisdiction of any competent court in Wayne County, Michigan, for any action arising out of this Contract. The Contractor will not commence any action against the Owner because of any matter arising out of or relating to the validity, construction, interpretation and enforcement of this Contract, in any courts other than those in the County of Wayne, State of Michigan unless original jurisdiction is in the United States District Court for the Eastern District of Michigan, Southern Division, the Michigan Supreme Court or the Michigan Court of Appeals.

SC-17.07 thru 17.14

Add Paragraphs 17.07 thru 17.14, which are to read as follows:

17.07 Ethics in Public Contracting

A. The Contractor must comply with Article 12 of Chapter 120 of the Wayne County Code of Ordinances governing "Ethics in Public Contracting."

B. Contractor's material misrepresentation or delinquency in the disclosures required by Section 120-225 of the Wayne County Code of Ordinances constitutes a material breach of this Contract, sufficient to warrant immediate termination and the imposition of liquidated damages (not a penalty) of fifteen percent (15%) of the compensation made or due under the Contract as of the date of termination.

C. If the Owner determines that the Contractor has made a material misrepresentation or is willfully delinquent or knowingly evasive in the disclosures required by Section 120-225, the Contractor and any other business which has substantially the same principal beneficiaries (as defined in Section 120-238 of the Wayne County Code of Ordinances), may be debarred by the Wayne County Purchasing Director, pursuant to Article 6 of Chapter 120 of the Wayne County Code of Ordinances, from competing for any further County contracts for up to three (3) years.

D. If the Contract Price is in excess of \$20,000, or the terms thereof require the approval of the Wayne

County Commission, and the Contractor knowingly collaborates in or induces a violation of any of the ethical standards that are set forth in Sections 120-223, 120-224, 120-225, 120-228, 120-229, 120-230, 120-231 or 120-233 of the Wayne County Code of Ordinances, the Owner has the right to impose any one or more of the following sanctions:

1. Immediately terminate the Contract and require the Contractor to pay the Owner liquidated damages, and not a penalty of 15% of the total Contract compensation;
2. Debar or suspend the Contractor from consideration from competing for further Wayne County contracts; or
3. Recover the value transferred or received in breach of the ethical standards by a Wayne County employee or other person.

17.08 *Anti-Discrimination Practices*

A. The Contractor must comply with:

1. Titles VI and VII of the Civil Rights Act (42 U.S.C. §§ 2000d et. seq.) and the United States Department of Justice Regulations (28 C.F.R. Part 42) issued pursuant to those Titles.
2. The Age Discrimination Act of 1985 (42 U.S.C. §6101-07).
3. Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. §794).
4. The Americans with Disabilities Act of 1990 (42 U.S.C. §12101 et. seq.) and its associated regulations.
5. The Michigan Civil Rights Act (P.A. 1976 No. 453) and the Persons With Disabilities Civil Rights Act (P.A. 1976 No. 220).
6. Article 11 of Chapter 120 of the Wayne County code governing "Equal Contracting Opportunity."

B. The Contractor must not:

1. Refuse to recruit, hire, employ, promote or to bar or discharge from employment an individual, or discriminate against an individual in compensation, terms, conditions or privileges of employment because of race, color, creed, national origin, age, marital status, handicap, sex, religion, familial status, height or weight.
2. Limit, segregate, or classify an employee or applicant for employment in a way which deprives or tends to deprive any individual of employment opportunities or otherwise adversely affects the employment status of an employee because of race, color, creed, national origin, age, marital status, handicap, sex, religion, familial status, height or weight.
3. Print or publish or cause to be printed or published a notice, application, or advertisement

relating to employment by the Consultant indicating a preference, limitation, specification, or discrimination based upon race, color, creed, national origin, age, marital status, handicap, religion, familial status, height or weight.

4. Except as permitted by rules and regulations promulgated pursuant to Article 11 of Chapter 120 of the Wayne County Code of Ordinances, or applicable state or federal law:
 - (a) make or use a written or oral inquiry or form of application that elicits or attempts to solicit information concerning the race, color, creed, national origin, age, marital status, handicap, sex, religion, familial status, height or weight, of prospective employees. Consultant also shall not make or keep a record of that information or disclose such information.
 - (b) make or use a written or oral inquiry or form of application that expresses a preference, limitation or specification based on religion, race, color, creed, national origin, age, height, weight, marital status, handicap, or sex.

C. The Contractor and its Subcontractors must not discriminate against any employee or applicant for employment, training, education, or apprenticeship connected directly or indirectly with the performance of this Contract, with respect to hire, promotion, job assignment, tenure, terms, conditions or privileges of employment because of religion, race, color, national origin, age, sex, height, weight, familial status, marital status, creed or handicap. This subsection does not apply if it is determined by Wayne County's Division of Human Relations that the requirements are bona fide occupational qualifications reasonably necessary to perform the duties required for employment. The burden of proof that the occupational qualifications are bona fide is upon the Contractor.

D. Breach of any of the covenants in this Paragraph may be regarded as a material breach of this Contract.

E. The Contractor must notify any Subcontractor of the obligations relative to non-discrimination under this Contract when soliciting the Subcontractor. The Contractor will include the provisions of this Paragraph in any subcontract, as well as provide the Owner with a copy of any subcontract agreement.

F. If the Contractor does not comply with the anti-discrimination provisions of this Contract, the Owner may impose sanctions, as it determines to be appropriate, including but not limited to:

1. the withholding of payments to the Contractor under this Contract until the Contractor attains compliance;
2. cancellation, termination or suspension of this Contract, in whole or in part; and/or;
3. the imposition of liquidated damages (not a penalty) in the amount of \$500.00 per day, for each day that the Contractor shall fail to comply with said requirements, as determined by Wayne County's Purchasing Director, in consultation with the County's Director of Human Relations and Corporation Counsel.

G. If the Contract is funded, in whole or in part, by federal funds:

1. Contractor's breach of the affirmative action commitments set forth in this Paragraph constitutes a material breach of the Contract sufficient to warrant termination and the imposition of liquidated damages as set forth above, based upon the decision of the

County's Director of Human Relations;

2. Contractor must provide immediate notice to the County's Chief Executive Officer, the Director of Human Relations, and the Wayne County Commission when a Subcontractor who was part of the Contractor's affirmative action commitment is terminated or substantially displaced by a Subcontractor who does not qualify as a disadvantaged business enterprise, as that term is defined in Section 120-192 of the Wayne County Code of Ordinances; and
3. Contractor must establish and implement a good faith plan and goal to eliminate the continuing effects of past discrimination, which is determined by the County's Division of Human Relations to be appropriate for that purpose, provided the County has been authorized by the funding source to require such an affirmative action commitment from the Contractor.

H. In the event that this Contract is or becomes subject to federal or state Laws or Regulations which conflicts with the requirements of Section 120-192 of the Wayne County Code of Ordinances, the provisions of the federal or state Laws or Regulations shall apply and the Contract shall be interpreted and enforced accordingly.

17.09 Records – Access

A. The Contractor must maintain complete books, ledgers, journals, accounts, correspondence, or documents (hereinafter "Records"), including electronically stored information, in which it keeps all entries reflecting its operation pursuant to this Contract. The Contractor must keep the records according to generally accepted accounting practices and for a minimum of three (3) years from the date of final payment under the Contract.

B. The Owner (including the Wayne County Legislative Auditor General) has the right to examine and audit all Records as it deems necessary of the Contractor, or any Subcontractors, Suppliers, or agents performing, furnishing materials or equipment, or rendering services for any part of the Work under this Contract, whether direct or indirect, which will permit adequate evaluation of the services or Work or the cost or pricing data submitted by the Contractor. The Contractor must include a similar covenant allowing for audit by the Owner in any contract it has with a Subcontractor, Supplier, or agent whose services or Work will be charged directly or indirectly to the Owner. The Owner may delay payment to the Contractor pending the results of any such audit without penalty or interest.

C. If a discrepancy should arise as to the amount of compensation due the Contractor, as a result of any audit conducted by or for a county, state of Michigan, or federal agency relating to the Contractor's performance under this Contract, the Owner may retain the amount of compensation in question from any funds allocated to the Contractor but not yet disbursed under the Contract. Should a deficiency still exist, the Owner may offset such a deficiency against the compensation to be paid the Contractor in any successive or future contracts between the parties.

D. The provisions of this Paragraph survive termination of the Contract.

17.10 Prompt Payment

A. Should the Contractor subcontract a part of its Work under this Contract, to a business which has been certified by the Wayne County Division of Human Relations as a small or disadvantaged business

enterprise, as those terms are defined in Section 120-251 of the Wayne County Code of Ordinances, the Contractor shall provide in each such subcontract third-party beneficiary provisions which establish for that business prompt payment protection from the Contractor such as that afforded to the Contractor pursuant to Section 120-46 of the Wayne County Code of Ordinances. The Owner has and assumes no liability or responsibility to the third-party beneficiary for payments to the third-party beneficiary.

17.11 Relationship of Owner to Engineer

A. Nothing in these General Conditions, as amended by the Supplementary Conditions, shall be used by Engineer against Owner to construe the relationship between Engineer and Owner. Engineer has no third-party beneficiary rights in these General Conditions, as amended, against Owner and may not seek to enforce any of the provisions of these General Conditions, as amended, against Owner. The relationship between Owner and Engineer shall be governed by a separate agreement between Owner and Engineer.

17.12 Liquidated Damages

A. The Owner and the Contractor hereby agree to the requirements set forth in this Contract. It is agreed between the Owner and Contractor that the actual damages to the Owner as a result of Contractor's failure to perform as required under this Contract would be difficult or impossible to determine with accuracy. The Owner and the Contractor therefore agree that liquidated damages as set forth below shall be a reasonable approximation of the damages that will be suffered by the Owner as a result of Contractor's failure to perform as required. Accordingly, if Contractor fails to perform its obligations under this Contract, except its obligations under Paragraph 6.20, Indemnification, at the written direction of the Owner, the Contractor shall pay the Owner the indicated amount as liquidated damages, and not as a penalty. The Owner retains all available legal and equitable remedies to enforce Paragraph 6.20. Amounts due the Owner as liquidated damages, if not paid by the Contractor within 15 days of notification of assessment, may be deducted by the Owner from any money payable to the Contractor pursuant to this Contract. The Owner will notify the Contractor in writing of any Claim for liquidated damages pursuant to this Paragraph on or before the date the Owner deducts such sums from money payable to the Contractor. No delay by the Owner in assessing or collecting liquidated damages shall be construed as a waiver of such rights.

B. In accordance with this Paragraph, Contractor agrees to forfeit and pay Owner as liquidated damages for delay (but not as a penalty), the amount of \$500.00 for each calendar day that expires after the time specified in the Contract Documents for Substantial Completion until the Work is substantially complete; and \$500.00 for each calendar day that expires after the time specified in the Contract Documents for completion of the Work so that it is ready for final payment, as evidenced by Engineer's written recommendation of final payment, until the Work is completed. These amounts represent a reasonable estimate of Owner's expenses for extended delays (but not as a penalty), and for inspection, engineering services, and administrative costs associated with such delay.

C. The Contractor shall not be liable for liquidated damages when, in the sole opinion of the Owner, incidents or delays result directly from Excusable Delays.

17.13 Confidential Information

A. If the Owner discloses confidential information to the Contractor's employees pertaining to the Owner's past, present and future activities, the Contractor must instruct its employees to regard all information gained by each person as a result of the services or Work to be performed as information which is confidential and not to be disclosed to any organization or individual without the prior written consent of

the Owner.

B. The Contractor agrees to take appropriate action with respect to its employees to insure that the obligations of nonuse and non-disclosure of confidential information concerning this Contract can be fully satisfied.

C. The provisions of this Paragraph survive termination of the Contract.

17.14 *Assignment*

A. Contractor will not assign or in any manner transfer this Contract, or any part or parts hereof, or interest herein, or subcontract for any Work, services, equipment or operations without the prior, written consent of the Owner. Any unauthorized assignment or transfer will be considered a breach of this Contract and result in the cancellation of the Contract at the Owner's discretion. If the Contract is not canceled, the assignment shall be deemed null and void. Consent by the Owner to one or more assignments of this Contract will not operate to extinguish the Owner's rights under this Paragraph 17.14. The sale of fifty percent (50%) or more of the capital stock of the Contractor (if the Contractor is a corporation having less than 10 shareholders) will constitute an assignment of this Contract within the meaning of this Paragraph.

END OF SECTION

SECTION 00915

LABOR HARMONY

Contractor shall not employ personnel, means, materials or equipment that may cause strikes, work stoppages or any disturbances by workers employed by Contractor or its Subcontractors on or in connection with the Work or the Project or the location thereof. Contractor agrees that all disputes as to jurisdiction of trades shall be adjusted in accordance with any plan for the settlement of jurisdictional disputes which may be in effect either nationally or in the locality in which the Work is being done and that it shall be bound and abide by all such adjustments and settlements of jurisdictional disputes, provided that the provision of this Subsection shall not be in violation of or in conflict with any provisions of law applicable to the settlement of such disputes. If possible, Contractor shall enter into a project labor agreement with the Greater Detroit Building and Construction Trades Council, AFL-CIO, and its affiliated unions for performance of the Work. Should the Contractor fail to carry out or comply with any of the foregoing provisions, the County shall have the right, in addition to any other rights and remedies provided by this Contract or other Contract Documents or by law, after three (3) days written notice mailed or delivered to the last known address of Contractor, to terminate this Contract or any part thereof or the employment of the Contractor for all or any portion of the Work, and, for the purposes completing the Work, to enter upon the Premises and take possession, in the same manner, to the same extent and upon the same terms and conditions as set forth in the termination provision of this Contract.

Contractors are strongly encouraged to post any job opportunities created in connection with this project in the Michigan Talent Bank at www.michworks.org/mtb.

END OF SECTION

SECTION 01005

ADMINISTRATIVE PROVISIONS

PART 1 GENERAL

1.1 SUMMARY OF WORK

The County of Wayne is requesting bids for Electrical Equipment Testing and Maintenance (480 volt and above) including substations, switchgear, motor control centers, variable frequency drives, transformers, and other electrical gear. Testing and Maintenance includes energized and de-energized testing (IFR thermography, ultrasonic, voltage and current harmonics, ground resistance, insulation resistance, and other tests).

1.2 RELATED REQUIREMENTS

- A. Section 00700 - General Conditions.
- B. Section 00800 - General Supplementary Conditions.
- C. Section 01310 - Progress Schedules.
- D. Section 01700 - Contract Closeout.

1.3 WORK SEQUENCE

- A. The Contractor shall arrange his work so that at no time will it cause unnecessary interruption to the operation of existing facilities. To this end, the Contractor shall prepare and submit to the Engineer for approval a complete detailed working schedule setting forth the sequencing of operations he proposes to follow.

1.4 ALTERNATIVES

- A. Contract Drawings indicate the extent and general arrangement of the work. If any departures from the Contract Drawings are deemed necessary by the Contractor to accommodate the material and equipment he proposes to furnish, details of such departures and reasons thereof shall be submitted as soon as practicable to the Engineer for approval.
- B. The Contractor shall refer to Section 01300, Submittals, for complete requirements regarding Alternates, Substitutions.

1.5 COORDINATION

- A. Contract Documents:
 - 1. It is not the intent nor shall it be so construed that work included in any one Section of the Specifications must be performed by a particular trade or by subcontract. The work to be performed by a particular trade is not necessarily restricted to that of any one Section.

2. Any item mentioned under any heading must be supplied even though it is not called for again under the heading for the respective work.

B. Existing Facilities:

1. All existing facilities and operations shall be uninterrupted by the Contractor's performances unless otherwise allowed in the Contract Documents.
2. All proposed interruptions or tie-ins to existing facilities or utilities or other activities affecting the operations shall be scheduled.
3. The Engineer shall approve the scheduling of all such activities.

1.6 CLEANLINESS OF THE WORK AND STREETS

- A. The work itself, and all property, shall be kept in a neat orderly condition at all times. Excess excavation, waste and rejected materials, rubbish, and debris shall not be allowed to accumulate. The newly constructed work shall be cleared of all temporary construction of facilities when such are entirely free of all debris and the premises left in a condition that will not be susceptible to soil erosion and that will not create a situation problem.

1.7 REGULATORY REQUIREMENTS

- A. The Contractor shall apply for inspection of the work to any and all local, state, public and/or private utilities or national authorities having jurisdiction and deliver to the Engineer all required certificates of approval of such authorities.
- B. All costs including fees, inspection charges, temporary improvements, and the restoration of existing improvements (e.g. sidewalks, pavements, soil erosion and sedimentation control, landscaping, etc.) to the satisfaction of the authority having jurisdiction in each case shall be included in the Contract Price.

1.8 ALTERATIONS OF EXISTING SERVICES

- A. The cutting, reconstructing, or relocating of any existing services connections necessitated to permit construction of the work under this Contract shall be performed by the contractor, and the cost of all work and material including inspection and permits shall be included in the Contract bid price.
- B. If the Contractor finds it necessary to shut down any existing services, he shall contact the Owner and they will then negotiate the best time for shut down mains. A minimum of three (3) days notice must be given.
- C. The Contractor shall receive no extra payment on account of the times when such shut offs and alterations have to be made or on account of delays incurred in conjunction with such alterations.

1.9 FIRE PROTECTION

- A. The Contractor shall take all necessary precautions to prevent fires and shall provide adequate equipment for extinguishing fires. No burning of trash or debris will be permitted.

- B. When fire or explosion hazards are created in the vicinity of the work as a result of the locations of fuel tanks or similar hazardous utilities or devices, the Contractor shall immediately alert the local Fire Marshal, the Engineer, and the Owner. The Contractor shall exercise all safety precautions and shall comply with all instructions issued by the Fire Marshal and shall cooperate with the Owner of the tank or device to prevent the occurrence of fire or explosion.

1.10 ABBREVIATIONS

- A. The following listed letters or abbreviations wherever they appear in the Contract shall mean and be interpreted as indicated below:

A.A.S.H.O.	- American Association of State Highway Officials
A.C.I.	- American Concrete Institute
A.G.M.A.	- American Gear Manufacturers Association
A.H.D.G.A.	- American Hot Dip Galvanizers Association
A.I.A.	- American Institute of Architects
A.I.S.C.	- American Institute of Steel Construction
A.I.S.I.	- American Iron and Steel Institute
A.M.C.A.	- Air Moving and Conditioning Association
A.N.S.I.	- American National Standards Institute
A.S.C.E.	- American Society of Civil Engineers
A.S.H.R.A.E.	- American Society of Heating, Refrigeration and Air Conditioning Engineers.
A.S.M.E.	- American Society of Mechanical Engineers
A.S.T.M.	- American Society for Testing and Materials
A.W.G.	- American Wire Gauge
A.W.S.	- American Welding Society
A.W.W.A.	- American Water Works Association
D.P.W.	- Department of Public Works - City of Detroit
D.W.S.D.	- Detroit Water & Sewerage Department
Fed. Spec.	- Federal Specification, Federal (of F.S.) Supply Service, General Services Administration, U.S. Government
I.E.E.E.	- Institute of Electrical and Electronics Engineers
I.P.C.E.A.	- Insulated Power Cable Engineers Association
M.D.O.T.	- Michigan Department of Transportation (Formerly M.D.S.H. & T)
M.I.O.S.H.A.	- Michigan Occupational Safety & Health Act
N.B.S.	- National Bureau of Standards
N.C.P.I.	- National Clay Pipe Institute
N.E.C.	- National Electrical Code
N.E.M.A.	- National Electrical Manufacturers Association
N.F.P.A.	- National Fire Protection Association
O.S.H.A.	- Occupational Safety & Health Administration
S.D.I.	- Steel Deck Institute
S.J.I.	- Steel Joist Institute
S.S.P.C.	- Steel Structures Painting Council
U.L.	- Underwriters Laboratories

1.11 REFERENCES

- A. Specifications by Reference:
 - 1. Where reference is made in the specifications to specifications or standards of any technical society, association, governmental agency, etc., it is understood and agreed that such specifications or standards are as much a part of the specifications as though fully repeated therein.
- B. Materials by Reference:
 - 1. A material included in more than one section of the specifications will be specified in detail in only one of the Sections.
 - 2. In other sections, the material is specified by reference to the section containing the specifications for the same material, and such specifications shall be considered as much a part of the other sections as if they were therein repeated in full.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01020

ALLOWANCES & MEASUREMENT & PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS

- A. This section details bid items and allowances identified in the Bid Form.
- B. A mark-up of 5%, 15%, or 20% may be made, depending upon the nature of the allowance as identified below.
- C. The Contractor shall be responsible for all coordination with the Agency involved and for the timely completion of the Work to fit his schedule. The Contractor shall not be allowed any additional compensation for the failure of the Agency involved to meet any schedule.

1.02 RELATED REQUIREMENTS

The requirements of the General Conditions and all Division 1 sections shall also apply to this work.

1.03 MEASUREMENT AND PAYMENT

This Section describes the method of measurement and basis of payment for all work included in the Contract and specified in the Bid Form. The Contractor shall provide all labor, material, tools, equipment and services required to complete the Work specified herein and indicated on the Plans.

The Owner will make no allowances for items not included in the proposal.

A. General Conditions

Administration will include bonds and insurance, daily supervision, project coordination, construction meetings, project scheduling, pay applications, requests for information, project closeout, other routine construction administration tasks, and any other work not identified in the items below. This amount will be paid on a monthly basis with each pay application on a prorated basis relative to the construction schedule.

B. Energized Testing and Inspection

This Work includes the work identified in Section 16210 3.8 A, and all other calibration, testing and reporting work identified therein and other appropriate Specification Sections.

C. De-Energized Testing and Inspection

This Work includes the work identified in Section 16210 3.8 B, and all other calibration, testing and reporting work identified therein and other appropriate Specification Sections.

D. Maintenance Service

This Work includes the work identified in Section 16210 3.8 C, and all other calibration, testing and reporting work identified therein and other appropriate Specification Sections.

E. Electrical Power Distribution System Analysis

This Work includes the work identified in Section 16210 3.8 D, and all other calibration, testing and reporting work identified therein and other appropriate Specification Sections.

F. Operational Tests

This Work includes the work identified in Section 16210 3.9, and all other calibration, testing and reporting work identified therein and other appropriate Specification Sections.

G. Electrical Equipment Replacement

The Electrical Equipment Replacement items will be used when the Testing and Maintenance work identifies deficiencies that need correction. The Contractor will be directed to perform any of these items via Allowance Authorization, or Work Order. The quantities identified on the Price Sheet are estimates.

Unit prices for electrical equipment replacement shall include all costs of each item including, but not limited to, labor and materials required to remove the existing component or equipment, salvage per the Owner's directions or dispose of it properly, provide and install the replacement components, test and start-up the replacement, and provide O&M documentation, including all associated expenses, supervision, taxes, insurance, overhead and profit.

Replacement parts shall be the original manufacturer's recommended parts and complete equipment replacements shall be as specified hereinafter or exact replacements for those presently installed.

H. Contingency Allowance

In the event that unforeseen conditions should be encountered on the Project, this allowance item shall be used to remedy the situation. The Contractor shall comply with all provisions of the Contract Documents when encountering and contending with an unforeseen site condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 INSPECTIONS, TESTS & MAINTENANCE

All work identified in Subsection 1.03 A through F above will be performed as scheduled by the Contractor. Those tasks will identify deficiencies and will recommend repairs to or replacement of equipment and/or components. The recommendations will be received by the Owner and, where acceptable, these deficiencies will be corrected under 1.03 G.

3.02 ELECTRICAL EQUIPMENT REPLACEMENT

The Owner will identify which equipment will be replaced from the reports submitted in Section 16210. The cost for the replacement will be based on the unit prices in the Bid Form. The schedule to implement that work will be established at that time.

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coordination of Work.
- B. Pre-Bid Meeting.
- C. Pre-Award Meeting. Pre-construction Meeting.
- E. Progress Meetings.
- F. Pre-installation Meetings.
- G. Pre-Start-up/Demonstration Meetings.

1.02 RELATED SECTIONS

- A. Section 00700 - General Conditions.
- B. Section 00800 - General Supplementary Conditions.
- C. Section 01005 - Administration Provisions.
- D. Section 01300 - Submittals.
- E. Section 01310 - Progress Schedules

1.03 COORDINATION

- A. Prior to mobilization, the Contractor shall coordinate all aspects of the Work and shall submit the Construction Schedule representing this coordination.
- B. Coordinate utility hook-ups for trailers with local utilities.
- C. Coordinate Building Permit requirements, Inspections, Temporary or Final Occupancy permits and any other Related Work with the Local Building Department or appropriate agency.
- D. Coordinate scheduling, submittals and review, equipment/material procurement, storage and delivery, installation, calibration, testing and start-up/demonstration of the various specification sections and Trades to assure efficient and orderly sequence of the Work.
- E. Verify that utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- F. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion and for portions of Work designated for Owner's occupancy.

- G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.04 PRE-BID MEETING

- A. Engineer will schedule a meeting as noted in the Instructions to Bidders.
- B. Attendance Required: Owner, Engineer.
- C. Attendance Requested: Regulatory Agencies, Utility Representatives, major suppliers, or proper department or agency, and all prospective Bidders.
- D. Agenda:
 - 1. Introduction.
 - 2. Summary of Work.
 - 3. Permits Required.
 - 4. Special Project Requirements.
 - 5. Owner Requirements (including MBE Goals, Owner provided Insurance and Drug Tests.)
 - 6. Regulatory Requirements.
 - 7. Review of Contract Documents.
 - 8. Critical work sequencing.
 - 9. Use of premises by Owner and Contractors.
 - 10. Construction facilities, equipment, controls or assistance provided by the Owner.
 - 11. Temporary utilities provided by Contractor and by Owner.
 - 12. Security and housekeeping procedures.
 - 13. Responsibility for testing.
 - 14. Questions and Answers.
- E. The Engineer will prepare minutes and distribute copies within one week after meeting to participants and plan holders.

1.05 PRE-AWARD MEETING

- A. Engineer may schedule a meeting prior to issuing Notice of Award.
- B. Attendance Required: Owner, Engineer, and Contractor.
- C. Agenda:
 - 1. Review of Owner-Contractor Agreement.
 - 2. Review of Submission of bonds and insurance certificates.
 - 3. Regulatory requirements affecting the project.
 - 4. Review of Federal, State and Local contract requirements.
 - 5. Review of list of Subcontractors, list of Products, and schedule of values.

6. Designation of personnel representing the parties in Contract, and the Engineer.
7. Critical work sequencing.
8. Use of premises by Owner and Contractor.
9. Construction facilities and controls provided by Owner.
10. Mobilization.
11. Project Coordination.

- D. The Engineer will prepare meeting minutes and distribute copies within one week after meeting to participants, and those affected by decisions made.

1.06 PRECONSTRUCTION MEETING

- A. Engineer will schedule a meeting within 2 weeks of issuing the Notice to Proceed.

- B. Attendance Required: Owner, Engineer, major Subcontractors and Contractor.

- C. Agenda:

1. Review of Execution of Owner-Contractor Agreement.
2. Review of Regulatory requirements affecting the project.
3. Distribution of Control Documents.
4. Submission of progress construction schedule.
5. Designation of personnel representing the parties in Contract, and the Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Critical work sequencing.
8. Use of premises by Owner and Contractor
9. Construction facilities and controls provided by Owner.
10. Mobilization
11. Project Coordination
12. Temporary utilities provided by Contractor and Owner.
13. Survey and layout.
14. Security and housekeeping procedures.
15. Procedures for testing.
16. Procedures for maintaining record documents.

- D. The Engineer shall prepare meeting minutes and distribute copies to participants and those affected by decisions made.

1.07 PROGRESS MEETINGS

- A. The Engineer will schedule and administer meetings throughout progress of the Work at maximum monthly intervals.

- B. Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

- C. Attendance Required: Job superintendent, major Subcontractors and Suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:

1. Overall Project Status.
2. Construction Schedule (including any changes to Substantial and/or Final Completion dates.)
3. Work Progress.
4. Planned Work
5. Submittals (Schedule and status)
6. Critical Path items.
7. Deliveries
8. Field observations and problems.

1.08 PRE-INSTALLATION MEETING

- A. When required in individual specification sections, convene a pre-installation meeting at work site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Engineer four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Engineer, Owner, participants, and those affected by decisions made.

1.09 PRE-START-UP/DEMONSTRATION MEETINGS

- A. When required, convene a Pre-Start-up/Demonstration Meeting at the work site prior to Equipment Demonstration.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY OF WORK

- A. Submittals for the Work include the following:
1. Contractual Requirements
 2. Construction Schedule
 3. Schedule of Values
 4. Shop Drawing Schedule
 5. Construction Payment Requests
 6. Shop Drawings, Product Data, and Samples including Manufacturer's Certificates and Test Data (when required).
 7. Manufacturer's O & M Manuals
 8. Shut-down Schedule and Work Plans (when required)
 9. Equipment Installation Certification and Field Calibration Reports
 10. Facility Start-up and Commissioning Documents
 11. As-Built Drawings
 12. Close-Out Documents

1.02 RELATED SECTIONS

- A. Section 00700 - General Conditions
- B. Section 01310 - Construction Progress Schedules
- C. Section 01400 - Quality Control
- D. Section 01700 - Contract Closeout
- E. Section 01730 - Operation and Maintenance Data
- F. Section 16210 - Electrical Testing Reports

1.03 SCHEDULE FOR SUBMISSION

- A. Contractual Requirements such as bonds, insurance, etc., shall be submitted per Section 00700.
- B. The Construction Schedule shall be submitted per Sections 00700 and 01310.

- C. The Schedule of Values and Schedule of Submittals, shall be submitted within 20 days of the Notice to Proceed.
- D. Shop Drawings, Product Data and Samples shall be submitted with sufficient time for Engineering review, modification, re-submittal, re-review, etc. until the submittals are approved.
- E. Manufacturer's Certificates and Test Data shall be submitted with the Shop Drawings or when performed but prior to shipping.
- F. Partial Payment Requests shall be submitted in accordance with Section 00700.
- G. Shut-Down Schedule Work Plan shall be submitted 15 days prior to shutdown.
- H. Manufacturer's O&M Manuals shall be submitted prior to equipment shipping.
- I. The Construction Schedule, Schedule of Values, and Schedule of Submittals will be reviewed by the Engineer. If rejected, these submittals must be revised and re-submitted until approval. The Engineer reserves the right to withhold the first Partial Payment Request until approval.
- J. Record drawings and Close-Out Documents shall be submitted per Section 01700.
- K. Schedule submittals to expedite the Project, and deliver to the Engineer in a manner to allow sufficient time for review and processing by the Engineer so as to not cause delays in the Work. Coordinate submission of related items.
- L. The Submittals shall not relieve the Contractor of his obligation to comply with specification requirements for items not listed on the schedule. Nothing herein shall be construed as allowing additional time for completion of the project in the event one or more resubmittals are required.

1.04 NUMBER OF SUBMITTALS

- A. The Contractor shall submit a .pdf file of all shop drawings.
- B. The Contractor shall submit 2 paper copies of all Draft O&M Manuals, and when approved, shall submit 5 copies of the final documents in a binder with tabs, and one final .pdf version on disk.

1.05 SCHEDULE OF VALUES

- A. The Schedule of Values shall include quantities and unit prices from the Bid Form, and lump sum prices for all remaining work by the Engineer. The lump sum items shall be segregated such that no item has a value larger than two (2) percent of the Total Bid Price unless approved by the Engineer.
- B. Each item shall include its proportionate share of the Contractor's general operating charges such as profit, overhead, supervision, insurance, bond premiums, interest, equipment cost,

depreciation and rental, contingencies, expendable tools, equipment and supplies. The total cost of the items and quantities the Contractor lists in the schedule of values shall equal the lump sum Contract Price established in the Bid Form.

- C. Where required, the Schedule of Values shall include a complete set of detailed work sheets on bid take off and bid summary covering estimated general conditions expense (field overhead, general overhead, profit mark ups and revisions leading to the final bid amount.
- D. When the Schedule of Values is approved by the Engineer, it shall become part of the Agreement and shall be used as the basis for Contractor progress payments, and to establish unit prices at which extra work may be authorized or deducted from the original Agreement.

1.06 SHOP DRAWING SCHEDULE

- A. The detailed Schedule of Submittals shall include all shop drawings, Product Data, Samples and O&M Manuals.
- B. The Schedule shall identify the submittal, submittal type, specification section and planned submittal date. All submittals on the Critical Path shall be identified in color or by alternate obvious means. The schedule shall be sorted by both specification section and by date.
- C. The schedule shall be revised monthly and resubmitted at monthly progress meetings.

1.07 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. General
 - 1. The contract drawings and specifications are complete in all aspects of layout, type of equipment and materials. They do not serve as detailed fabrication, materials, or installation drawings, and the preparation of such submittals required or necessary for this purpose shall be the responsibility of the Contractor.
 - 2. Shop Drawings, Product Data, and Samples are required for all equipment, products, materials, fasteners, shims, etc. furnished or installed by the Contractor. Therefore, no extra charge will be allowed on a claim that particular supplemental drawings or instructions differed from the Contract documents, incurring extra work, unless the Contractor has first brought the matter, in writing, to the Engineer's attention for proper adjustment before starting on the work covered by such and has received from the Engineer an order in writing to so proceed.
 - 3. For the purposes of these documents:
 - a. Shop Drawings are fabrication, assembly and/or installation drawings, diagrams, schedules or other documents specifically prepared for the Work by the Contractor, subcontractor, manufacturer, supplier and/or distributor to illustrate some portion of the Work.
 - b. Product Data are illustrations, standard schedules, performance charts, instructions, catalog cuts, brochures, diagrams, materials lists and other

information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

- c. Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.
4. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of these submittals is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.
5. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Engineer. Such Work shall be in accordance with approved submittals.
6. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Engineer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in the Shop Drawings, Product Data, Samples or similar submittals by the Engineer's approval thereof, as the Engineer's review is intended to cover compliance with the Contract Document and not to enter into every detail of the shop work.
7. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those required by the Engineer on previous submittals.
8. When professional certification of performance criteria of materials systems or equipment is required by the Contract Documents, the Engineer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.
9. Substitutions – Whenever a particular brand or make or type of material, equipment, or other item is specified or is indicated on the Contract Drawings, it is for the purpose of establishing a standard of quality, design, and type desired and to supplement the detailed specifications. Any other brand or make or type which in the opinion of the Engineer is equivalent to that specified or indicated may be offered as a substitute, subject to the provisions of Section 01600.

B. Submittal Preparation

1. All drawings, information and documentation shall be prepared in English language and dimensions in American units.

2. Identify all variations from the Contract Documents. If there are none, state that in each submittal. Clearly identify any required field dimensions or existing elevations requests, coordination required to adjoining or related work.
3. Provide room and/or Building layout drawings to scale, identifying concrete pads, equipment placement, panel locations, piping, drains, etc. Identify dimensions to adjacent equipment or work. Identify any manufacturer's recommended space requirement for equipment access or maintenance.
4. Identify all equipment and component dimensions, materials, special service or maintenance access requirements, wiring diagrams, motor data, etc.
5. Provide space for Contractor and Engineer review stamps.
6. All subcontractors and manufacturers' drawings shall first be sent directly to the Contractor, who shall keep a record of the drawing numbers and the dates of receipt. The Contractor shall:
 - a. check thoroughly all such drawings, as regards measurements, sizes of members, materials, and all other details to assure himself that they conform to the intent of the drawings and the specification,
 - b. coordinate submittal with related work supplied by others, including electrical and instrumentation equipment, and
 - c. shall promptly return to the subcontractors and/or manufacturers for correction such drawings as are found inaccurate or otherwise in error.

C. Submittal Procedures

1. Transmit each submittal with Engineer approved transmittal form. Sequentially number the transmittal form. Re-submittals shall have original number and a sequential decimal suffix.
2. Identify Project, Contractor, Subcontractor and supplier; pertinent drawing and detail number, and/or specification section number on each transmittal form.
3. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
4. Maintain a shop drawing log, separate from the Engineer's log.
5. Distribute copies of reviewed submittals to all concerned and related parties. Instruct parties to promptly report any inability to comply with provisions.
6. Revise and resubmit submittals as required and identify all changes made since previous submission.
7. The Engineer reserves the right to refuse to check or review any submittal of a

subcontractor or manufacturer which is not presented in compliance with the foregoing requirements.

8. Electronic Submittals:
 - a. All electronic submittals shall follow the procedures outlined above.
 - b. Electronic submittal procedures are only applicable to Shop Drawings and product data submittals.
 - c. Electronic submittals shall be made in a standard format the Engineer has agreed in advance to accept.
 - d. Reviewed submittals shall be returned in PDF electronic format for the Contractor's printing and distribution.

Shop Drawings

1. Submit shop drawings in the form of one reproducible transparency and one opaque reproduction. Only the reproducible transparency will be returned. Folding of reproducibles should be avoided.
2. Where submittal by reproducible is not possible submit the number of opaque reproductions which Contractor requires, plus four copies which will be retained by Engineer.
3. After review, produce copies and distribute in accordance with the Submittal Procedures article herein and for record documents purposes described in Section 01700 – Contract Closeout.

Product Data

1. Submit the number of copies of Product Data which the Contractor requires, plus four copies which will be retained by the Engineer.
2. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.
3. Product data shall be bound with an index sheet containing a space at least 5" x 8" for approval stamps and notes.
4. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 – Contract Closeout.

Samples

1. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

2. Submit samples of sufficient size and representative of finishes indicating textures, and patterns for Owner selection.
3. Include identification on each sample, with full Project information.
4. Submit the number of samples specified in individual specification sections; two of which will be retained by the Engineer.
5. Reviewed samples which may be used in the work are indicated in individual specification sections.
6. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or contained within such submittals with the requirements of the Work and of the Contract Documents.

D. Submittal Review

1. The Engineer reserves the right to reject outright any submittal which is deemed incomplete or not adequately coordinated with other work elements.
2. The Engineer will review the submittals within a reasonable time after receipt thereof and will return one comment sheet or one copy with any corrections which may be necessary to meet the Contract requirements. The Contractor shall then review such notations and/or instructions and if he concurs therein, shall make or have made such required corrections, and shall resubmit corrected drawings to the Engineer as soon as possible, for final review. Such further review by the Engineer will be limited to the corrections only, and the Contractor, by such re-submission shall be held to have represented that such drawings contain no other alterations, additions or deletions, unless the Contractor (in writing) directs the Engineer's specific attention to same. Should the Contractor question, or dissent from, such notations and/or instructions, he shall so inform the Engineer and request further clarification before resubmitting the drawings.
3. The review of Contractor's, subcontractors', and manufacturers' drawings by the Engineer is for coordination and assistance, and the Engineer does not thereby assume responsibility for errors or omissions. Such errors or omissions must be made good by the Contractor, irrespective of the receipt, review of the drawings by the Engineer, and even though the work is done in accordance with such drawings.

E. Manufacturer Certificates

1. When specified in individual sections, submit manufacturer's certification to the Engineer in quantities specified for Product Data.
2. Indicate material or Product meets or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
3. Certificates may be recent or previous test results on material or Product, but must be acceptable to the Engineer.

1.08 SHUT-DOWN SCHEDULE AND WORK PLANS

- A. The Contractor shall schedule shut-downs a minimum of 5 days in advance. Such shut-downs can include electrical and instrumentation testing and/or installations.
- B. The Contractor shall submit a Shut-Down Work Plan for each interruption. The Work Plan shall include but is not limited to the following:
 1. A description and purpose of the shut-down.
 2. The approximate date and duration of each interruption.
 3. The means and methods to perform the work including identification of equipment to be used.
 4. Identification of provisions to immediately resume flow in the event of an emergency.
 5. Owner requested assistance (such as power disconnection, manual operation and control of normally automated equipment, equipment isolation, etc.

1.09 EQUIPMENT INSTALLATION, CALIBRATION REPORT AND SERVICE REPORT

- A. When specified, the Manufacturer shall submit a certificate to check that the equipment has been properly installed by the Contractor and calibrated or set-up by the field technician.
- B. When a product or equipment must be checked or serviced, a service report shall be submitted identifying what was served or if any parts were replaced.

1.10 CONTRACT CLOSE-OUT DOCUMENTS

- A. Submit Contract Close-out Documents per Section 01700.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

SHUT-DOWN WORK PLAN

1. Identify the purpose of the shutdown:

2. Identify the planned date(s): _____ Back-up Date(s): _____

3. Identify the planned time(s): _____ Back-up time(s): _____

4. List activities and procedures to be performed.

5. Identify personnel required:

	At beginning/ completion of <u>shutdown</u>	Full duration of shutdown
General Foreman	<input type="checkbox"/>	<input type="checkbox"/>
Mfr/Testing Specialist	<input type="checkbox"/>	<input type="checkbox"/>
Mechanical Subcontractor	<input type="checkbox"/>	<input type="checkbox"/>
Electrical Subcontractor	<input type="checkbox"/>	<input type="checkbox"/>
I&C Subcontractor	<input type="checkbox"/>	<input type="checkbox"/>
Owner's:		
Project Manager	<input type="checkbox"/>	<input type="checkbox"/>
Engineer	<input type="checkbox"/>	<input type="checkbox"/>
Operator	<input type="checkbox"/>	<input type="checkbox"/>
Mechanic	<input type="checkbox"/>	<input type="checkbox"/>
Electrician	<input type="checkbox"/>	<input type="checkbox"/>
Instrument Technician	<input type="checkbox"/>	<input type="checkbox"/>

6. List required Owner assistance (such as gate and/or valve operation, pump stoppage, temporary power disconnections, etc.).

7. Identify the need for bypass pumping, temporary power, alarms, monitoring of depth, flow, pressure, etc., during shutdown.

EQUIPMENT CERTIFICATION SUBMITTAL

Note to Contractor: The Equipment supplier must complete this form and submit it as part of the submittal. Complete only ONE of the following certifications.

Equipment Name

Specification Number

NO EXCEPTIONS CERTIFICATION:

I _____ do hereby certify that the referenced equipment shop
Print / Type Name
drawing as submitted complies with all the provisions of the specifications. I understand that it is my responsibility to identify any and all exceptions. Should the equipment supplied and installed be different from that specified, I will correct the deficiencies.

Signature

Date

* * **OR** * *

EXCEPTIONS CERTIFICATION:

I _____ do hereby certify that the shop drawing and equipment
Print / Type Name
provided comply with all the provision of the specifications, except for the following:

I understand that it is my responsibility to identify any and all exceptions. Should the equipment supplied and installed be different from that specified as determined at any point in the future, I will provide the necessary correction free of charge.

Signature

Date

END OF SECTION

SECTION 01310
CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Project Schedule
- B. Seven Day Schedule

1.02 RELATED SECTIONS

- A. Section 00700 - General Conditions
- B. Section 00800 - General Supplementary Conditions
- C. Section 01300 - Submittals: Shop drawings, product data, and samples

1.03 QUALITY ASSURANCE

- A. Any and all float shall not be used exclusively by Contractor but shall be available to both the Owner and Contractor alike.
- B. Any schedule showing completion of the Work prior to the contractual Substantial and/or Final Completion dates, nor the review of such schedule shall signify agreement and acceptance of early completion, nor shall it be a means on which to base delay claims.
- C. The Contractor shall obtain input from all sub contractors when compiling and updating the schedules.
- D. The schedule shall be prepared using Primavera, Microsoft Project or approved software.

1.04 FORMAT

- A. Project Schedule
 - 1. Prepare schedule as a horizontal bar chart with separate bar for each major portion of work or operation, identifying first work day of each week.
 - 2. Sequence of Listings: The chronological order of the start of each item of work.
 - 3. Critical path: Denote Work in red.
 - 4. Scale and Spacing: To provide space for notations and revisions.
 - 5. Sheet Size: 11 x 17 inches
- B. Seven Day Schedule
 - 1. Identify what is to be done on each day of the next week.
 - 2. E-mail schedule on Friday of the prior week.

1.05 PROJECT SCHEDULE CONTENT

- A. Identify Notice to Proceed, Substantial Completion and Final Completion dates.
- B. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- C. Identify the dates and duration when processes or major equipment are taken out of service.
- D. The schedule will include submittal preparation, review, re-submittal, fabrication/assembly, delivery, installation, testing and startup for all major equipment.
- E. Include system or facility start-up,
- F. Identify the Project Float, defined as the time between early completion and final (contractual) completion.
- G. Identify each item by specification section number.
- H. Identify interdependent work elements.
- I. Identify work of separate stages and other logically grouped activities.
- J. Provide sub-schedules to define critical portions of the entire schedule.
- K. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the last day of each month.
- L. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect/Engineer.

1.06 REVISIONS TO SCHEDULES

- A. The project schedule shall be updated monthly.
- B. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
- C. Identify activities modified since previous submittal, including any schedule slippage, revision to Project Float, major changes in scope, and other identifiable changes.
- D. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect, on schedules of separate contractors.

1.07 SUBMITTALS

- A. Submit initial schedules within 30 days after the Notice to Proceed. After review, resubmit required revised data within ten days.
- B. Submit four color copies.

1.08 DISTRIBUTION

- A. Distribute copies of reviewed schedules to Project site file, Subcontractors, suppliers, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance - control of installation.
- B. Tolerances
- C. References.
- D. Mockup.
- E. Inspecting and testing laboratory services.
- F. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

- A. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.
- B. Section 01600 - Material and Equipment: Requirements for material and product quality.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

- A. The Contractor shall monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. The Contractor shall comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, the Contractor shall request clarification from Architect/Engineer before proceeding.
- D. The Contractor shall comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. The Contractor shall perform work by persons qualified to produce workmanship of specified quality.
- F. The Contractor shall secure equipment in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

- A. The Contractor shall monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. The Contractor shall comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. The Contractor shall adjust Products to appropriate dimensions; position before securing Products in place.

1.5 REFERENCES

- A. For Products or workmanship specified by association, trade, or other consensus standards, the Contractor shall comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The Contractor shall conform to reference standard by date of issue current on date specified in the individual specification sections, except where a specific date is established by code.
- C. The Contractor shall obtain copies of standards where required by product specification sections.
- D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect/Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.6 MOCK-UP

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. The Contractor shall assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups are representative of the quality required for the Work.
- D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.

1.7 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable, and to initiate instructions when necessary.

- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- C. Submit report in duplicate within 30 days of observation to Engineer for information.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIAL, PRODUCTS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY OF WORK

- A. This Work includes:
 - 1. Transportation, storage, handling, and installation of all work.
 - 2. Product options and substitutions for materials and equipment supplied and installed.

1.02 RELATED SECTIONS

- A. Section 01300 - Submittals.
- B. Section 01400 - Quality Control

1.03 GENERAL PROVISIONS

- A. Products (including all materials, machinery, equipment, and systems) shall be carefully designed and installed to insure that all required functions are adequately performed within specified degrees of precision, and that each unit shall operate with every other part, furnished or existing, to provide a complete integrated system which shall operate to the satisfaction of the Engineer. Any changes or revisions of existing work made necessary by the type and dimensions of furnished products shall be made at the expense of the Contractor, and he shall furnish detail drawings showing such changes or revisions for the approval of the Engineer.
- B. All materials, equipment, and accessories shall be new and unused and shall be essentially the products of a manufacturer regularly engaged in the production of such material or equipment and shall essentially duplicate material or equipment that has been in satisfactory operation at least 5 years.
- C. The owner reserves the right to reject any material or equipment manufacturer who, although he meets the above requirements, does not provide satisfactory evidence indicating adequate and prompt post-installation repair and maintenance service as required to suit the operational requirements of Owner. Items of any one type of materials or equipment shall be the product of a single manufacturer.

1.04 TRANSPORTATION AND HANDLING

- A. No equipment, materials or other products shall be shipped without approved O&M Manuals, or approved storage, handling and/or maintenance requirements from the manufacturer.
- B. The manufacturer shall crate all parts of equipment carefully to facilitate shipping and handling. Crates shall completely protect the equipment and be sufficiently strong to permit lifting and skidding without additional bracing or reinforcement.
- C. Transport and handle Products and equipment in accordance with manufacturer's instructions. Transport and handle all materials in such a manner to avoid breakage, inclusion of foreign materials, and/or damage by water or other causes.
- D. All shipments shall be identified on the Shipping and Maintenance Log. The Engineer shall be notified of the time of delivery and shall be present.
- E. Deliver packaged materials in original unopened shipping containers. Packages or materials showing evidence of damage or contamination regardless of cause will be rejected. The Contractor shall promptly inspect apparently undamaged shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.
- F. The Contractor shall repair or replace all items damaged or broken as a result of the Contractor's operation at no cost to the Owner.
- G. When specified in individual Sections, equipment shall be made available for conditional acceptance by the Engineer at the factory prior to shipment.
- H. Equipment shall not be delivered unless it can be immediately incorporated into the work or proper storage facilities are available.
- I. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.
- J. Notify the Engineer at least two days in advance of the delivery of equipment.

1.05 STORAGE AND PROTECTION

- A. Store and protect Products in accordance with manufacturers' instructions, with seals and labels intact and legible.
- B. Store sensitive Products in weather tight, climate controlled enclosures.
- C. For exterior storage of fabricated Products, place on sloped supports, above ground.
- D. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

- E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product. Provide temporary heat where required.
- F. Provide power to all motor heaters if stored outdoors or in unheated areas.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store Products and equipment by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.06 PRODUCT OPTIONS

- A. Products specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products specified by naming one or more manufacturers with a provision for "or Equal" or "Approved Equal" Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.
- C. Products specified by naming one or more manufacturers with the provision "No Substitutions": Products of manufacturers named and meeting specifications, no options or substitutions allowed.

1.07 "OR EQUAL" CLAUSE

- A. Specifying an article, material, or piece of equipment by reference to a proprietary product or by using the name of a manufacturer or vendor followed by the clause "or equal" shall be understood to indicate the type, function, minimum standard of design, efficiency, and quality required and shall not be construed in such a manner as to exclude products of comparable quality, design, and efficiency.
- B. Comparable products shall be capable of performing equal function and shall be compatible with other equipment, materials, or systems to which they connect or will become an integral part of.
- C. The clause "or approved equal" which may appear elsewhere in the documents shall mean the same as "or equal".
- D. Wherever a material, product, or equipment is defined by specifying a proprietary product or manufacturer, the term "or equal" if not included, shall be implied.
- E. Substitutions of "or equal" products are subject to the approval of the Engineer.

1.08 SUBSTITUTIONS

- A. Engineer will consider requests for Substitutions after the date established in Notice to Proceed.
- B. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- C. A request constitutes a representation that the Contractor:
 - 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the Substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
- D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- E. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Contractor shall submit for each proposed substitution sufficient details, complete descriptive literature and performance data together with samples of the materials where feasible to enable the Engineer to determine if the proposed substitution is equal to that specified.
 - 3. Contractor shall submit certified tests where applicable by an independent laboratory, acceptable to the Owner, attesting that the proposed substitution is equal.
 - 4. A list of installations where the proposed substitution is used.
 - 5. Requests for substitutions shall include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the Owner.
 - 6. Where the approval of a substitution requires revision or redesign of any part of the work, all such revision and redesign and all new drawings and details required, therefore, shall be provided by the Contractor at his own cost and expense and shall be subject to the approval of the Engineer.
 - 7. In all cases, the Engineer shall be sole judge as to whether a proposed substitution is to be approved. The Contractor shall abide by the Engineer's decision when proposed

substitute items are judged to be unacceptable and shall in such instances furnish the item specified or indicated. No substitute items shall be used in the work without approval of the Engineer.

1.09 INSTALLATION OF EQUIPMENT

A. General

1. Contractor shall have on hand sufficient personnel, proper equipment, and machinery of ample capacity to facilitate the work.
2. Contractor shall be responsible for rigging, locating, aligning, and leveling all equipment.
3. Complete manufacturer's installation instructions including permissible tolerances shall be furnished with each unit of equipment.
4. All equipment shall be installed in accordance with the approved manufacturer's specifications, drawings, and tolerances under the direct supervision of the required manufacturer's engineer.
5. Equipment shall be erected in a neat and workman-like manner on the foundations at the locations and elevations shown on the drawings unless directed otherwise by the Engineer during installation.

B. Installation

1. Special care shall be used in locating, aligning and, leveling all equipment and parts thereof to insure that each item is in the proper position relative to other equipment and that all parts are aligned within allowable tolerances. The Contractor shall be responsible for this accuracy and shall notify the Engineer of any conditions in prior work which would prevent this alignment before proceeding with the work. The Contractor shall employ a competent surveyor or millwright to set all lines and levels of equipment to the accuracy required.
2. All blocking and wedging required for the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed except steel wedges and bronze shims which may be left in place. All wedges, shims, fasteners or other products left in place must be included in the Shop Drawing.
3. Each piece of equipment or supporting base bearing on concrete foundations shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2" thick grouting or as indicated on Contract Drawings.

1.10 DAMAGE DURING TESTS AND INSTRUCTION PERIODS

- A. Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and he shall neither have or make any claim for damage which may occur to equipment prior to Substantial Completion.

1.11 SERVICES OF MANUFACTURER'S ENGINEERS

- A. The contract price shall include the cost of furnishing competent engineers or technicians from each company manufacturing equipment for the Project to:
1. Assist the Contractor to install, adjust, and test the equipment in conformity with the Contract Documents.
 2. Supervise start-up operations and adequately instruct designated employees of the Owner in the proper operation and maintenance procedures when requested by the Owner throughout the guarantee period of the equipment. A report on each visit shall be filed by the Manufacturer's representative with the Engineer.

1.12 EQUIPMENT MANUFACTURER CERTIFICATION

- A. The Contractor will provide Engineer with written certification obtained from each Manufacturer for the Project that the equipment is installed and does operate in accordance with the Manufacturer's recommendations.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Closeout procedures
- B. Final cleaning
- C. Adjusting
- D. Project Record Documents
- E. Spare Parts and Special Tools
- F. Equipment Startup Services
- G. Substantial Completion
- H. Warranties

1.02 RELATED SECTIONS

- A. Section 01300 - Submittals
- B. Section 01730 - Operation and Maintenance Data

1.03 SUBMITTALS

- A. Record Drawing Set
- B. Final Change Order
- C. Final Application for Payment
- D. Contractual Statements including:
 - 1. Waiver of Lien
 - 2. Contractor's Affidavit
 - 3. Contractor's Declaration
 - 4. Release of Surety.
- E. Manufacturers' Extended Warranties, Material and Guaranty Bond (if required).

- F. Copy of Occupancy Permit and any other permits from local governing authority (if required).
- G. Start-Up and Commissioning Documents
- H. Final O&M Manuals
- I. Construction Photographs and Video(s) where specified.

1.04 FINAL CLEANING

- A. Complete final cleaning and restoration prior to final project inspection.
- B. Remove all temporary labels, stains and foreign substances. Wash or clean by approved methods all surfaces on which dust and dirt has collected.
- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Clean debris from drainage systems.
- E. Clean site; sweep paved areas, rake clean landscaped surfaces.
- F. Remove waste and surplus materials, rubbish, and construction facilities from the site.
- G. Restore disturbed area. Lawn area may be seeded unless otherwise noted. Paved area shall be restored to their original condition, compatible with the surrounding area, using like materials and workmanship.
- H. Touchup painted surface. Clean and repaint with matching color all scratched, marred or otherwise damaged painted surfaces of all equipment and enclosures.

1.05 PROJECT RECORD DOCUMENTS

- A. Maintain on site, one set of the following record documents:
 - 1. Record Drawings (Red-line set)
 - 2. Contract Documents
 - 3. RFSS, RFIs, and RFQs
 - 4. Change Orders and other modifications to the Contract
 - 5. Submittal Log
 - 6. Reviewed Shop Drawings, Product Data, and Samples
 - 7. Manufacturer's O&M Manuals
- B. As the work progresses, keep a complete and accurate record of all changes in the Contract Documents (including Drawings, Shop Drawings, Product Data, and Specifications) indicating the work as actually installed. All changes shall be neatly shown on the drawings affected kept at the job site for inspection by the Owner and the Engineer. All equipment schedules shall be updated on the Contractor's as-built set.

- C. Ensure entries are complete and accurate, enabling future reference by Owner.
- D. Store as-built documents separate from documents used for construction.
- E. Record information concurrent with construction progress.
- F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of other floors, slabs, platforms and foundations in relation to finish main floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities, conduits, and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension, detail and placement.
 - 5. Details not on original Contract drawings.
 - 6. Conduit and wiring information changed, or not shown on drawings including home runs.
- G. On completion of the work, prior to the Contractor's application for final payment and as a condition to its approval by the Engineer and Owner, the Contractor shall arrange such site records in order in accordance with the various sections of the specifications bind them together and index them and deliver them to the Engineer. In addition the Contractor shall request a complete set of reproducible contract Drawings, and transfer all record revisions and changes to them and deliver them to the Engineer. These drawings shall be dated and marked "As-Built Drawings". The Engineer shall review these Drawings for completeness and accuracy and may require re-submittals.
- H. All reproducible tracings made by the Contractor, equipment manufacturers, and/or material suppliers shall be corrected to show the work as actually completed or installed and a reproducible copy of these drawings shall then be turned over to the Engineer.
- I. Prints in triplicate of all corrected opaque drawings shall be furnished to the Engineer prior to the issuance of the final estimate.
- J. Written approval or other evidence satisfactory to the Engineer of the final conditions of the work shall be obtained from all public authorities or agencies having jurisdiction over any portion of the work.
- K. All public authorities or agencies having jurisdiction over any part of the work shall be determined, and all the requirements of these authorities or agencies with respect to but not limited to inspection, permits, fees, approval, and the like regardless of whether they are listed above or not shall be met.
- L. Submit all documents to Engineer for approval prior to submittal of final Application for Payment.

1.06 SATISFACTION OF CLAIMS

- A. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled, or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained to secure payment therewith interest.
- B. In the event that any Contractor has trespassed upon private property in the prosecution of the work of this contract, the Owner may withhold payment for the value of such work in or on the property, but in any case, no less than a sum of \$500 for each property trespassed until the Contractor has secured a release from the property owner upon whose property the trespass was committed.

1.07 SUBSTANTIAL COMPLETION

- A. Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy and utilize the facilities for its intended use.

1.08 WARRANTIES

- A. Provide duplicate copies of all warranties, dated from the date of Substantial Completion.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers and insert into the Warranty tab Section of the O&M Manuals.
- C. Submit warranty documents prior to final Application for Payment.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.
- E. All parts of the work or equipment which is in the opinion of the Engineer prove defective in material, workmanship, or operation within the warranty period shall be removed and replaced or repaired in a manner satisfactory to the Engineer and at not cost to the Owner.
- F. Any service material or equipment required because of the defect shall be supplied without charge.
- G. All work specified to be designed by the Contractor shall be guaranteed to perform as specified.
- H. The Warranty period shall be one year from the date of Substantial Completion unless:
 - 1. A greater period is specified elsewhere.

2. Owner chooses to take over and use a portion of the Work as provided for in the Specifications; in which case the warranty shall be one year from said takeover and use.
- B. Equipment or work replaced and/or repaired during the warranty period shall be guaranteed for one year from the date of acceptance of the repair or replacement or until expiration of the original warranty period whichever comes later.

1.10 FINAL PAYMENT

- A. Within thirty (30) days after the completion of the work under this Contract to the satisfaction of the Owner and the Engineer, in accordance with all and singular terms and stipulations herein contained, the Owner shall make final payment, from a final estimate made by the Engineer. Before final payment is made, the Contractor shall, as directed by the Owner,, furnish a Contractor's Affidavit that he has paid or satisfactorily secured all claims of every nature. Also, the Contractor shall furnish a release from the surety or sureties and permit agencies as applicable, approving payment of final estimate by the Owner. The final payment, when made, shall be considered as final approval and acceptance of the completed work herein specified.
- B. The acceptance by the Contractor of the final payment aforesaid shall operate as, and shall be, a release to the Owner and his agents, from all claim and liability to the Contractor for anything done or furnished for, relating to the work, or for any act or neglect of the Owner or of any person relating to or affecting the work.

1.11 CLOSEOUT PROCEDURES

- A. Submit completion matrix, identifying the dates for:
 1. Approved shop drawings
 2. Approved O&M manuals
 3. Start-up
 4. Training
 5. Spare Parts
- B. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
- C. Perform satisfactory completion of Punch List.
- D. Submit final Application for Payment identifying Total Adjusted Contract Sum, previous payments, and sum remaining due.
- E. Provide satisfactory evidence that all claims have been settled.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

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SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Format and content of manuals.
- B. Instruction of Owner's personnel.
- C. Submittals.

1.02 RELATED SECTIONS

- A. Section 01300 - Submittals
- B. Section 01400 - Quality Control
- C. Section 01600 – Material, Products and Equipment
- D. Section 01700 - Contract Closeout
- E. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.04 FORMAT

- A. Prepare data in the form of an instructional manual.
- B. Binders: Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 3 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings. Fill binders to no more than 75% capacity.
- C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; Volume number, Owner Name and Address, General Contractor name and address and Engineer name and address.
- D. Provide tabbed indexes for each separate product and system, with typed description of product and system.

- E. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- F. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- G. Arrange content by process flow under section numbers and sequence of Table of Contents of this Project Manual.
- H. Submit O&M Manual Checklist (see last page).

1.05 CONTENTS, GENERAL FOR EACH VOLUME

- A. Table of Contents: Provide title of Projects and the names, addresses, and telephone numbers of Engineer, Subconsultants, and Contractor in the heading. Next, provide a schedule of products and systems, indexed to content of the volume.
- B. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information. Identify specific model numbers, size, etc.
- D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Preventive Maintenance (PM): Provide a tabbed section identifying daily, weekly, monthly, quarterly, semi-annual, and yearly PM as required.
- G. Warranties and Bonds: Bind in copy of each.
- H. Start-up documentation. Provide a binder tab for inclusion following start-up. Add a tab for factory tests and field calibration reports where required.

1.06 MANUFACTURERS MANUALS FOR EQUIPMENT AND SYSTEMS

- A. Each Item of Equipment and Each System: Include description of unit or system, and component parts with diagrams, charts, capabilities, etc. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, complete nomenclature and model number of replaceable parts, and catalog data or literature with correct model number of equipment noted where literature covers more than one model.
- B. All information, tables, charts, lists, etc., shall be annotated for this job.

- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications, either typed or by label machine.
- D. Include color coded wiring diagrams as installed.
- E. Shipping, storage and handling: Include all necessary requirements.
- F. Storage maintenance: Include all necessary rotation, lubrication, heating or other provisions required during storage.
- G. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- H. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions and drawings; and alignment, adjusting, balancing, calibration and checking instructions.
- I. Provide preventive maintenance recommendations servicing and lubrication schedule, and list of lubricants required. Include manufacturer's printed storage and installation instructions with alignment instructions and tolerances.
- J. Include manufacturer's printed operation and maintenance instructions. Provide trouble shooting guide for equipment and system components.
- K. Include sequence of operation by controls manufacturer.
- L. Provide original manufacturer's detailed parts list and parts drawing, illustrations, assembly/disassembly drawings and instructions, and diagrams required for maintenance. Provide a cross reference to all individual component manuals for all parts lists and illustrations provide correct parts numbers. All bearing numbers shall be listed.
- M. Provide control diagrams by controls manufacturer as installed.
- N. Provide Contractor's coordination drawings, with color coded piping diagrams as installed for equipment systems.
- O. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams for each equipment system.
- P. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage and how to obtain them.
- Q. Include test and balancing reports as specified in Section 01400 and Divisions 11 through 16.
- R. Include start-up documentation specified in Section 01650.
- S. Additional Requirements: As specified in individual Product specification sections.

- T. Provide a listing in Table of Contents for design data, with tabbed indexed and space for insertion of data.

1.07 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. For equipment requiring seasonal operation, perform instructions for other seasons.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.
- E. Refer to individual equipment specification section for instruction and training requirements.

1.08 SUBMITTALS

- A. Draft submittals must be submitted prior to shipment for review. Draft submittal can be stapled without binder and tabs.
- B. Submit final volumes prior to equipment start-up. Final manuals shall be in a binder with binder tabs. These copies will be used during training. Revise content of all document sets where required following training within 60 days.
- C. Submit final annotated O&M Manuals in .pdf format on disk.
- D. Submit revisions of final documents following training where required.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF TEXT SECTION

O&M MANUAL CHECKLIST

Note to Contractor: This form must be submitted with all O&M manuals.

Equipment Name

Specification Number

I, _____ do hereby certify that the O&M Manual for the referenced equipment:

(Print / Type Name) _____
meets requirements and specification for 01730 as noted below:

Format	yes	no		yes	no
Table of Contents:	<input type="checkbox"/>	<input type="checkbox"/>	Annotated Format:	<input type="checkbox"/>	<input type="checkbox"/>
Provide 3-Ring Binder:	<input type="checkbox"/>	<input type="checkbox"/>	Tabs:	<input type="checkbox"/>	<input type="checkbox"/>
Cover/Spine					
Equip. Title:	<input type="checkbox"/>	<input type="checkbox"/>	Owner:	<input type="checkbox"/>	<input type="checkbox"/>
Project Title:	<input type="checkbox"/>	<input type="checkbox"/>	Contractor:	<input type="checkbox"/>	<input type="checkbox"/>
Date:	<input type="checkbox"/>	<input type="checkbox"/>	Engineer:	<input type="checkbox"/>	<input type="checkbox"/>
			Representative:	<input type="checkbox"/>	<input type="checkbox"/>
			Manufacturer:	<input type="checkbox"/>	<input type="checkbox"/>
General					
Design Data:	<input type="checkbox"/>	<input type="checkbox"/>	Expanded Views:	<input type="checkbox"/>	<input type="checkbox"/>
Spare Parts List:	<input type="checkbox"/>	<input type="checkbox"/>	Complete Parts List:	<input type="checkbox"/>	<input type="checkbox"/>
Equip. Drawings:	<input type="checkbox"/>	<input type="checkbox"/>			
Operations:					
Handling & Storage:	<input type="checkbox"/>	<input type="checkbox"/>	Start-Up:	<input type="checkbox"/>	<input type="checkbox"/>
Installation Procedures:	<input type="checkbox"/>	<input type="checkbox"/>	Trouble Shooting:	<input type="checkbox"/>	<input type="checkbox"/>
Maintenance					
Maintenance Procedures:	<input type="checkbox"/>	<input type="checkbox"/>	Preventive Maint. Req.:	<input type="checkbox"/>	<input type="checkbox"/>
Lubrication Specs.:	<input type="checkbox"/>	<input type="checkbox"/>	Preventive Maint. Sched.:	<input type="checkbox"/>	<input type="checkbox"/>
Electrical					
Motor Data:	<input type="checkbox"/>	<input type="checkbox"/>	Control Wiring Diagram:	<input type="checkbox"/>	<input type="checkbox"/>
Wiring Diagrams:	<input type="checkbox"/>	<input type="checkbox"/>			
Test / Field Reports					
Balance Report:	<input type="checkbox"/>	<input type="checkbox"/>	Noise (dB) Readings:	<input type="checkbox"/>	<input type="checkbox"/>
Certif. of Installation:	<input type="checkbox"/>	<input type="checkbox"/>	Pressure Tests:	<input type="checkbox"/>	<input type="checkbox"/>
Field Calibration Reports	<input type="checkbox"/>	<input type="checkbox"/>			
Miscellaneous					
Extended Warrantee:	<input type="checkbox"/>	<input type="checkbox"/>	MSDS Sheets:	<input type="checkbox"/>	<input type="checkbox"/>

Comments: _____

Signature

Date

SECTION 16210

ELECTRICAL EQUIPMENT MAINTENANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Inspection, testing, and calibration of existing electrical equipment and control components.

1.2 SCOPE OF WORK

- A. Electrical power distribution and control equipment throughout the Downriver Wastewater Treatment Facilities require testing and maintenance. The equipment included under this Contract are listed in subsection 3.12, Table 1.
- B. The Contractor shall be a recognized testing firm for the purpose of performing inspections and tests as herein specified.
- C. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
- D. It is the purpose of these Specifications to assure that all tested electrical equipment and systems are operational and within industry and manufacturer's tolerances.
- E. The Contractor shall inspect, test, and maintain all of the equipment listed in Table 1 and according to the Maintenance Tasks identified therein.

1.3 RELATED SECTIONS

- A. Section 01039 – Coordination and Meetings.
- B. Section 01400 – Quality Control.
- C. Section 16215 – Sample Test & Inspection Forms.

1.4 REFERENCES

- A. Institute of Electrical and Electronic Engineers - IEEE
- B. ANSI/IEEE C2-1997, National Electrical Safety Code
- C. American National Standards Institute – ANSI
- D. American Society for Testing and Materials – ASTM
- E. Association of Edison Illuminating Companies – AEIC

- F. Insulated Cable Engineers Association – ICEA
- G. National Electrical Manufacturer’s Association – NEMA
- H. National Fire Protection Association – NFPA 70B
- I. Occupational Safety and Health Administration – OSHA
- J. Scaffold Industry Association – SIA
- K. State and local codes and ordinances
- L. Underwriters Laboratories, Inc. – UL
- M. NETA MTS – 2007 Maintenance Testing Specifications for Electrical Power Distribution Equipment, International Electrical Testing Association
- N. NFPA 70 - National Electrical Code

1.5 SUBMITTALS

- A. Contractor qualifications documentation.
- B. Device calibration and settings sheets.
- C. Test equipment ratings, functions, features, and calibration certificates.
- D. Work schedules and testing procedures.
- E. Test Reports: Indicate procedures and results for field testing and inspection.

1.6 QUALIFICATIONS

- A. The manufacturer of the replacement components shall be a manufacturer of the type of existing components within the assembly.
- B. Testing Contractor: The electrical testing contractor shall be regularly involved in the testing, inspection and maintenance of electrical apparatus and must be qualified in using the applicable IEEE, ANSI and NETA specifications for testing and maintenance.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70B.

PART 2 PRODUCTS

Not used.

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PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

3.2 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Control.
- B. Perform inspections and tests listed below.

3.3 QUALIFICATIONS OF CONTRACTOR

- A. The Contractor shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- B. The Contractor shall utilize technicians who are regularly employed by the firm for testing services.
- C. The Contractor shall be an independent testing organization or an independent division of a major electrical equipment manufacturer, which can function as an unbiased testing authority.
- D. The testing plan and procedures shall be reviewed and approved by one of the testing firm's registered professional electrical engineers. The registered professional engineer shall be a full time employee of the Contractor with at least 10 years of field experience testing electrical apparatus.
- E. The Contractor's test technician or project manager shall be Level 3 or higher, ANSI certified and shall be a full time employee, with at least 10 years of experience testing electrical apparatus in the field, and has obtained specific electrical equipment training. All other employees working on this project shall have had specific factory, and/or field training in accordance industry standards. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and/or linemen may assist; but may not perform testing and/or inspection services. It is the intention of the Contract that the day-to-day management and review of all test procedures and all test results and records shall be conducted by the degreed engineer, therefore, it is mandatory that the degreed engineer shall be on-site during any and all work related to this Contract. The proposal shall contain the name and resume of the degreed engineer who would act in this capacity for this Contract.
- F. The Contractor shall utilize the ANSI standardized set of Maintenance Testing Guidelines that highlight primary and secondary activities to ensure equipment reliability.
- G. The Contractor shall utilize the ANSI standardized set of Engineering Procedures to insure consistency while making diagnostic tests or critical repairs.
- H. The Contractor shall maintain a central database of all test equipment with documentation of calibrations with all reports.

- I. Acceptable Contractors:
 - 1. Dymax Service Inc.
 - 2. High Voltage Maintenance Corp.
 - 3. Magna Electric Corporation
 - 4. Northern Electrical Testing, Inc.
 - 5. Motor City Electric Co.
 - 6. Power Plus Engineering, Inc.
 - 7. Utilities Instrumentation Service, Inc.

3.4 DIVISION OF RESPONSIBILITY

- A. The Owner shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.
- B. The Owner shall notify the testing firm when equipment becomes available for maintenance tests. Work shall be coordinated to expedite project scheduling.
- C. The Owner shall supply a short-circuit analysis and coordination study, a protective device setting sheet, a complete set of electrical plans, specifications, and any pertinent change orders to the Contractor prior to commencement of testing.
- D. The Contractor shall notify the Owner prior to commencement of any testing.
- E. Any system, material, or workmanship which is found defective on the basis of maintenance tests shall be reported.
- F. The Contractor shall maintain a written record of all tests and shall assemble and certify the final test reports.
- G. Safety and Precautions
 - 1. Safety practices should include, but are not limited to, the following requirements:
 - a. Current Occupational Safety and Health regulations
 - b. National Safety Council, *Accident Prevention Manual for Industrial Operations*
 - c. Applicable state and local safety operating procedures
 - d. Owner's safety practices
 - e. ANSI/NFPA 70E, *Electrical Safety Requirements for Employee Workplaces*
 - f. OSHA 29 CFR 1910.147. *Control of Hazardous Energy Sources (Lockout/Tagout)*
 - 2. All tests shall be performed with apparatus de-energized, except where otherwise specifically required.
 - 3. The Contractor shall have a designated safety representative on the project site to supervise operations with respect to safety.

3.5 SUITABILITY OF TEST EQUIPMENT

- A. All test equipment shall be in good mechanical and electrical condition.
- B. Split-core current transformers and clamp-on or tong-type ammeters require careful consideration of the following in regard to accuracy:
1. Position of the conductor within the core
 2. Clean, tight fit of the core pole faces
 3. Presence of external fields
 4. Accuracy of the current transformer ratio in addition to the accuracy of the secondary meter
- C. Selection of metering equipment should be based on a knowledge of the waveform of the variable being measured. Digital multimeters shall be rms sensing. When the variable contains harmonics or dc offset and, in general, any deviation from a pure sine wave, averaging sensing, rms scaled meters may be misleading.
- D. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.
- E. Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of two percent of the scale used.
- F. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.
- G. The Contractor shall provide for his/her use all required materials, tools, equipment, etc. necessary to appropriately carry out all testing, infrared and ultrasonic surveying, and preventive maintenance tasks and procedures outlined under this Specification.
- H. For Harmonics testing, the Contractor shall utilize test equipment which measures "true" RMS values, with one millisecond peak hold capability to capture the half cycle peak of the wave form. In addition, the test equipment shall have a crest factor capability of at least three (3) at full scale, and the ability to measure the frequency of the current. Portable test equipment which is average responding RMS calibrated shall not be acceptable testing instrumentation.
- I. For infrared surveying, the Contractor shall utilize thermographic test equipment which meets or exceeds the following specifications for either short wave or long wave electromagnetic radiation:
1. Short Wave Electromagnetic Radiation

System Type:	Focal plane array camera
Spectral Range:	3.6 to 5 Microns (Std.)
Detector:	PtSi Nybrid Silicon FPA

Image Storage Capability: Image storage transferable to a color computer.
Imaging and printing capability of problem areas.

Ultra high resolution 320 by 244 focal plane array detector (78,080 pixels) (FPA
required-rotating polygons and scanning mirrors unacceptable)

Single element temperature measurement. Full ratio metric 12-bit images (4,096
thermal levels)

2. For Long Wave Electromagnetic Radiation

Imaging and Measurement Capabilities:

System Focal plane array infrared camera

Spectral Range 7.5 – 13 microns

Detector Uncooled microbolometer

Temperature Measurement Accuracy + 2% of range or 2°

J. For Power Factor testing, the Contractor shall utilize a clamp-on type of Current/Power Probe that measures dc current, ac current, and ac power in conjunction with a true RMS multimeter. Probe shall be switch-selectable for outputs representing amps or kilowatts. Kilowatt measurement shall take into account the phase angle and waveform distortion of both voltage and current to provide good performance over a wide range of input signals. A zero control function shall be provided to offset core magnetization to improve accuracy of low-level dc current and kilowatt measurements. Multimeter shall be a 4000 count instrument and shall measure frequencies between 0.5 Hz and 200 KHz with up to 0.01 Hz resolution. Accuracy shall be 1% for any range for all functions.

K. For Ultrasound Inspecting, the Contractor shall utilize ultrasonic test equipment which meets or exceeds the following specifications:

Circuitry: Solid state heterodyne receiver with temperature compensation.

Frequency Response: Detect ultrasonic frequencies between 20 kHz and 100 kHz,
continuously variable. Frequencies are converted to 100 Hz to 3 kHz audio.

Scanning Module: Patented TRISONIC plug-in type consisting of a phased array of
multiple transducers for airborne ultrasound. This probe shall be shielded against RF
interference.

L. Features:

Frequency tuning adjustment dial: Scale 20 – 100 kHz with “fixed band” position for
ultra-narrow frequency response.

Bi-Modal Meter Switch: For logarithmic and linear meter scale adjustments.

Auxiliary Mode: Selection for chart recorder output: 0 – 50 mV, Precision 10 turn adjustment dial with numerically calibrated sensitivity increments for finite gain adjustment.

The ultrasonic test equipment shall meet or exceed ASTM E1002-93 requirements for leak detection.

3.6 TEST INSTRUMENT CALIBRATION

- A. The Contractor shall maintain a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
- B. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- C. Instruments shall be calibrated in accordance with the following frequency schedules:
 - 1. Field instruments: Analog, 6 months maximum. Digital, 12 months maximum.
 - 2. Laboratory instruments: 12 months
 - 3. Leased specialty equipment: 12 months where accuracy is guaranteed by lessor.
 - 4. Dated calibration labels shall be visible on all test equipment.
 - 5. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.
 - 6. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument.
 - 7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

3.7 TEST REPORTS

- A. A separate test report shall be provided for each piece of equipment listed in Table 1. Each test report shall include the following:
 - 1. Description of equipment tested.
 - 2. Description of each test performed.
 - 3. Test results.
 - 4. List of test equipment used and calibration dates.
 - 5. Description of Maintenance Services performed.
 - 6. Analysis and recommendations.
- B. Furnish five (5) printed copies and a digital or electronic copy on CD of each report to the Owner, no later than 30 days after completion of testing.

3.8 INSPECTION AND TEST PROCEDURES

- A. Energized Testing and Inspection

The Contractor shall provide the safety equipment, service instruments, and qualified technicians to conduct, document, and interpret the results of the applicable comprehensive diagnostic services and inspections that can be safely performed on the covered electrical component(s) and/or connection(s) of the power distribution equipment. These services shall be performed while the Owner's electrical distribution system is energized. The following testing and inspection services, as appropriate, shall be conducted:

1. True Root-Mean-Square (RMS) Voltage and Current Testing: Capture and record the square root of the average square of the instantaneous magnitude of the voltage and current. This service is used to determine if the correct voltage and current is present to properly operate the Owner's equipment and optimize its life cycle.
2. Voltage Drop: Measure and record the difference of voltages at the two terminals of passive impedance. This service is used to determine if the Owner's electrical components, i.e., circuit breakers, contact surfaces, etc., are operating properly to reduce hazards and equipment destruction.
3. Infrared Thermographic Imaging Service: Measure and record to identify temperatures that exceed NFPA Standard 70B recommendations, i.e., high resistance electrical connections, current overload, defective circuit breakers and/or defective insulator conditions. This service is used to reduce the risk of brown-outs and black-outs, as well as safety and fire hazards.
4. Ultrasonic Testing: Measure and record sound waves and/or vibrations on medium voltage equipment that are above audible sound (16-18 KHZ). This service is used to complement the thermographic imaging service and determine if corona discharge, tracking, arcing and vibration are present, and to assure the quality and integrity of the Owner's electrical system.
5. Voltage and Current Harmonics Testing: Capture and record Total Harmonic Distortion-Voltage (THDV) and Total Harmonic Distortion-Current (THDC) that exceed IEEE recommendations. This service is used to determine if the Owner's harmonic contamination is within tolerance levels. In addition, this service is designed to assure accurate power (kW) charges and to minimize the risk of damage to microelectronic equipment, transformers, circuit breakers, motors, etc.
6. Power Factor Testing: Measure and record the ratio of the circuit power (watts) to the circuit volt-amperes. This service is used to determine if the Owner is paying increased costs to their utility company because the Owner's power factor is in a higher rate schedule. In addition, correcting a poor power factor situation may allow the Owner to expand their electrical system's capacity without costly system additions.
7. Visual and Mechanical Inspections: All components shall be inspected to ascertain, and if necessary, make certain adjustments to ensure that its performance remains within specified limits. The Contractor shall also identify corrosion, rust and discoloration, leaks, safety hazards, applicable electric code violations, grounding, physical damage and the general condition of components.
8. Phase-Balance Measurements: Assure that the phases in the Owner's electrical system are balanced. This service is used to address unbalanced components that increase power-quality problems, total harmonic distortion as well as increased temperature rise of devices and current-carrying conductors.

B. De-Energized Testing and Inspection

The Contractor shall provide the safety equipment, service instruments and qualified technicians to conduct, interpret, and document the results of the applicable comprehensive diagnostic services and inspections that can be safely performed on the covered electrical component(s) and/or connection(s) to the power distribution equipment. These services shall

be performed at a mutually agreed schedule, while the Owner's electrical distribution system and/or electrical component(s) is de-energized and include, as appropriate, the following:

9. Insulation Resistance: Measure and record the resistance of insulation under specified conditions set forth by applicable standards such as NFPA Standard 70B. This service is designed to assure that the Owner's electrical system and components' insulation values are at an acceptable level, reducing the risk of explosions, fires and catastrophic breakdowns.
10. Winding Resistance Service: Measure, record and compare the winding resistance of components. This service will assure that components are operating to applicable specifications, extending useful life, and reducing the risk of catastrophic failure.
11. Contact Resistance Service: Measure and record the resistance between contact surfaces. This service addresses poor contact surfaces that would cause increased voltage drop, increased heat and reduced life expectancy, causing brown-outs, black-outs, explosions, fires and catastrophic failures.
12. Circuit Breaker Testing (Low Voltage): Measure, test, record and document findings regarding all applicable low voltage circuit breakers. The proper testing and inspection of the Owner's circuit breakers will reduce the risk of business interruption, fire and catastrophic failure.
13. Ground Resistance Testing: Measure and record the resistance of conductors, connections and devices. This service will reduce the risk of power quality, harmonic and safety issues.
14. Transformer Service: Measure, record and monitor all appropriate services and inspection to applicable standards such as NFPA Standard 70B. This service and inspection is performed to reduce the risk of transformer failure, which could result in fire, and/or catastrophic failure.
15. Visual and Mechanical Inspection: All components shall be inspected to ascertain and, if necessary, make certain adjustments to ensure that its performance remains within specified limits. The Contractor shall also identify corrosion, rust and discoloration, leaks, safety hazards, applicable electric code violations, grounding, physical damage and the general condition of components.

C. Maintenance Service

The Contractor shall provide the safety equipment, service instruments, and labor to perform the maintenance services tasks that can be safely performed, as appropriate, in either an energized or de-energized state. These service tasks shall be performed on the specified electrical component(s) and/or connection(s). The following tasks, as appropriate, shall be conducted:

16. Inspect physical, electrical, and mechanical condition.
17. Torque all connections and terminations to applicable specifications.
18. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
19. Exercise all active components (when applicable).
20. Inspect all indicating devices for correct operation and indication.

21. Clean interior and exterior of equipment, including vacuuming or blowing out as required.
22. Lubricate, as appropriate, to assure proper mechanical function(s).
23. Perform minor repairs (i.e., replace missing knock-outs).
24. Assess service results in order to determine appropriate actions to minimize the likelihood of an unscheduled power loss or safety hazard.

D. Electrical Power Distribution Systems Analysis

Any immediate safety or hazard concern that is identified during any visit shall be documented to the Owner while on-site.

At the completion of each service visit, the Contractor shall compile the results of all inspections, measurements, surveys and preventive, predictive and proactive service activities. The Contractor shall then analyze these results to ascertain the condition of the electrical devices and/or components. The analysis shall be documented in the form of an Electrical Power Distribution Systems Analysis Report (Analysis Report), made available in hard copy and electronic interactive format that both the Owner and Contractor can easily update, and shall be presented to the Owner.

The Analysis Report shall be reviewed by HRC with the Owner and, if appropriate, include any recommended repairs, solutions and/or opportunities for improved electrical system efficiency, reduced electrical utility costs and/or improving safety conditions and/or minimizing the risk of downtime. If any component is found to be in a non-maintainable condition, during the service task on each component, the Owner shall be provided with the options and associated costs to either:

1. Repair or replace the doubtful component; or
2. Remove the doubtful component from the repair or replacement provisions of the contract.

E. Replacement components shall be original manufacturer's recommended replacement parts or specified replacement units and shall meet the requirements of the detailed Specifications herein. Repair and replacement costs shall be as provided in the Unit Price Schedule.

3.9 OPERATIONAL TESTS

A. General

1. Perform system function tests upon completion of equipment tests as defined in Sub-Section 3.8. It is the purpose of the system function tests to prove the correct interaction of all sensing, processing, and action systems.
2. Implementation
 - a. Develop test parameters for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 - b. Perform the tests.
 - c. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.

- d. Verify the correct operation of all sensing devices, alarms, and indicating devices.

- B. Five certified copies of the results of all tests made on the equipment shall be delivered to the Owner.

3.10 DEMONSTRATION

- A. Section 01700 – Contract Closeout.
- B. Demonstrate operation of all equipment and components tested and maintained.

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3.11 TABLES

Table 1 - Maintenance of Equipment Schedule

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
<u>Maintenance Building:</u>					
Primary Switch	Park Metal	PMS15-5-60	15	5kV fuses & load break switch	A (all), 9, 11, 13, 15, 16, 17, 21, 22
500kVA Dry Type Transformer	Olsun		15		1, 2, 3, 4, 7, 8, 9, 10, 14, 15, 16, 17, 21
MDP (distribution panel)	General Electric	Spectrum	15	Main breaker & 10 feeder breakers	1, 2, 3, 5, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Motor Control Center MCC-1	General Electric	8000 Line	15	3 sections; 15 starters	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-3	General Electric	8000 Line	15	1 section; 2 starters & 6 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-4-7	General Electric	8000 Line	15	4 sections; 21 starters	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
<u>Aeration Building:</u>					
Motor Control Center MCC-AE1	Westinghouse	Type W	34	10 sections; 31 starters & 9 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-AE2	Westinghouse	Type W	34	11 sections; 31 starters & 9 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
MV Line-ups MC & MD	Cutler-Hammer	Ampgard	13	4 starters, 2 main switches, tie switch, 4 feeder switches	A (all), 9, 10, 11, 13, 15, 16, 17, 19, 21, 22
<u>Low Lift Pump Station:</u>					
Unit Substation LL-1	Cutler-Hammer	DS-II	12	Double-ended with two 1500/2000 kVA dry-type transformers, 2 main breakers, tie breaker, and 12 feeder breakers	A (all), B (all), 16, 17, 19, 21, 22
Pump #1 VFD-1	ASI Robicon	454GT	5	350HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
Pump #2 VFD-2	ASI Robicon	454GT	5	350HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Pump #3 VFD-3	ASI Robicon	454GT	5	350HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Pump #4 VFD-4	ASI Robicon	454GT	5	350HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Secondary Clarifier No. 1:					
Motor Control Center MCC-FT1	General Electric	7700 Line	34	5 sections; main breaker, 7 starters, & 11 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
RAS Pump #1 VFD	ASI Robicon	454GT	8	150HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Sump Pump wall mounted starter	Allen-Bradley	unknown	34	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Secondary Clarifier No. 2:					
Motor Control Center MCC-FT2	General Electric	7700 Line	34	5 sections; main breaker, 7 starters, & 11 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
RAS Pump #2 VFD	ASI Robicon	454GT	8	150HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Sump Pump wall mounted starter	Allen-Bradley	unknown	34	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Secondary Clarifier No. 3:					
Motor Control Center MCC-FT3	General Electric	7700 Line	34	3 sections; main breaker, 7 starters, & 11 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
RAS Pump #3 VFD	ASI Robicon	454GT	7	150HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Secondary Clarifier No. 4:					
Motor Control Center MCC-FT4	General Electric	7700 Line	34	3 sections; main breaker, 7 starters, & 11 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
RAS Pump #4 VFD	ASI Robicon	454GT	7	150HP, 480V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Sump Pump wall mounted starter	Allen-Bradley	unknown	34	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
<u>RAS Pumping Station:</u>					
Exhaust Fan EF-8 wall mtd. starter	Square D	unknown	22	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Exhaust Fan EF-9 wall mtd. starter	Square D	unknown	22	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Exhaust Fan EF-12 wall mtd. starter	Square D	unknown	22	Size 1 combination starter	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
<u>Electrical Room #1:</u>					
Primary Switchgear A & B	Cutler-Hammer	VCP-W	13	Metering devices, transfer control, and protective relays only	7, 16, 17, 19, 20, 21
Unit Substation I-1	General Electric	AKD-5	34	double-ended with 2 primary fused switches, two 2000kVA silicone oil filled transformers (retro-filled in 1992), 2 main breakers, tie breaker, and 12 feeder breakers (breaker trip units replaced with C-H DigiTrip units in 1997)	A (all), B (all), 16, 17, 19, 20, 21, 22
MV Starter Line-up MA	Cutler-Hammer	Ampgard	13	2 starters, tie switch, 1 feeder switch	A (all), 9, 10, 11, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-ATO	General Electric	7700 Line	34	4 sections; 2 fused switches, ASCO automatic transfer switch, 3 starters, 2 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IA	General Electric	7700 Line	34	5 sections; Only Owner selected and used starters and feeder breakers; see Table 2	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IB	General Electric	7700 Line	34	5 sections; Only Owner selected and used starters and feeder breakers; see Table 2	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
Motor Control Center MCC-IC	General Electric	7700 Line	34	5 sections; Only Owner selected and used starters and feeder breakers; see Table 2	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-ID	General Electric	7700 Line	34	5 sections; Only Owner selected and used starters and feeder breakers; see Table 2	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IH	General Electric	7700 Line	34	5 sections; 13 starters, 8 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Service Building:					
Motor Control Center MCC-SB	General Electric	7700 Line	34	2 sections; 8 starters, 4 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
DAF Building:					
Motor Control Center MCC-1	General Electric	8000 Line	22	14 sections; 2 Cutler-Hammer main breakers added in 1997, only Owner selected and used starters and feeder breakers; see Table 2	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Skimmings Building:					
Motor Control Center MCC-2	General Electric	8000 Line	22	4 sections; 10 starters, main breaker, 6 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Electrical Room #2:					
Unit Substation F-1	General Electric	AKD-5	34	double-ended with 2 primary fused switches, two 1500kVA silicone oil filled transformers (retro-filled in 1992) , 2 main breakers, tie breaker, and 9 feeder breakers (breaker trip units replaced with C-H DigiTrip units in 1997)	A (all), B (all), 16, 17, 19, 20, 21, 22
Motor Control Center MCC-DA	General Electric	8000 Line	15	6 sections; 15 starters, 15 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-DB	General Electric	8000 Line	15	6 sections; 15 starters, 13 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
Motor Control Center MCC-GA	General Electric	7700 Line	34	5 sections; 12 starters, 3 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-GB	General Electric	7700 Line	34	5 sections; 13 starters, 3 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Primary Tanks 1 - 6:					
Motor Control Center MCC-MB1	Cutler-Hammer	Advantage	13	6 sections; 17 starters, main breaker, tie breaker, 9 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-MB2	Cutler-Hammer	Advantage	13	5 sections; 22 starters, main breaker, 3 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Primary Tank 7:					
Motor Control Center MCC-MB3	Cutler-Hammer	Advantage	13	5 sections; 9 starters, 2 main breakers, 4 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Polymer Building:					
Polymer Feed Pump 311 VFD	ProMinent	unknown	13	240 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Polymer Feed Pump 312 VFD	ProMinent	unknown	13	240 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Polymer Feed Pump 313 VFD	ProMinent	unknown	13	240 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Tunnel Pump Station:					
Unit Substation T1	Cutler-Hammer	DS-II	12	Double-ended with 2 primary fused switches, two 2000/2300/3067 kVA dry-type transformers, 2 main breakers, tie breaker, and 6 feeder breakers	A (all), B (all), 16, 17, 19, 21, 22
Pump P-1 Starter	Cutler-Hammer	Easy Start EA	12	455HP, 480 V Reduced Voltage Starter	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21
Pump P-3 VFD	Robicon	454GT	12	455HP, 480 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
Pump P-4 Starter	Cutler-Hammer	Easy Start EA	12	455HP, 480 V Reduced Voltage Starter	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21
Motor Control Center MCC-T1	Cutler-Hammer	Advantage 2100	12	2 sections; 5 starters, 6 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-T2	Cutler-Hammer	Advantage 2100	12	2 sections; 3 starters, 8 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Automatic Transfer Switch	Cutler-Hammer	IQ Transfer	12		1, 2, 3, 5, 7, 8, 9, 10, 11, 13, 15, 16, 17, 19, 21, 22
<u>Administration Building:</u>					
Motor Control Center MCC-ML	General Electric	7700 Line	34	3 sections; 3 starters, 15 feeder breakers, separate main breaker mounted on left side panel	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
<u>Old Solids Handling Building:</u>					
Unit Substation P1	General Electric	AKD-8	22	double-ended with 2 primary fused switches, two 2000kVA silicone oil filled transformers (retro-filled in 1992) , 2 main breakers, tie breaker, and 10 feeder breakers (breaker trip units replaced with C-H DigiTrip units in 1997)	A (all), B (all), 16, 17, 19, 20, 21, 22
Motor Control Center MCC-MC	General Electric	8000 Line	22	5 sections; Main breaker, 9 starters, 12 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Unit Substation D1	Cutler-Hammer	DS-II	11	Double-ended with 2 primary fused switches, two 2000/2667/3554 kVA dry-type transformers, 2 main breakers, tie breaker, and 14 feeder breakers	A (all), B (all), 16, 17, 19, 21, 22
Manual Transfer Switch	Cutler-Hammer	unknown	11		1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 13, 15, & 16
Motor Control Center MCC-DC	General Electric	8000 Line	11	4 sections; 2 main breakers, 7 starters, 5 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
<u>Aerated Grit Building:</u>					
Motor Control Center MCC-ME1	Cutler-Hammer	Advantage	13	4 sections; Main breaker, 15 starters, 10 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-ME2	Cutler-Hammer	Advantage	13	4 sections; Main & tie breakers, 6 starters, 19 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
<u>Influent Pump Station:</u>					
Substation IP1	Cutler-Hammer	DS-II	13	Double-ended with 4 primary fused switches, 2 main breakers, tie breaker, and 16 feeder breakers	A (all), 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IP1	Cutler-Hammer	Advantage	13	2 sections; Pump IP1 starter (size 5)	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IP2	Cutler-Hammer	Advantage	13	2 sections; Pump IP2 starter (size 5)	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IP3	Cutler-Hammer	Advantage	13	2 sections; Pump IP3 starter (size 5)	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IP4	Cutler-Hammer	Advantage	13	2 sections; Pump IP4 starter (size 5)	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Influent Pump IP5 VFD	Robicon	454GT	13	800HP, 480 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Influent Pump IP6 VFD	Robicon	454GT	13	800HP, 480 V variable frequency drive unit	1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 21
Motor Control Center MCC-MA1	Cutler-Hammer	Advantage	13	4 sections; Main breaker, 13 starters, 8 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-MA2	Cutler-Hammer	Advantage	13	4 sections; Main & tie breakers, 8 starters, 11 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22
Motor Control Center MCC-IPH	Cutler-Hammer	Advantage	13	3 sections; 6 starters, 4 feeder breakers	1, 2, 3, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 21, 22

Equipment Designation	Manufacturer	Model No.	Age	Components	Maintenance Tasks
Transformer IP-A	Cutler-Hammer	Type RSL	13	3000/4200 kVA, oil filled, outdoor, substation type	1, 2, 3, 4, 6, 7, 9, 10, 13, 14, 15, 16, 17, 20, 21
Transformer IP-B	Cutler-Hammer	Type RSL	13	3000/4200 kVA, oil filled, outdoor, substation type	1, 2, 3, 4, 6, 7, 9, 10, 13, 14, 15, 16, 17, 20, 21

Maintenance Tasks:

A. Energized Testing and Inspection

1. True RMS Voltage and Current Testing
2. Voltage Drop
3. Infrared Thermographic Imaging Service
4. Ultrasonic Testing
5. Voltage and Current Harmonics Testing
6. Power Factor Testing
7. Visual and Mechanical Inspection
8. Phase-Balance Measurements

B. De-energized Testing and Inspection

9. Insulation Resistance
10. Winding Resistance Service
11. Contact Resistance Service
12. Circuit Breaker Testing (Low Voltage)
13. Ground Resistance Testing
14. Transformer Service
15. Visual and Mechanical Inspection

C. Maintenance Service

16. Inspect physical, electrical, and mechanical condition
17. Torque all connections and terminations
18. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment
19. Exercise all active components
20. Inspect all indicating devices for correct operation and indication
21. Clean interior and exterior of equipment
22. Lubricate
23. Perform minor repairs
24. Assess service results

Table 2 – Specific MCC Equipment Schedule

Equipment Designation	Components
Electrical Room #1:	
Motor Control Center MCC-IA	Section 1: reactor Section 2: lighting transformer circuit breaker, spare circuit breaker, SF-1 starter Section 3: fan starter, IW Pump #2 starter Section 4: exhaust fan starter, spare starter Section 5: no work
Motor Control Center MCC-IB	Section 1: reactor Section 2: lighting transformer circuit breaker, spare starter Section 3: fan starter, spare starter Section 4: two spare starters Section 5: no work
Motor Control Center MCC-IC	Section 1: reactor Section 2: lighting transformer circuit breaker, spare starter Section 3: fan starter, spare starter Section 4: no work Section 5: no work
Motor Control Center MCC-ID	Section 1: reactor Section 2: fan starter, spare starter Section 3: fan starter, spare starter Section 4: two spare starters Section 5: no work
DAF Building:	
Motor Control Center MCC-1	Section 1: Main circuit breaker Section 2: three heater circuit breakers, HVAC starter, spare starter Section 3: two exhaust fan starters Section 4: no work Section 5: no work Section 6: two spare size 1 starters Section 7: South Door Operator C.P. circuit breaker, Welder Recept. circuit breaker Section 8: North Door Operator C.P. circuit breaker Section 9: Sump Pump circuit breaker Section 10: DAF Bldg. Rooftop Furnace starter Section 11: two fan starters Section 12: no work Section 13: lighting transformer circuit breaker Section 14: Main circuit breaker

END OF SECTION

SECTION 16215

SAMPLE TEST & INSPECTION FORMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. The following sample forms:
 - 1. Automatic Transfer Switch Test form
 - 2. Loadbreak Disconnect Test form
 - 3. Low Voltage Power Circuit Breaker Insulation Test and Inspection form
 - 4. Medium Voltage Vacuum Motor Starter Test form
 - 5. Motor Control MCC Test Report form
 - 6. Motor Starter Test form
 - 7. Switchgear Inspection form
 - 8. Transformer Inspection form
 - 9. Variable Frequency Drive form

1.2 RELATED SECTIONS

- A. Section 16210 – Electrical Equipment Maintenance.

1.3 PROJECT RECORD DOCUMENTS

- A. Submit test results under provisions of Section 01700, using sample forms or similar forms.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

- A. Sample Forms:



AUTOMATIC TRANSFER SWITCH TEST

16215 / 2

CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____ TYPE _____
CATALOG NO. _____ SYSTEM VOLTAGE _____ AMPACITY _____
WIRING NO. _____ CONTROLS TYPE: ☐ ELECTROMECHANICAL ☐ SOLID STATE ☐ MICROPROCESSOR
INSTALLED OPTIONS _____

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OVERALL CLEANLINESS			
INSULATING MEMBERS			
MECHANICAL CONNECTIONS			
STRUCTURAL MEMBERS			
MAIN CONTACTS			
ARCING CONTACTS			

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
ARCING CHUTES			
OPERATING MECHANISM			
CONTACT SEQUENCE			
GROUND CONNECTION			
AUXILIARY DEVICES			
LOAD CONDUCTOR NO.	SIZE	CU	AL

TIME DELAYS		SPECIFIED		AS FOUND		AS LEFT	
OVERRIDE MOMENTARY OUTAGES ADJUSTMENT RANGE: FACTORY SET @ _____ SEC							
TRANSFER TO EMERGENCY ADJUSTMENT RANGE: FACTORY SET @ _____ SEC							
NO LOAD ENGINE COOL DOWN ADJUSTMENT RANGE: FACTORY SET @ _____ MIN							
RE-TRANSFER TO NORMAL ADJUSTMENT RANGE: FACTORY SET @ _____ MIN							
SENSOR SETTINGS		NOMINAL VOLTAGE:		VOLTS & HZ	%	VOLTZ & HZ	%
NORMAL SOURCE PICKUP VOLTAGE ADJUSTMENT RANGE: FACTORY SET @ _____ %	PHASE A						
	PHASE B						
	PHASE C						
NORMAL SOURCE DROPOUT VOLTAGE ADJUSTMENT RANGE: FACTORY SET @ _____ %	PHASE A						
	PHASE B						
	PHASE C						
EMERGENCY SOURCE VOLTAGE ADJUSTMENT RANGE: FACTORY SET @ _____ %	PICKUP						
	DROPOUT						
EMERGENCY SOURCE FREQUENCY ADJUSTMENT RANGE: FACTORY SET @ _____ %	PICKUP						
	DROPOUT						

POLE RESISTANCETESTED FROM LINE TO
LOAD TERMINALS

EQPT. TEMP _____ °C

TCF TO 20 °C _____

COMMENTS:

DEFICIENCIES:

NORMAL				
POLE	AS FOUND	20 °C	AS LEFT	20 °C
A				
B				
C				
N				

EMERGENCY				
POLE	AS FOUND	20 °C	AS LEFT	20 °C
A				
B				
C				
N				

TEST EQUIPMENT USED _____

TESTED BY: _____



LOADBREAK DISCONNECT TEST

16215 / 3

CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

FUSE DATA

MANUFACTURER _____ TYPE _____ HOLDER _____ MAX. AMPS _____
REFILL ELEMENT TYPE _____ SIZE _____ CAT. NO. _____ TCC NO. _____ VOLTAGE _____ kV

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
VOLTAGE _____ TYPE _____ AMPERES _____ INTERRUPTING RATING _____ kA
TYPE OPERATING MECHANISM _____ AGE _____ B.I.L. RATING _____ kV
MOMENTARY FAULT CLOSING AMPS _____ kA OTHER NAMEPLATE DATA _____

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OVERALL CLEANLINESS	<input type="checkbox"/>		
INSULATING MEMBERS	<input type="checkbox"/>		
MECHANICAL CONNECTION	<input type="checkbox"/>		
STRUCTURAL MEMBERS	<input type="checkbox"/>		
CUBICLE	<input type="checkbox"/>		
AUXILIARY DEVICES	<input type="checkbox"/>		

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
MAIN CONTACTS	<input type="checkbox"/>		
HEATERS	<input type="checkbox"/>		
BEARINGS	<input type="checkbox"/>		
CONTACT SEQUENCE	<input type="checkbox"/>		
GROUND CONNECTION	<input type="checkbox"/>		

INSULATION TEST VOLTAGE _____ kVDC TEST VOLTAGE MULTIPLIER, K1 = _____ K2 = (K1) (TCF)
EQUIPMENT TEMPERATURE _____ °C TEMPERATURE CORRECTION FACTOR TO 20 °C, TCF _____

INSULATION TESTS

	RANGE MULTIPLIER	K2	POLE 1 (P1-P2)		POLE 2 (P2-P3)		POLE 3 (P1-P3)	
			READING	20 °C	READING	20 °C	READING	20 °C
POLE TO POLE								
POLE TO FRAME								
LINE TO FRAME								
LOAD TO FRAME								
LINE TO LOAD								

CONTACT MEASUREMENTS

		POLE 1	POLE 2	POLE 3
CONTACT RESISTANCE MICRO-OHMS	RDG.			
	20 °C			
FUSE RESISTANCE - MICRO-OHMS				
OPENING SPEED (ft/sec)				
CLOSING SPEED (ft/sec)				

	POLE 1	POLE 2	POLE 3
ARCING CONTACT WIPE - INCHES			
MAIN CONTACT WIPE - INCHES			
MAIN CONTACT GAP - INCHES			
MAIN CONTACT TRAVEL - INCHES			

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED _____ TESTED BY: _____



LOW VOLTAGE POWER CIRCUIT BREAKER INSULATION TEST AND INSPECTION

16215 / 4

CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

MANUFACTURER _____ SN / SO NO. _____ FRAME SIZE(F) _____
BREAKER TYPE _____ SENSOR TAPS _____ MOUNTING ☐ B.I. ☐ D.O.
FUSE CAT. NO. _____ CUBICLE CODE _____
TRIP UNIT TYPE _____ CATALOG NO. _____ ZONE INTLK ☐ TARGETS ☐

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OVERALL CLEANLINESS	<input type="checkbox"/>		
INSULATING MEMBERS	<input type="checkbox"/>		
STRUCTURAL MEMBERS	<input type="checkbox"/>		
CUBICLES	<input type="checkbox"/>		
RACKING DEVICES	<input type="checkbox"/>		
SHUTTER	<input type="checkbox"/>		
OVERCURRENT DEV. BATTERY	<input type="checkbox"/>		

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
CONTACT FINGERS	<input type="checkbox"/>		
MAIN CONTACTS	<input type="checkbox"/>		
ARCING CONTACTS	<input type="checkbox"/>		
OPERATING MECHANISM	<input type="checkbox"/>		
CONTACT SEQUENCE	<input type="checkbox"/>		
GROUND CONNECTION	<input type="checkbox"/>		
AUXILIARY DEVICES	<input type="checkbox"/>		

SETTINGS AS FOUND

LONG TIME PU _____ x _____ A = _____ A DELAY _____
RATING PLUG(R) _____ SHORT TIME PU _____ = _____ A DELAY _____ I²T ☐ IN ☐ OUT ☐ N/A
SENSOR TAP _____ INST. PU _____ = _____ A ☐ ON ☐ OFF
GRD. FLT. ☐ 3W ☐ 4W GRD. FLT. PU _____ = _____ A ☐ ON ☐ OFF DELAY _____ I²T ☐ IN ☐ OUT ☐ N/A

SETTINGS AS LEFT

LONG TIME PU _____ x _____ A = _____ A DELAY _____
RATING PLUG(R) _____ SHORT TIME PU _____ = _____ A DELAY _____ I²T ☐ IN ☐ OUT ☐ N/A
SENSOR TAP _____ INST. PU _____ = _____ A ☐ ON ☐ OFF
GRD. FLT. ☐ 3W ☐ 4W GRD. FLT. PU _____ = _____ A ☐ ON ☐ OFF DELAY _____ I²T ☐ IN ☐ OUT ☐ N/A

EQUIPMENT TEMPERATURE _____ °C TEMPERATURE CORRECTION FACTOR TO 20 °C, TCF _____

	POLE 1 MΩ (P1-P2)		POLE 1 MΩ (P2-P3)		POLE 1 MΩ (P1-P3)	
	READING	20 °C	READING	20 °C	READING	20 °C
POLE TO POLE						
POLE TO FRAME						
LINE TO LOAD						

POLE RESISTANCE (MICRO-OHMS)		
READING		
POLE 1	POLE 2	POLE 3

CONTROL WIRING - MEGOHMS			
READING		20 °C	

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED _____ TESTED BY: _____



MEDIUM VOLTAGE VACUUM MOTOR STARTER TEST

16215 / 5

CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____ TYPE _____
CATALOG NO. _____ STARTER SIZE _____ FORM _____
SERIES _____ MAXIMUM VOLTAGE _____ INT. RATING _____ kA @ _____ kV
OPERATING VOLTAGE _____ CONTROL VOLTAGE _____ OTHER _____
MOTOR CONTROL CENTER SYSTEM VOLTAGE _____ STARTER IDENTIFICATION _____

OVERCURRENT PROTECTION DEVICES

CONTROL POWER FUSE: MFR. _____ TYPE _____ SIZE _____
MAIN POWER FUSE: MFR. _____ TYPE _____ SIZE _____
OVERLOAD PROTECTION: MFR. _____ TYPE _____ TESTED ☐ YES ☐ NO

INSTRUMENT TRANSFORMER DATA

CONTROL POWER TRANSFORMER: MFR. _____ VA RATING _____ TYPE _____ VOLTAGE _____
CURRENT TRANSFORMER: MFR. _____ RATIO _____ :5 TYPE _____ CAT. NO. _____

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OVERALL CLEANLINESS			
INSULATING MEMBERS			
MECHANICAL CONNECTIONS			
STRUCTURAL MEMBERS			
CUBICLE			
RACKING DEVICES			
SHUTTER			

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OPERATING MECHANISM			
CONTACT FINGERS			
VACUUM INTERRUPTER			
CONTACT EROSION INDICATOR			
CONTACT SEQUENCE			
GROUND CONNECTIONS			
AUXILIARY DEVICES			

INSULATION TEST VOLTAGE _____ KVDC TEST VOLTAGE MULTIPLIER, K1 = _____ K2 = (K1) (TCF)
EQUIPMENT TEMPERATURE _____ °C TEMPERATURE CORRECTION FACTOR TO 20°C, TCF _____
MILLIWATT LOSS TEST VOLTAGE _____ KVDC HIGH POTENTIAL TEST VOLTAGE _____ KVDC _____ KVAC

INSULATION TESTS	RANGE MULTIPLIER	K2	POLE 1 MEGOHMS (P1 - P2)		POLE 2 MEGOHMS (P2 - P3)		POLE 3 MEGOHMS (P1 - P3)	
			READING	20 °C	READING	20 °C	READING	20 °C
POLE TO POLE								
POLE TO FRAME								
LINE TO FRAME								
LOAD TO FRAME								
LINE TO LOAD								

CONTACT MEASUREMENTS		POLE 1	POLE 2	POLE 3
CONTACT TRAVEL - INCHES				
POLE RESISTANCE	RDG.			
	20 °C			
INTERRUPTER RESISTANCE	RDG.			
	20 °C			

CONTROL WIRING - MEGOHMS			
READING		20 °C	

	POLE 1	POLE 2	POLE 3
HIGH POTENTIAL TEST DC			
MILLIWATT LOSS TEST DC			

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED _____ TESTED BY: _____



MOTOR STARTER TEST

16215 / 7

CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____ TYPE _____
CATALOG NO. _____ STARTER SIZE _____ FORM _____
SERIES _____ MAXIMUM VOLTAGE _____ INT. RATING _____ kA @ _____ kV
OPERATING VOLTAGE _____ CONTROL VOLTAGE _____ OTHER _____
MOTOR CONTROL CENTER SYSTEM VOLTAGE _____ STARTER IDENTIFICATION _____

OVERCURRENT PROTECTION DEVICES

CONTROL POWER FUSE: MFR. _____ TYPE _____ SIZE _____
MAIN POWER FUSE: MFR. _____ TYPE _____ SIZE _____
OVERLOAD PROTECTION: MFR. _____ TYPE _____ TESTED ☐ YES ☐ NO

INSTRUMENT TRANSFORMER DATA

CONTROL POWER TRANSFORMER: MFR. _____ kVA _____ TYPE _____ VOLTAGE _____
CURRENT TRANSFORMER: MFR. _____ RATIO _____ :5 TYPE _____ CAT. NO. _____

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
OVERALL CLEANLINESS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
INSULATING MEMBERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MECHANICAL CONNECTIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
STRUCTURAL MEMBERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CUBICLE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RACKING DEVICES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SHUTTER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONTACT FINGERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

DESCRIPTION	INSPECTED	CONDITION	CLEAN/LUBE
MAIN CONTACTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ARCING CONTACTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ARC CHUTES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OPERATING MECHANISM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONTACT SEQUENCE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GROUND CONNECTIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AUXILIARY DEVICES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

INSULATION TEST VOLTAGE _____ kVDC TEST VOLTAGE MULTIPLIER, K1 = _____ K2 = (K1) (TCF)
EQUIPMENT TEMPERATURE _____ °C TEMPERATURE CORRECTION FACTOR TO 20 °C, TCF _____

	RANGE MULTIPLIER	K2	INSULATION RESISTANCE TEST RESULTS - MEGOHMS							
			POLE 1 (P1-P2)		POLE 2 (P2-P3)		POLE 3 (P1-P3)			
			READING	20 °C	READING	20 °C	READING	20 °C		
POLE TO POLE										
POLE TO FRAME										
LINE TO FRAME										
LOAD TO FRAME										
LINE TO LOAD										

CONTACT RESISTANCE MICRO-OHMS	POLE 1	POLE 2	POLE 3

CONTROL WIRING - MEGOHMS			
READING		20 °C	

COMMENTS: _____
DEFICIENCIES: _____

TEST EQUIPMENT USED _____ TESTED BY: _____



SWITCHGEAR INSPECTION

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CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____ TYPE _____
CATALOG NO. _____ CURRENT RATING _____ AMPERES
VOLTAGE CLASS _____ VOLTS ADDITIONAL INFORMATION _____

CONDITION	REMARK NUMBER	INSPECTIONS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		EXTERIOR OF EQUIPMENT
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		ALL INTERIOR OF CUBICLES
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> ALL INTERIOR BUS <input type="checkbox"/> CABLE SYSTEMS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		BUS SUPPORT INSULATORS AND SPACING
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> DOORS <input type="checkbox"/> PANELS <input type="checkbox"/> BRACKETS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> DOOR HANDLES <input type="checkbox"/> LOCKING BARS / MECHANISMS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> INSTRUMENTS <input type="checkbox"/> RELAY COVERS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> BREAKER <input type="checkbox"/> CELL CONTACTS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> CONTROL TRANSFORMERS <input type="checkbox"/> METERING TRANSFORMERS <input type="checkbox"/> INSTRUMENTS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> GROUNDING
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> RAILS <input type="checkbox"/> GUIDES <input type="checkbox"/> ROLLERS <input type="checkbox"/> SHUTTER MECHANISMS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> WIRING <input type="checkbox"/> TERMINAL CONNECTIONS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> GRID ASSEMBLIES <input type="checkbox"/> SPACE HEATERS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> CELL INTERLOCKS <input type="checkbox"/> AUXILIARY CONTACT ASSEMBLIES
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> FILTERS IN PLACE <input type="checkbox"/> VENTS ARE CLEAR
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		
CONDITION	REMARK NUMBER	SYSTEM MAINTENANCE AND CHECKS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		TORQUE-TEST BOLTED BUS (READILY ACCESSIBLE CONNECTIONS ONLY)
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		LUBRICATE DRAW-OUT ASSEMBLY PARTS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		VACUUM AND CLEAN INTERIOR OF CUBICLES
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		OPERATE CONTROLS AND CHECK CORRECTNESS OF FUNCTIONS
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		CHECK AUTOMATIC TRANSFER RELAY OPERATION (IF USED)
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		<input type="checkbox"/> ANNUNCIATOR <input type="checkbox"/> ALARM / TARGET OPERATION
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		
<input type="checkbox"/> G <input type="checkbox"/> P <input type="checkbox"/> C <input type="checkbox"/> I		

G = ITEMS FOUND IN SATISFACTORY CONDITION
P = ITEMS FOUND IN POOR CONDITION AND REQUIRING FUTURE CORRECTIVE ACTION
C = ITEMS REPAIRED OR CORRECTED AND LEFT IN SATISFACTORY CONDITION
I = ITEMS REQUIRING IMMEDIATE CORRECTIVE ACTIONS

TEST EQUIPMENT USED _____ TESTED BY: _____

**INSULATION RESISTANCE**

DESCRIBE WHAT WAS TESTED _____

REFERENCE STANDARD: ☐ NETA ☐ _____ ACCEPTABLE

TEST VOLTAGE: _____ VOLTS DC DURATION: _____ MINUTE(S)	MEASURED RESULT (MEGOHMS)	RECOMMENDED MINIMUM (MEGOHMS)	RESULT ACCEPTABLE (YES / NO)
PHASE - TO - PHASE - AND - GROUND			
PHASE A TO PHASE B, PHASE C AND GROUND			
PHASE B TO PHASE C, PHASE A AND GROUND			
PHASE C TO PHASE A, PHASE B AND GROUND			

OVERPOTENTIAL

DESCRIBE WHAT WAS TESTED _____

REFERENCE STANDARD: ☐ NETA ☐ _____ ACCEPTABLE

TEST VOLTAGE: _____ VOLTS DC DURATION: _____ MINUTE(S)	MEASURED RESULT (MEGOHMS)	RESULT (PASS / FAIL)	RESULT ACCEPTABLE (YES / NO)
PHASE - TO - PHASE - AND - GROUND			
PHASE A TO PHASE B, PHASE C AND GROUND			
PHASE B TO PHASE C, PHASE A AND GROUND			
PHASE C TO PHASE A, PHASE B AND GROUND			

CONNECTION RESISTANCE

CONNECTION FROM CONNECTION TO	MEASURED RESULT (_____ OHMS)	ACCEPTABLE (YES / NO)	CONNECTION FROM CONNECTION TO	MEASURED RESULT (_____ OHMS)	ACCEPTABLE (YES / NO)
PHASE <input type="checkbox"/> A <input type="checkbox"/> _____			PHASE <input type="checkbox"/> A <input type="checkbox"/> _____		
PHASE <input type="checkbox"/> B <input type="checkbox"/> _____			PHASE <input type="checkbox"/> B <input type="checkbox"/> _____		
PHASE <input type="checkbox"/> C <input type="checkbox"/> _____			PHASE <input type="checkbox"/> C <input type="checkbox"/> _____		
CONNECTION FROM CONNECTION TO			CONNECTION FROM CONNECTION TO		
PHASE <input type="checkbox"/> A <input type="checkbox"/> _____			PHASE <input type="checkbox"/> A <input type="checkbox"/> _____		
PHASE <input type="checkbox"/> B <input type="checkbox"/> _____			PHASE <input type="checkbox"/> B <input type="checkbox"/> _____		
PHASE <input type="checkbox"/> C <input type="checkbox"/> _____			PHASE <input type="checkbox"/> C <input type="checkbox"/> _____		

☐ NETA ☐ _____ CONNECTION RESISTANCE REQUIREMENT: COMPARE RESULTS TO RESULTS OF SIMILAR CONNECTIONS.
ARE RESULTS SATISFACTORY ☐ YES ☐ NO (IF NO, SEE COMMENTS FOR AN EXPLANATION)

COMMENTS:

DEFICIENCIES:



TRANSFORMER INSPECTION

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CUSTOMER _____ PAGE _____
ADDRESS _____ JOB # _____
USER _____
OWNER REPRESENTATIVE _____ TELEPHONE _____
DATE _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % EQPT. LOCATION _____
SUBSTATION _____ POSITION _____

NAMEPLATE DATA

MANUFACTURER _____ SERIAL NO. _____
SPECIFICATION NO. _____ KVA _____ / _____ / _____ TYPE _____ CLASS _____
PHASE _____ 3 _____ TEMPERATURE RISE _____ °C IMPEDANCE _____ % B.I.L. RATING _____ kV PRI. _____ kV SEC. _____
COOLANT _____ CAPACITY _____ GALLONS TOTAL WEIGHT _____
WINDING POLARITY _____ SUBTRACTIVE _____ WINDING MATERIAL _____ K FACTOR _____ NA _____
PRIMARY VOLTAGE _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
SECONDARY VOLTAGE _____ / _____ 0 _____ DELTA WYE RATED CURRENT _____ / _____ / _____ AMPERES
TAP VOLTAGES _____
TAP CONNECTIONS _____
TAP SETTING _____ VOLTS # FANS _____ TAP CHANGER: ☒ INTERNAL ☐ EXTERNAL DRY TYPE ☐

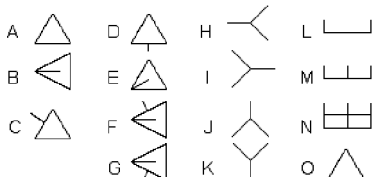
GAUGES:

WINDING TEMPERATURE _____ °C MAXIMUM WINDING TEMPERATURE _____ °C
COOLANT TEMPERATURE _____ °C MAXIMUM COOLANT TEMPERATURE _____ °C RESET TEMPERATURE GAUGES ☐
COOLANT LEVEL _____ PRESSURE VACUUM _____ # LCR COUNTER _____
OTHER GAUGES _____

VISUAL INSPECTION:

BUSHINGS _____ SUPPORT INSULATORS _____ CONNECTIONS _____
PAINT _____ RADIATORS _____ FANS _____
NO-LOAD TAP CHANGER _____ LEAKS _____
FAN PUMP CONTROLS _____
ADDITIONAL EQUIPMENT _____
GROUND CONDUCTOR SIZE _____ AWG/KCM NO. OF GROUND CONDUCTORS _____ GROUND CONDUCTOR CONDITION _____

VECTOR DIAGRAM



PRI. VECTOR: A
SEC. VECTOR: H

POST TEST VOLTAGES

NO LOAD SECONDARY VOLTAGE			
X1 - X2	V	X0 - G	V
X1 - X3	V	X0 - X1	V
X2 - X3	V	X0 - X2	V
		X0 - X3	V

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED _____ TESTED BY: _____

VARIABLE FREQUENCY DRIVE

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SUBSTATION _____ POSITION _____ PAGE _____

EQPT. LOCATION _____ DATE _____

ASSET ID _____ AMBIENT TEMPERATURE _____ °C HUMIDITY _____ % JOB # _____

EQPT. INVENTORY NO. _____ TESTED BY _____

VFD	
MFG:	
EQUIPMENT ID:	
I/D:	
P/N:	
MODEL/HP:	
ENG:	
SYSTEM S/N:	
INPUT:	
OUTPUT:0-460VAC	
ORDER:	
WIRING DIAGRAM:	

MOTOR	
MFG:	
EQUIPMENT ID:	
I/D:	
M/D:	
HP:	
FRAME:	
VOLTS:	
AMPS:	
RPM:	

COOLING FANS:	Fan Manufacturer	
	Fan Model Number	
	Number of Fans	
	Number of Fans Not Operating	
	Number of Fans Replaced	

DLRO READINGS (micro-ohms)	LABEL:	AS FOUND:	AS LEFT:	LABEL:	AS FOUND:	AS LEFT:
	L1					
	L2					
	L3					
	T1					
	T2					
	T3					

TEST LOCATION:	L1 Channel 1	Red Probe
	L2 Channel 2	Black Probe
	Reference to Ground	Ground lead of scope

Input Voltage (Line-Line)

RMS Measurements In Volts AC: L1-L2: L1-L3: L2-L1: L2-L3: L3-L1: L3-L2:

COMMENTS: _____

DEFICIENCIES: _____

Input Voltage (Line-Ground)

RMS Measurements In Volts AC:

L1-G:

L2-G:

L3-G:

Inputs To Negative DC Bus

RMS AC Measurements:

VL1-BUS:

IL1:

VL2-BUS:

IL2:

L3-BUS:

IL3:

DC BUS VOLTAGE AND AC RIPPLE

DC BUS VOLTAGE (in volts):

DC BUS AC RIPPLE (in volts):

Output To Load

RMS Measurements In Volts AC:

T1-T2:

T1-T3:

T2-T1:

T2-T3:

T3-T1:

T3-T2:

Output To Load (Voltage And Current)

RMS Measurements In Volts AC:

T1V-L:

T1I:

T2VL:

T2I:

T3V-L:

T3I:

CONTROL BOARD DC VOLTAGE

CONTROL BOARD DC VOLTAGE (in volts):

SECTION 16322

DISTRIBUTION TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and installing replacement Substation Transformers.

1.2 RELATED SECTIONS

- A. Section 16960 - Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-up of Systems.
- C. Section 16980 - Demonstration and Training.

1.3 REFERENCES

- A. ANSI C57.12.00 - General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- B. ANSI C57.12.28 - Switchgear and Transformers--Pad-Mounted Equipment--Enclosure Integrity.
- C. ANSI C57.12.90 - Test Code for Liquid-Immersed Distribution Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers.
- D. IEEE C57.106 - Guide for Acceptance and Maintenance of Insulating Oil in Equipment.
- E. NEMA 260 - Safety Labels for Padmounted Switchgear and Transformers Sited in Public Areas.
- F. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (International Electrical Testing Association).
- G. NFPA 70 - National Electrical Code.
- H. NECA 409-2002, Dry-Type Transformers (ANSI).

1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals.
- B. Shop Drawings: The following information shall be submitted to the Engineer for liquid-filled transformers:
 - 1. Master drawing index.

2. Front view elevation.
 3. Floor plan.
 4. Schematic diagrams.
 5. Nameplate diagram.
 6. Component list.
 7. Conduit entry and LV bus exit locations.
 8. Ratings including:
 - a. kVA.
 - b. Voltage.
 - c. Continuous current (FLA).
 - d. Basic Impulse level.
 - e. Impedance.
 9. Cable terminal sizes.
- C. The following information shall be submitted to the Engineer for dry-type transformers:
1. Outline dimensions and weights
 2. Technical certification sheet
 3. Transformer ratings including:
 - a. kVA
 - b. Primary and secondary voltage
 - c. Taps
 - d. Basic Impulse Level (BIL) for equipment over 600 volts
 - e. Design impedance
 - f. Insulation class and temperature rise
 - g. Sound level
 4. Product data sheets.
- D. Where applicable the following additional information shall be submitted to the Engineer:
1. Busway connection.
 2. Connection details between close-coupled assemblies.
 3. Composite floor plan to close-coupled assemblies.

1.5 SUBMITTALS FOR INFORMATION

- A. Section 01300 - Submittals: Submittals for information.
- B. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- C. Submit manufacturer's installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.6 PROJECT CLOSEOUT SUBMITTALS

- A. Section 01700 - Contract Closeout: Submittals for project closeout.

- B. The following information shall be submitted for record purposes prior to final payment:
 - 1. Final as-built drawings and information for items listed in sub-section 1.04.
 - 2. Connection diagrams.
 - 3. Certified production test reports.
 - 4. Installation information.
- C. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; procedures for sampling and maintaining fluid.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum ten years documented experience, and with service facilities within 100 miles of Project.
- B. Testing Agency: Company member of InterNational Electrical Testing Association and specializing in testing products specified in this Section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. All transformers shall be UL listed and bear the UL label.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Accept transformers on site. Inspect for damage.
- C. 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.

1.10 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.11 MAINTENANCE MATERIALS

- A. Section 01700: Contract closeout requirements.
- B. Operation and maintenance manuals shall include the following information:
 - 1. Instruction books and/or leaflets.
 - 2. Drawings and information required by sub-section 1.6

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Eaton Cutler-Hammer
- B. Asea Brown Boveri (ABB)
- C. General Electric
- D. Square D

2.2 LIQUID-FILLED TRANSFORMERS

- A. Liquid-filled Transformers: ANSI C57.12.26, three phase, self-cooled or fan cooled transformer unit.
- B. Cooling and Temperature Rise: ANSI C57.12.00; Class ONAF. 55/65 degrees C, self-cooled or fan cooled, to match existing.
- C. Insulating Liquid: Less flammable hydrocarbon fluid conforming to IEEE C57.121, Cooper Power Systems Envirotemp FR3 or equal.

2.3 SERVICE CONDITIONS (LIQUID-FILLED TRANSFORMERS)

- A. Meet requirements for usual service conditions described in ANSI C57.12.00.
- B. Maximum Ambient Temperature: 104 degrees F (40 degrees C).
- C. Altitude: 600 feet above sea level.
- D. Load Current Harmonic Factor: 0.05 per unit, maximum.

2.4 RATINGS (LIQUID-FILLED TRANSFORMERS)

- A. Capacity: Shall match the existing transformer.
- B. Primary Voltage: 4.8 kV delta connected.
- C. Taps: ANSI Standard primary MV Taps +/- two - 2-1/2 % full capacity.
- D. Secondary Voltage: 480/277 volts, wye connected.
- E. Impedance: 5.75 percent minimum.
- F. MV Basic Impulse Level: 95 kV; LV Basic Impulse Level: 30 kV min.
- G. Energy Efficiency: as required by DOE 10 CFR Part 431 Energy Conservation program for Commercial Equipment.

2.5 ACCESSORIES (LIQUID-FILLED TRANSFORMERS)

- A. Transformer features and accessories shall include:
1. De-energized tap changer with cover mounted, externally operated, padlockable handle.
 2. Combination drain and filter valve and sampling device.
 3. Manual gas pressure test connection.
 4. One inch filling plug and filter, press connection in cover.
 5. Dial type liquid thermometer.
 6. Magnetic liquid level gauge.
 7. Provisions for lifting; provisions for jacking; base design for skidding or rolling in two directions.
 8. Ground pad.
 9. Instruction nameplate.
 10. Pressure/vacuum gauge.
 11. Welded-on main tank cover and handhole in cover.
 12. Pressure relief device that automatically reseals after operation, with semaphore operation indicator.
 13. Alarm contacts shall be provided on the following devices with wiring to terminals in the control cabinet:
 - a. Dial type thermometer.
 - b. Liquid level gauge.
 - c. Pressure relief device.
 14. Control cabinet with fan controls, control terminals, and alarm terminals (fan cooled units only).
 15. Control power transformer, 4800-240/120V. AC for fans (fan cooled units only).
- B. Terminal Compartments
1. The transformer unit supplied shall include a HV terminal compartment and a LV compartment with busway flange. Connections between the primary switch and transformer shall be cable and between the transformer and secondary switchgear shall be busway.

2.6 CONSTRUCTION (LIQUID-FILLED TRANSFORMERS)

- A. The unit shall be mineral oil filled and shall be in accordance with the latest edition of the N.E.C..
- B. The transformer shall carry its continuous rating with average winding temperature rise by resistance that shall not exceed 55 degrees C, based on average ambient of 30 degrees C over 24 hours with a maximum of 40 degrees C. The insulation system shall allow an additional 12% kVA output at 65 degrees C average winding temperature rise by resistance, on a continuous basis, without any decrease in normal transformer life. All transformer windings, busbars, and conductors shall be copper.
- C. Transformer shall include all devices, wiring, fans, and auxiliary equipment necessary for automatic temperature controlled forced air cooling to obtain an additional 15% capacity on units 750 through 2,000 kVA and an additional 25% capacity on units 2,500 kVA and over. Control power for fans shall be 240/120V AC, single phase furnished from a control

transformer. All wiring for external connections shall be terminated in a NEMA Type 4X control cabinet. The control cabinet shall also contain the fan controls.

- D. The transformer shall be designed to carry short time emergency overloads in accordance with ANSI C57.12.92 as applicable. Duration and magnitude of designed withstand capability shall be as outlined in ANSI C57.12.90 and the latest draft of the IEEE Short Circuit Test code.
- E. The transformer shall be designed to meet the sound level standards for liquid transformers as defined in NEMA TR1.
- F. All high voltage windings shall have nomex wrapped insulation for copper windings prior to winding the coils. Insulation between layers of the windings shall be by Insuldur paper or equal.
- G. The main transformer tank and attached components shall be designed to withstand pressures 25% greater than the required operating design value without permanent deformation. Construction shall consist of carbon steel plate reinforced with external sidewall braces. All seams and joints shall be continuously welded.
- H. Each radiator assembly shall be individually welded and receive a quality control pressurized check for leaks. The entire tank assembly shall receive a similar leak test before tanking. A final six-hour leak test shall be performed after the transformer is tanked, welded and completed to ensure that there are no leaks before shipment.

2.7 FACTORY FINISHING (LIQUID-FILLED TRANSFORMERS)

- A. Clean surfaces before applying paint.
- B. Apply corrosion-resisting primer to all surfaces.
- C. Outdoor transformers shall be painted utilizing an initial phosphatizing cleaning treatment, followed by Zinc Rich Coating (ZRC) as a primer, and a DuPont "Imron" polyurethane enamel (#326-Y-67639) as a finish coat, color as determined by the Owner. Two spare paint touch-up kits shall be provided to the Owner.

2.8 DRY-TYPE TRANSFORMERS

- A. Dry-type Transformers: ANSI C57.12.50, three phase, self-cooled transformer unit.

2.9 SERVICE CONDITIONS (DRY-TYPE TRANSFORMERS)

- A. Maximum Ambient Temperature: 104 degrees F (40 degrees C).
- B. Altitude: 600 feet above sea level.
- C. Load Current Harmonic Factor: 0.05 per unit, maximum.

2.10 RATINGS (DRY-TYPE TRANSFORMERS)

- A. kVA and voltage ratings shall match the existing transformer.
- B. Transformers shall be designed to operate at the nameplate base rating without the use of supplemental cooling or fans.
- C. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96
- D. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

Up	to	9 kVA	-	40 db
10	to	50 kVA	-	45 db
51	to	150 kVA	-	50 db
151	to	300 kVA	-	55 db
301	to	500 kVA	-	60 db
501	to	700 kVA	-	62 db
701	to	1000 kVA	-	64 db

- E. Impedance: 4.5 to 6.5
- F. MV Basic Impulse Level: 30 kV, LV Basic Impulse Level: 10 kV minimum.
- G. Energy Efficiency: as required by DOE 10 CFR Part 431 Energy Conservation program for Commercial Equipment.

2.11 CONSTRUCTION (DRY-TYPE TRANSFORMERS)

- A. Insulation Systems
 - 1. Transformers shall have 220 degrees C insulation system with 115 degree C rise, ventilated design.
 - 2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24 hour average ambient of 30 degrees C.
 - 3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.
- B. Core and Coil Assemblies
 - 1. Transformer core shall be constructed with high-grade, non-aging, grain-oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the normal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of electrical grade aluminum with continuous wound construction.
 - 2. On units rated 30 kVA and below, the core and coil assembly shall be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture

- proof, shock-resistant seal. The core and coil encapsulation system shall minimize the sound level. Taps shall be two (2) steps below nominal voltage in 5% increments.
3. On units rated 45 kVA and above, the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and seal out moisture. The assembly shall be installed on vibration absorbing pads. Taps shall be two (2) steps above and four (4) steps below nominal voltage in 2.5% increments.

2.12 ENCLOSURE (DRY-TYPE TRANSFORMERS)

- A. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be grounded to the enclosure.
- B. On units rated 30 kVA and below, the enclosure construction shall be NEMA Type 3R, with lifting eyes.
- C. On units rated 45 kVA and above, the enclosure construction shall be ventilated, NEMA Type 2, drip-proof, with lifting holes or lifting eyes. All ventilation openings shall be protected against falling dirt.

2.13 FINISH (DRY-TYPE TRANSFORMERS)

- A. Enclosures shall be finished with ANSI 61 color weather-resistant enamel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

3.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Manufacturer Quality Control.
- B. The following standard factory tests shall be performed on all equipment provided under this Section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
1. Resistance measurements of all windings on the rated voltage connection of each unit and at the tap extremes of one unit only of a given rating on this project.
 2. Ratio tests on the rated voltage connection and on all tap connections.
 3. Polarity and phase-relation tests on the rated voltage connections.
 4. No-load loss at rated voltage on the rated voltage connection.
 5. Exciting current at rated voltage on the rated voltage connection.
 6. Impedance and load loss at rated current on the rated voltage connection of each unit and on the tap extremes of one unit only of a given rating on this project.

7. Applied potential test.
 8. Induced potential tests.
- C. The following special factory tests shall be performed on the equipment provided under this Section.
1. Temperature test(s) shall be made on all units furnished for this project. When a transformer is supplied with auxiliary cooling equipment to provide more than one rating, temperature tests as listed above shall be made on the lowest kVA, self-cooled rating and the highest kVA, forced air cooled rating. All temperature tests shall be in accordance with the latest revision of ANSI and NEMA standards.
 2. Basic impulse test on all windings for 100% quality assurance.
- D. The manufacturer shall provide three (3) certified copies of factory test reports.

3.3 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations (NECA 409-2002 standards for dry-type transformers).
- B. Install plumb and level.
- C. Install safety labels to NEMA 260.

3.4 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance, Section 16960, and Section 16970: Field inspection, testing, adjusting, and balancing.
- B. 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 herein.
- C. Perform inspections and tests listed in NEMA ATS, Section 7.2. Include the following field tests:
1. Measure primary and secondary voltages for proper tap settings.
 2. Megger primary and secondary windings.
 3. Power factor or dissipation-factor tests in accordance with manufacturer's instructions.
 4. Winding-resistance tests for each winding at nominal tap setting.
 5. Individual excitation current tests on each phase.
 6. Insulating liquid specific gravity, power factor, water content, dissolved gas, and total combustible gas for liquid-filled transformers.
 7. Operational test and adjustments on fan controls and alarm functions.

3.5 ADJUSTING

- A. Section 01700 - Contract Closeout: Adjusting installed work.

- B. Adjust primary taps so that secondary voltage is within 2 percent of rated voltage.

3.6 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.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification before final payment is made.

END OF SECTION

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SECTION 16347

PRIMARY SWITCHGEAR COMPONENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metering, control, and protective devices for metal clad switchgear.

1.2 RELATED SECTIONS

- A. Section 16960 - Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-up of Systems.
- C. Section 16980 - Demonstration and Training.

1.3 REFERENCES

- A. IEEE C37.90 - 1989, Standard for Relay and Relay Systems Associated with Electric Power Apparatus.
- B. ANSI C57.13 - Requirements for Instrument Transformers.
- C. NFPA 70 - National Electrical Code.
- D. Standards - The switchgear specified herein and all components thereof shall be constructed and tested in conformity, as a minimum, with all current applicable standards of ANSI, IEEE and NEMA and as specified herein.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.

1.5 SUBMITTALS FOR INFORMATION

- A. Section 01300 - Submittals: Submittals for information.
- B. Test Reports: Indicate procedures and results for specified field testing and inspection.
- C. Submit manufacturer's installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

- F. Product Sheets and Descriptive Bulletins.

1.6 PROJECT CLOSEOUT SUBMITTALS

- A. Section 01700 - Contract Closeout: Submittals for project closeout.
- B. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Equipment shall be handled and stored in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 PROTECTIVE RELAYS AND INSTRUMENTS

- A. Current Transformers
 - 1. The current transformers shall have an accuracy classification for relaying of C100 in conformity with the current American Standard Requirements of Instrument Transformers, ANSI C-57.13.
 - 2. The current transformers shall be designed for installation in switchgear. The primary shall be insulated such that the current transformer installation will be equal to the BIL of the switchgear. The current transformers shall have sufficient thermal capacity and mechanical strength to withstand currents equal to the maximum short circuit rating of the associated switchgear.
 - 3. Each current transformer shall be equipped with shorting blocks and each set of current transformers shall have test blocks.
- B. Potential Transformers
 - 1. The voltage ratio of the potential transformers shall be 4800/120, and the primary connections shall be configured Wye to match the utility source. The transformers shall have a full wave impulse rating of not less than 60 kV for 7.2 kV class equipment.
 - 2. The transformers shall have an ANSI accuracy classification of 0.3.
- C. Differential Protection Relays (Device No. 87)
 - 1. Differential protection relays shall be high speed, high impedance, intended primarily for bus differential protection. Differential protection relay shall provide high speed and sensitive protection against faults within the protected zone of substations or equipment. Protective relay shall be as manufactured by ABB Type KAB (electromagnetic).

- D. Undervoltage, Overvoltage, and Phase Sequence Voltage Relays (Device No. 27/47/59)
 - 1. The multiple function relay shall be capable of detecting the following abnormal voltage conditions:
 - a. Undervoltage - 75 to 90 percent of normal voltage.
 - b. Overvoltage - 100 to 115 percent of normal voltage.
 - c. Phase sequence shall be adjustable at 75 to 90 percent of normal voltage and shall be able to detect phase failure, incorrect phase sequence, and negative sequence.
 - 2. The setting of the relays, timing, and contact closing shall be incorporated in the overall protection and shall avoid tripping on transient conditions.
 - 3. The relays shall be as manufactured by ABB Type CVQ.
- E. Lock-Out Relay (Device No. 86)
 - 1. The overcurrent lock-out relay shall be of the electrically operated, manual reset switchboard type. The relay shall operate at 125 VDC and shall be equipped with contacts rated not less than 20 amperes continuous duty. Two spare contacts shall be provided in addition to contacts required.
 - 2. The relays shall be Electros witch Type WL-2.

2.2 MEDIUM VOLTAGE TRIP UNIT (MVTU)

- A. The protection relays (MVTU) shall be microprocessor-based three phase relays, including communication capability via local area network. The relays shall be Eaton Cutler-Hammer Digitrip 3000.
- B. MVTU Three-Phase Protective Device
 - 1. Devices for phase inverse-time over-current, instantaneous over-current, and ground fault protection, ANSI 50/51, 50/51G, or 50/51N, shall be incorporated into a single device, having all features and functions herein specified.
 - 2. The device shall be of the programmable, solid-state, microprocessor based, multi-function type that operates from the 5 ampere secondary output of current transformers. The device shall provide ANSI 50/51 protective functions for each of the three phases, and ANSI 50/51N or 50/51G ground fault protection functions. The device shall be true RMS sensing of each phase and ground. Ground element shall be capable of being utilized in residual or zero sequence, or ground source connection schemes, or deactivated.
 - 3. The protection curves shall be field programmable for close coordination with downstream devices. The time over-current protection curves for phase and ground shall have field selectable FLAT, IT, I²T, and I⁴T long delay slopes as well as selectable short delay pick-up and short delay time settings to coordinate with existing overcurrent relays and power fuses. The phase instantaneous overcurrent trip shall have field programmable pick-up points from 1.0 to 25 times current transformer primary rating or "NONE". In addition, discriminator circuit, selectable "ON" or "OFF," shall be included such that when phase instantaneous overcurrent has been programmed to "NONE," the discriminator circuit shall protect against currents exceeding 11 times current transformer primary rating, only when the breaker is being closed. The device shall have independent time-overcurrent (ANSI 51) and instantaneous (ANSI 50) overcurrent trip contacts.

4. The device shall have a built-in alphanumeric display capable of displaying the following information with metering accuracy of one (1) percent of primary current transformer rating or full scale:
 - a. Individual phase currents.
 - b. Ground current.
 - c. Cause of trip.
 - d. Magnitude and phase of current causing trip.
 - e. Peak current demand for each phase and ground since last reset.
 - f. Current transformer Primary rating.
 - g. Programmed phase and ground set-points.
5. Device shall have the following features:
 - a. Integral manual testing capability for both phase and ground.
 - b. A full bus differential scheme shall be required for both phase and ground in addition to specified time over-current and instantaneous over-current phase and ground fault protection. Bus differential scheme shall be provided with separate differential current transformers for all incoming and outgoing loads, as well as appropriate differential relays (ANSI 87 and 87G) as approved by the Engineer. Where zone selective interlocking is an integral part of the protective devices and is implemented for short time and ground fault protection, the bus differential scheme is not required.
 - c. Continuous self-testing of internal circuitry.
 - d. Unit failure alarm contact for customer use.
 - e. Programmable lockout/self-reset after trip function (Device No. 86).
 - f. Programmable set-points for device curve selection.
 - g. Programmable inputs, such as, current transformer ratios.
 - h. Access to program and test modes shall be via sealable hinged cove for security.
6. Device shall be suitable for operating temperatures from -30 degrees to +55 degrees C. Device shall be suitable for operating with humidity from 0 to 95% relative humidity (non-condensing).
7. Device shall have communication capability via local area network. Device shall be capable of the following over the communication network:
 - a. Ability to transmit all information contained in the device such as, currents, set-points, cause of trip, magnitude of trip current, actual trip curve, and open-close trip status.
 - b. Ability to close and open the associated breaker from remote location over the communication network.
8. Device Alarm and/or Trip contacts shall not change state if power is lost or an undervoltage occurs. These contacts shall only cause a trip upon detection of an over-current or fault condition based upon programmed settings.
The device shall be suitable for operating on control power with a nominal voltage of 125 volt DC. The device shall remain operable for variations of DC power from 105 volts to 125 volts.

2.3 METERS AND INSTRUMENTS

A. Meter Monitor and Protection (MMP) Device

1. The digital line Meter Monitor and Protection device shall be Cutler-Hammer type IQ DP-4000 Series having the features and functions specified below. The device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the device shall auto range between units, kilo-units and mega-units. The device shall provide the adjustable protection functions indicated and the capability to communicate data via twisted pair network. The device shall be UL listed, cUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

Metered Values (Accuracy % Full Scale)

Alarm Functions

Ac Phase Amperes +/- (0.3%)	Voltage Phase Loss
Ac Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
Vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% - 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
Varhours +/- (0.6%)	(105 to 140% - 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% - 5% steps)
Watt Demand (with	Time Delay for Overvoltage,
10-, 15-, 20-, 25-,	Undervoltage, and Phase
30-, 45-, 60-minute interval)	Unbalance (0 to 20 seconds –
% THD (through 31 st harmonic)	1-sec. steps)

Voltage – minimum/maximum
Current – minimum/maximum
Power – minimum/maximum
Power Factor – minimum/maximum
Frequency – minimum/maximum
Peak % THD
Peak Demand

2. Input ranges of the device shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes.
3. Control power shall be capable of being supplied from separate remote power source (96 to 264 Vac or 100 to 350 Vdc).
4. Provide the following features:
 - a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.
 - b. Load shed feature, which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.

- c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240 Vac or 30 Vdc resistive. In addition, provide a separate Form C (NO/NC) contact to provide a programmable kilowatt-hour pulse output.
- 5. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible two-wire local area network to a central personal computer for storage and/or printout. The network shall also be capable of transmitting data in RS-232c format via a translator module.

2.4 CONTROL DEVICES

- A. Control Switches
 - 1. The circuit breaker control switches shall be of the rotary switchboard type and shall have a voltage rating of 600 volts. The contacts shall have a continuous current rating of not less than 20 amperes at 125 VDC. These switches shall be Electroschwitch Type W-2, Square D, or equal.
 - 2. The circuit breaker control switches shall be of the three-position type with spring return to the neutral position. Each switch shall be equipped with a pistol grip operating handle and a mechanically operated target to indicate the last operation of the switch. The positions of the switch shall be indicated by a pointer and the legends "TRIP" and "CLOSE".

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

3.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Manufacturer quality control.
- B. Test in accordance with ANSI C37.20.1.

3.3 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance and Section 16970 – Calibration and Start-up of Systems: Field inspection, testing, adjusting.

3.4 ADJUSTING

- A. Section 01700 - Contract Closeout: Adjusting installed work.
- B. Adjust protective relays in accordance with recommendations in the coordination study.

C. Service

1. The Contractor shall have a qualified factory representative, acceptable to the Owner, inspect and make all necessary adjustments to the primary switchgear components after installation. Testing shall be as specified under Section 16960.

3.5 DEMONSTRATION

- A. Section 01700 - Contract Closeout, Section 16970 – Calibration and Start-up of Systems, and Section 16980 - Demonstration and Training: Start-up and Demonstration of installed work.

END OF SECTION

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SECTION 16349

MEDIUM VOLTAGE STARTER LINE-UP COMPONENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Medium voltage starter line-up components.

1.2 RELATED SECTIONS

- A. Section 16960 - Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-Up of Systems.
- C. Section 16980 - Demonstration and Training.

1.3 REFERENCES

- A. ANSI/NEMA ICS-2-324.
- B. UL347.

1.4 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.

1.5 SUBMITTALS FOR INFORMATION

- A. Submit under Provisions of Section 01300.
- B. Submit manufacturer's installation instructions.

1.6 SUBMITTALS FOR CLOSEOUT

- A. Section 01700 - Contract Closeout: Submittals for project closeout.
- B. Operation and maintenance manuals shall include the following information:
 - 1. Instruction books and/or leaflets.
 - 2. Recommended renewal parts list.
- C. The following information shall be submitted for record purposes prior to final payment:
 - 1. Wiring diagrams.
 - 2. Installation information.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc., or other testing firm acceptable to the authority having jurisdiction, as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Protect products from weather and moisture.

PART 2 PRODUCTS

2.1 MOTOR STARTER COMPONENTS

- A. Meter Monitor and Protection (MMP) Device
 - 1. The digital line Meter Monitor and Protection device shall be Cutler-Hammer type IQ DP-4130 having the features and functions specified below. The device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the device shall auto range between units, kilo-units and mega-units. The device shall provide the adjustable protection functions indicated and the capability to communicate data via twisted pair network. The device shall be UL listed, cUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

Metered Values (Accuracy % Full Scale)	Alarm Functions
Ac Phase Amperes +/- (0.3%)	Voltage Phase Loss
Ac Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
Vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% - 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
Varhours +/- (0.6%)	(105 to 140% - 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% - 5% steps)
Watt Demand (with	Time Delay for Overvoltage,
10-, 15-, 20-, 25-,	Undervoltage, and Phase
30-, 45-, 60-minute interval)	Unbalance (0 to 20 seconds –
% THD (through 31 st harmonic)	1-sec. steps)
Voltage – minimum/maximum	
Current – minimum/maximum	

Power – minimum/maximum
Power Factor – minimum/maximum
Frequency – minimum/maximum
Peak % THD
Peak Demand

2. Input ranges of the device shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes.
3. Control power shall be capable of being supplied from separate remote power source (96 to 264 Vac or 100 to 350 Vdc).
4. Provide the following features:
 - a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.
 - b. Load shed feature, which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.
 - c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240 Vac or 30 Vdc resistive. In addition, provide a separate Form C (NO/NC) contact to provide a programmable kilowatt-hour pulse output.
5. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible two-wire local area network to a central personal computer for storage and/or printout. The network shall also be capable of transmitting data in RS-232c format via a translator module.

2.2 MOTOR PROTECTION RELAY (MPR)

- A. The MPR shall be Eaton/Cutler-Hammer type MP-3000 relay. The MPR shall meet UL 1053, CUL and CSA standards.
- B. The true rms current into the motor shall be constantly monitored, and by means of a protective algorithm, separated into positive and negative sequence components. These components shall be used to determine the heating effects on the stator and rotor of the motor to provide maximum motor protection and utilization. The relay shall be capable of being connected by three-wire conductor or fiber optic to a remote Universal Resistance Temperature Detection Module (URTDM) located at the motor to monitor up to six (6) motor winding, four (4) bearing and one (1) auxiliary RTD inputs. The MPR shall integrate the temperature input data from the URTDM with the protective algorithm. The protective curve algorithm shall be adaptive based on the motor temperature as measured by the URTDM. The protective algorithm shall provide faster trip times for higher temperatures providing maximum motor protection and shall operate with a longer trip time for lower temperatures allowing maximum motor utilization. The MPR shall provide the following protective functions:
 1. Motor running time overcurrent protection (IEEE Device 49/51).
 2. Adjustable instantaneous overcurrent protection (IEEE Device 50) with adjustable start delay in one-cycle increments.
 3. Adjustable current unbalance protection (IEEE Device 46 – adjustable in percent unbalance).

4. Rotor protection.
 5. Underload trip with start and run time delays (IEEE Device 37/2).
 6. Jam trip with start and run time delays.
 7. Auxiliary overtemperature protection with URTDM.
 8. Zero sequence ground fault protection (IEEE Device 50/51G) or Residual ground fault protection (50/51N) with adjustable start delay and run delay in one-cycle increments.
 9. Stator protection with URTDM (IEEE Device 49).
 10. Motor bearing overtemperature protection with URTDM (IEEE Device 38).
 11. Load bearing overtemperature protection with URTDM (IEEE Device 38).
- C. Only the following settings shall be needed to define the motor thermal protective curve:
1. Motor full-load amperes (FLA).
 2. Locked rotor current in percent of FLA.
 3. Locked rotor stall time in seconds.
 4. Ultimate trip current based on motor service factor.
- D. The following control functions shall be provided by internal solid-state based timers or relays:
1. Incomplete sequence delay (IEEE Device 2/19).
 2. Limitation on number of starts per time period in minutes (IEEE Device 66).
 3. Anti-backspin time delay (IEEE 2).
 4. Programmable transition relay based on current and/or time.
 5. Time between starts.
 6. Number of cold starts.
 7. Mechanical load shedding and restore function with timers.
 8. Zero speed switch input timer for use with long accelerating time motors.
- E. The MPR shall have a real-time clock for time tagging of events, operations, and history. The relay shall have quick and easy access to monitored values, view settings, motor history, and motor log records. The relay shall monitor and display the following:
1. Motor currents: average current (I_{ave}), individual phase and ground current in primary amperes and percent of full load and percent phase unbalance.
 2. Motor RTD: Individual winding, motor bearing, load bearing and auxiliary temperatures.
 3. Motor: Percent I^2t (thermal accumulation), time until next start can occur, remaining number of starts, and time left on oldest start.
- F. The MPR shall be capable of accommodating external current transformers with ranges from 10/5 through 4000/5 amperes. Provide three (3) current transformers sized per manufacturer's recommendations based on motor full-load amperes and service factor. Where ground fault protection is specified, it shall be from an independent measuring circuit that utilizes either a separate zero sequence current transformer (50/51G) or residual scheme utilizing the three-phase current transformers (50/51N). For zero sequence ground fault protection, provide a 50/5-ampere zero sequence transformer.
- G. Two user-programmable discrete inputs shall be provided for external control or trip functions. Programmable input functions shall be included for shutdown based on external

contacts for incomplete sequence of operation and remote trip, remote reset, differential trip, motor stop, reset disable, zero speed switch, or emergency override.

- H. The MPR shall be capable of providing a 4-20 mA output signal proportional to either the average of the three-phase currents, hottest winding RTD temperature, or I^2t level.
- I. The unit shall draw its power from a control power transformer located in the starter. The MPR shall be suitable for either 50 Hz or 60 Hz.
- J. The device shall have separate Form C (NO/NC) Trip, two programmable Form C (NO/NC) Alarm and Auxiliary contacts. All contacts shall have ratings of 10 amperes at 115/240 Vac or 30 Vdc resistive. The alarm and auxiliary relay output contacts shall be programmable to operate from any internal protection function or from a discrete input signal such as differential trip or remote trip. All contacts shall be programmable to function in either a mode 1 (non-fail-safe) or mode 2 (fail-safe) operation. The device shall be capable of providing a 4-20 mA output signal proportional to one of the following user selectable parameters:
 - 1. Average of the three-phase currents.
 - 2. Hottest winding RTD temperature.
 - 3. I^2t level.
- K. The relay shall be capable of monitoring electrical current, receiving commands from remote sources either by contact closure or digital data, and giving commands by means of contact closure to the motor starter and other devices under its control. The MPR shall be capable of displaying information by alphanumeric display to the operator or by digital communication signals to a remote location.
 - 1. The combination relay and operator panel shall be mounted on the door of the starter. Specific data entry to suit the actual motor application shall be programmed into the device by means of the operator panel pushbuttons.
 - 2. Entered data shall be stored in non-volatile memory so as not to require battery backup. Non-volatile memory shall be capable of storing all setup information event after power failure, all monitored information at the time of a trip, and cause of trip even after power failure. Access to all programmed set points shall be restricted by means of a secured and sealed access cover.
 - 3. Alphanumeric display shall read out (in English) complete description of all protective functions, e.g., “instantaneous overcurrent” and all monitored and programmable data such as “percent of full load in amps” and “motor bearing temperature.”
 - 4. The MPR shall be user-selectable to either be programmable while the motor is running or to require a motor shutdown for programming. If configured for programming while the motor is running, the protection shall stay active while programming is based on previous settings. Upon the user exiting the programming mode, the new settings shall take effect.
 - 5. The MPR shall have a user-selectable emergency override feature to reset I^2t thermal accumulation and deactivate start inhibit timers for emergency starting of the motor. The emergency override feature shall be capable of being activated from an access-restricted button, communications, or via a contact input into the MPR.

6. The MPR shall provide a programmable control function for reduced voltage applications for the transition from reduced to full-voltage starting. The transition shall be programmable based on current, time, current and time.
- L. The MPR shall provide the following data logging and display capability for history including the date and time from when the history was last reset and counting began. The history shall include:
 1. Resettable motor history for operational counter, runtime, highest starting and running currents, highest percent phase unbalance, maximum winding, bearing and load RTD temperature, and number of emergency overrides.
 2. Resettable trip history for number of trips for ground faults, overloads, instantaneous overcurrent, JAM, underload, phase unbalance, RTDs, phase reversal, incomplete sequence, remote differential, communication, starts exceeded, time between starts, and transition.
 3. Resettable alarm history for number of alarms, for ground faults, overloads, JAM, underload, phase unbalance, RTDs, starts exceeded.
 4. A permanent history record which cannot be reset shall include local trips, run time and operations count.
 5. A log book including a chronological list of events or operations as detected by the MPR, such as, starts, stops, setting change, emergency override, trips, alarms or changes in the state of discrete inputs.
 6. An event log providing detailed information on trips and alarms including phase and ground currents, percent phase unbalance, maximum RTD temperatures and cause of trip or alarm.
 7. A start log providing information on the four most recent starts including maximum phase and ground starting current, maximum percent unbalance, time from start to transition, current at transition, and time from start to run to trip.
- M. The MPR shall be provided in a quick release drawout case. The MPR shall have a user-programmable armed/disarmed feature with alarm indication. The disarmed mode shall permit relay installation while the motor is running with the trip outputs blocked. The drawout case shall have a spare self-shorting contact to allow for continuous motor running or relay removed alarm functions.

Provide an addressable communications card capable of changing set points, transmitting all data, including trip/alarm data, a starting profile of the average phase current for the two most recent starts, all over a two-wire area network to a central computer for storage and/or printout.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

3.2 SOURCE QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Manufacturer quality control.

3.3 INSTALLATION

- A. The Contractors shall install all components per the manufacturer's recommendations.

3.4 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 components.

3.5 FIELD ADJUSTMENTS

- A. Program the motor protective relays in accordance with the recommendations documented by the Owner.

3.6 FIELD TESTING

- A. Sequence the control circuit to verify that the starter will start and run properly.
- B. Prepare and start systems under provisions of Sections 01400 and 16970.

END OF SECTION

SECTION 16426

LOW VOLTAGE SECONDARY SWITCHGEAR COMPONENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Low voltage secondary switchgear drawout power air circuit breakers.
- B. Microprocessor-based metering, protection, and control devices.
- C. Potential transformers, current transformers, and ground fault protection devices.

1.2 RELATED SECTIONS

- A. Section 16960 - Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-up of Systems.
- C. Section 16980 - Demonstration and Training.

1.3 REFERENCES

- A. The low voltage secondary switchgear components shall be designed, manufactured, and tested in accordance with the following latest applicable standards:
 - 1. ANSI-C37.20.1 - Metal-Enclosed low-voltage power circuit breaker switchgear.
 - 2. ANSI-C37.13 - Low-voltage power circuit breakers.
 - 3. ANSI-C37.17 - Trip devices.
 - 4. ANSI-C37.90 - Relays.
 - 5. ANSI-C39.1 - Meters.
 - 6. NEMA SG-3 - Low-voltage power circuit breakers.
 - 7. UL 1558.
 - 8. ANSI C57-13 - Requirements for Instrument Transformers.
 - 9. NFPA 70, Latest National Electrical Code.

1.4 SUBMITTALS—FOR REVIEW/APPROVAL

- A. Section 01300: Procedures for submittals.
- B. The following information shall be submitted to the Engineer:
 - 1. Component list.
 - 2. Major component ratings including:
 - a. Voltage.
 - b. Continuous current.
 - c. Interrupting ratings.

1.5 SUBMITTALS — FOR INFORMATION

- A. Section 01300: Submittals for information.
- B. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- C. Submit manufacturer's installation instructions.
- D. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.

1.6 PROJECT CLOSEOUT SUBMITTALS

- A. Section 01730: Operation and Maintenance Data, Submittals for project closeout.
- B. Include copy of manufacturer's certified drawings and production test reports in project record documents.
- C. Operation Data: Include operating instructions for manually and electrically opening and closing circuit breakers.
- D. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; instructions for circuit breaker removal, replacement, testing and adjustment, and lubrication; procedures for sampling and maintaining fluid.
- E. Final as-built drawings, wiring diagrams, and information for items listed in sub-section 1.4.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. The switchgear components shall bear a UL label.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600: Transport, handle, store, and protect products.
- B. 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 the time of shipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Eaton Cutler-Hammer to match existing equipment in Substations LL-1, T1, D1, and IP1.

- B. General Electric Company to match existing equipment in Substations I-1, F-1, and P1.

2.2 RATINGS

- A. Voltage rating shall be 600 VAC.
- B. All circuit breakers shall have a minimum symmetrical interrupting capacity equal to the replaced circuit breaker. To assure a fully selective system, all circuit breakers shall have 30 cycle short time withstand ratings equal to their symmetrical interrupting ratings, regardless of whether equipped with instantaneous trip protection or not.
- C. Where circuit breakers are equipped with current limiters, the combination shall have short time ratings in accordance with the characteristics of the limiter selected.
- D. All ratings shall be tested to the requirements of ANSI C37.20.1, C37.50 and C37.51 and UL witnessed and approved.

2.3 CIRCUIT BREAKERS

- A. All protective devices shall be drawout, low-voltage, power, air circuit breakers.
- B. All breakers shall be manually operated (MO), unless existing are electrically operated (EO).
- C. Power circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes RMS at rated voltage.
- D. Air breakers shall incorporate specially designed circuit-interrupting devices which provide high interrupting efficiency and minimize the formation of arc flame and gases.
- E. Each drawout breaker shall be equipped at least with 1) position indicator; 2) mechanical pushbutton; and 3) solid-state trip unit (TU).
- F. Electrically operated breakers shall be complete with 120 Vac motor operators. The charging time of the motor shall not exceed 6 seconds.
- G. To facilitate lifting, the power circuit breaker shall have integral handles or slots on the side of the breaker.
- H. The power circuit breaker shall have a closing time of not more than 3 cycles.
- I. The primary contacts shall be easily accessible to inspect for contact erosion.
- J. The power circuit breaker shall have windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker and for viewing the breaker trip unit and status information. Each accessory shall have a label that indicates its function and voltage.
- K. 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.

- L. The breaker control interface shall have 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.
- M. 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 tripped or opened.
- N. The current sensors shall have a back cover window that permits viewing the sensor rating on the back of the breaker or shall be printed on the front mounted nameplate. A rating plug shall 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 indication of the breaker position in the cell. These positions shall be Connect, Test, and Disconnect. 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 a minimum of forty-eight (48) front mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate No. 10 AWG maximum field connections with ring tongue or spade terminals, fast-on connectors, or bare wire.
- Q. All manually operated breakers shall have stored energy operating mechanisms. Stroking the operating handle shall be necessary to charge the stored energy spring when operating the manual breaker. The release of the energy to close the breaker manually shall be by means of a mechanical pushbutton.
- R. Replacement protective (main, tie, and feeder), drawout, low-voltage, power circuit breakers shall be new, Eaton Cutler-Hammer Type "Magnum DS" or General Electric Type "AK" or "AKR" to match existing breakers. Frame ratings shall match existing breaker ratings. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

2.4 TRIP UNITS (TU)

- A. 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.
- B. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed-type. Rating plugs shall be interlocked so they are not interchangeable between frames. Removal of the rating plug shall prevent the breaker from being closed and latched with the rating plug removed or trip the breaker at low current levels.
- C. Complete system selective coordination shall be provided by the addition of the following individually adjustable time/current curve shaping solid-state elements:
 - 1. All trip units shall have adjustment for long delay pickup and time.

2. All trip units shall have individual adjustments for short delay pickup and time, and include selective flat or I^2t curve shaping.
 3. Trip units shall have adjustable instantaneous pickup.
 4. All trip units shall have individually adjustable ground fault current pickup and time, and include selective flat or I^2t curve shaping.
- D. The microprocessor-based trip unit shall have both powered and unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.
- E. Trip units shall include zone interlocking capability 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 circuit breaker and allow the circuit 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 the pre-set time delay.
- F. For trip units without an instantaneous adjustment, a discriminator circuit shall be provided to prevent the breaker being closed and latched on to a faulted circuit.
- G. Where internal ground fault protection is specified, setting shall not exceed 1200 amperes.
- H. The trip unit shall have an information system that utilizes battery backed-up 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 trip reset button shall be provided to turn off the LED indication after an automatic trip. A test pushbutton shall energize an LED to indicate battery status.
- I. The trip unit shall be provided with a representation of the time-current curve on the trip unit that indicates the protection function settings. The unit shall be continuously self-checking and provide LED indication that the internal circuitry is being monitored and is fully operational.
- J. The trip unit shall contain an integral test panel with a test selector switch and a test pushbutton. The test selector switch shall enable the user to select the values of test current within a range of available settings. The basic protection functions shall not be affected during test operations. The breaker shall be capable of being tested in either the "Trip" or "No Trip" test mode. Provide a keyed receptacle for use with an auxiliary power module. The auxiliary power module shall allow the breaker trip unit to be tested with a 120-volt external power source.
- K. A four-digit, 3/4-inch high minimum, LED alphanumeric display shall be provided to indicate the following data:
1. Cause of trip.
 2. Instantaneous value of maximum phase and ground current.
 3. Level of fault current that initiated an automatic trip operation.
 4. Display shall be high output LED for low-level light readability. LCD display are unacceptable.

- L. 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, it shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. Internal relays shall provide contacts for remote indication of mode of trip and high load.
- M. A red LED shall be provided on the face of the trip unit pre-set to turn on when 85% of the trip setting is exceeded (a 40-second delay shall be provided to avoid nuisance alarms).
- N. Metering display accuracy of the complete system including current sensors, auxiliary CTs, and the trip unit shall be +/- 2% of full scale for current values in the range of 5% - 100%.
- O. The trip unit shall include a potential transformer module, suitable for operation up to 600 V, 50/60 Hz. The primary of the PTM shall be connected internally to the load side of the circuit breaker through a dielectric disconnect plug. The unit shall calculate energy monitoring parameters as follows:
 - 1. Peak demand (Megawatts).
 - 2. Present demand (Megawatts).
 - 3. Energy consumption (Megawatt-hours).
- P. The energy-monitoring parameter values (peak demand, present demand and energy consumption) shall be indicated in the trip unit alphanumeric display panel.
- Q. Metering accuracy of the complete system of full scale shall be +/- 4% for power values, +/- 5% of full scale for energy values.
- R. The trip unit shall be equipped to permit communication via a network twisted pair to the LAN system provided in the equipment, for remote monitoring and control. The trip unit shall be provided with an address register for identification of the network. All monitored values shall be transmittable over the network.
- S. For enhanced system analysis the following additional parameter values shall be calculated and indicated in the trip unit alphanumeric display panel:
 - 1. Line-to-line voltage.
 - 2. Power factor.
 - 3. Percentage harmonic content.
 - 4. Total Harmonic Distortion (THD).
- T. Trip Units (TU) shall be Eaton Cutler-Hammer Digitrip RMS 910 to replace existing units or Digitrip 1150 on new replacement breakers.

2.5 MISCELLANEOUS DEVICES

- A. Current transformers and ground sensors shall match existing components, to be replaced.
- B. Fused control power transformers shall match existing components, to be replaced.

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2.6 ASSEMBLIES ELECTRONIC MONITOR (AEM)

- A. Replacement Assemblies Electronic Monitor (AEM) shall be microprocessed-based, self-contained device (NEMA Type 3R/12 faceplate) suitable for door mounting and shall perform the following listed functions. Each assembly shall have provisions for a communications module to provide for remote computer monitoring up to 7500 feet.
- B. Monitor and display parameters of up to 40 circuit breakers equipped with microprocessor-based trip units (TU). Communications over the local area network shall be field DIP switch selectable at either 1200 or 9600 baud. There shall be separate step up and step down buttons to select specific breakers by means of a breaker address in a display window. Parameters locally displayed at the AEM for each breaker and shall also be capable of being communicated via twisted pair to a remote personal computer and shall include:
 - 1. Customized field programmable circuit breaker designation.
 - 2. LEDs shall indicate circuit breaker status - "Tripped," "Open," "Closed," and "No Response."
 - 3. Indicate cause of trip - "Long Delay," "Short Delay," "Instantaneous," "Ground," "Override/Discriminator," or "Communications Network."
 - 4. LED shall also indicate circuit breaker high-load alarm when current exceeds 85% of LDPU setting for at least 40 seconds.
 - 5. Current in each phase and ground, power in megawatts, peak power demand, energy used in megawatt hours, breaker trip unit in test mode, long delay pickup (overload in progress), missing or defective rating plug, unit failed RAM/ROM check, negative power, cause of circuit breaker trip, circuit breaker address, trip buffers with real-time stamp data, shall be shown in display window selected by means of membrane-type pushbuttons.
- C. The AEM shall be capable of transmitting via twisted pair network to a remote computer in addition to the locally displayed parameters, the following additional circuit breaker parameters:
 - 1. Circuit breaker type.
 - 2. Current rating of circuit breaker trip rating plug.
- D. The program directing the functions, and trip buffer data shall be permanently stored in the AEM so there is no need to reload data after an AC power loss. In addition, the addresses of breakers, type of devices, and descriptions shall be stored in memory during an initial learn mode and shall be retained during an AC power loss.
- E. The AEM shall have a built-in alarm relay with Form C contacts rated 10 amperes resistive at 115 vAC for remote alarm, as well as an alarm LED. An ACK/Reset pushbutton shall be provided to acknowledge the alarm as well as de-energize the alarm relay, change the alarm LED from flashing to steady on, and stop cycling the alarmed breakers. The alarm data shall be stored in AEM memory and displayed whenever the alarm breaker address is selected. The alarm data shall be purged from memory only after the ACK/Reset pushbutton has been depressed again after the breaker trip unit is reset.
- F. The AEM shall be operated from 120-volt, single-phase input.

- G. The AEM shall have a "Help" button function which shall scroll English explanations in the alphanumeric window for any condition or abbreviations.
- H. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible local area network. Provide date and time stamping for all breaker operations. Reprogramming of the AEM shall not be required when adding a communication module.
- I. Replacement AEM shall be Eaton Cutler-Hammer AEM II to match existing units.

2.7 METER ANALYZER AND PROTECTION (MAP) DEVICE

- A. Replacement digital line Meter Analyzer and Protection (MAP) device shall be a Cutler-Hammer type IQ Analyzer 6000 Series and shall have the features and functions specified below. The MAP shall be UL listed, CSA certified, and also meet ANSI Standard C37.90.1 for surge protection. The device shall also meet ANSI C12.20 (0.5%) energy revenue metering accuracy standard.
- B. The device shall provide direct reading metered or calculated values of the items listed below and shall auto range between units, kilo-units and mega-units for all metered values. The device shall be capable of displaying the frequency distribution in graphic form and shall be capable of displaying the Waveform in graphic form on the meter or via software. The device shall be capable of displaying multiple parameters at once, including four (4) user-configurable custom screens, displaying any seven (7) of the parameters listed.
- C. Ac current (amperes) in A, B, and C phase, 3-phase average, Neutral (N) and Ground (G) (provide neutral and ground current transformer). Accuracy +/- 0.2%.
- D. Ac voltage (volts) for A-B, B-C and C-A, phase average, A-N, B-N and C-N, average phase to N, and N to G. Accuracy +/- 0.2%.
- E. Real Power (Watts), Reactive Power (Vars), Apparent Power (VA), Real Energy (WH), Reactive Energy (VarH), Apparent Energy (VAH) for each phase and system. Accuracy +/- 0.4%. Forward/Reverse indication shall be provided.
- F. Frequency (Hertz) Accuracy +/- 0.4%.
- G. Demand values for System Current (Amperes), System Real Power (Watts), System Reactive Power (Vars), and System Apparent Power (VA).
- H. Power Factor for both Displacement and Apparent.
- I. Percent Total Harmonic Distortion (THD) for all Currents and Voltages.
- J. K-Factor, Transformer Derating Factor, and Crest Factor.
- K. The device shall provide the following advanced analysis features:

1. Onboard logging capability, including the ability to log a total of 24 parameters with intervals ranging from 0.13 seconds (every 8 cycles) to twice a week (5,040 minutes). Four separate trends shall be available.
2. Trend Analysis Screens displaying the minimum and maximum values for each metered value, with all parameters time stamped to 10 millisecond resolution.
3. Time-of-use metering capability to store energy usage data for time-of-use revenue metering. Provide complete programmability for 32 schedules including weekdays, Saturday, Sunday, 22 holidays, 8 seasons, and 10 time periods per schedule for up to four (4) different utility rates.
4. Demand Analysis Screens displaying present demand and peak demands for phase current and power. Peak demands shall display time and date stamped to within 10 millisecond resolution. Demand Window Selection for metered demand values shall be selectable as a fixed or sliding window, a synch, pulse initiation, or a communication system initiation.
5. Harmonic Analysis Screens shall be capable of being function key triggered to capture a high-speed waveform of two (2) cycles of data sampled at 128 samples per cycle, simultaneously recording all currents and voltages. Data captured shall include the magnitude and the direction of the harmonic source from 1st through the 50th harmonic.
6. Event/Alarm Analysis Screens shall display data recorded for up to ten (10) event/alarm conditions. For each event/alarm a description of the event/alarm, date, and time of event/alarm shall be recorded (10 mS resolution).
7. The device shall be capable of transmitting all data at time of the event via communications to a personal computer for creating and displaying waveforms.
8. The device shall have the ability to store the last 504 meter events in non-volatile memory. Each event shall be date and time stamped with 10 millisecond accuracy. The device shall provide the ability to view the events via the local display or via communications.
9. Event/Alarm Condition Levels shall be capable of being triggered by up to 7 of any of 61 conditions when the programmed threshold is exceeded. All shall have programmable time delays from 0.1 to 60 seconds, except voltage disturbance which shall be programmable from 0 to 3,600 cycles.

L. The device shall be capable of receiving the following inputs:

1. Instrument Transformers: Input ranges of the device shall accommodate external current transformers with ranges from 10,000/5 through 5/5 amperes. External current transformers for each phase, neutral and ground circuit are existing. The device shall be capable of overranging up to eight (8) times nominal current rating. Potential transformers shall be self included and fused for up to 600 volts with potential connections suitable for 3-phase 100 V, 208/220/240 V, 380/416 V, 460/575 V.
2. Control Power: The device control power shall be capable of being supplied from the monitored incoming ac line up to 600 volts without the need for a separate ac control circuit. The device shall also be capable of being supplied from a separate control power source (input range of 100 to 240 Vac, 100 to 250 Vdc, or 24 to 48 Vdc).
3. Dry Contacts: Three (3) dry discrete input contacts shall be capable of being monitored which may be programmed by the user to perform any of the following

- functions. The status of the input contacts shall be locally displayable and accessible through the communications port.
4. Trigger an Event/Alarm Analysis including Harmonic Analysis information for display on the device and information for Waveform Analysis and display at a personal computer.
 5. Act as a synchronizing pulse input to synchronize demand windows with a utility provided synchronizing pulse.
 6. Actuate a relay output.
 7. Reset a relay output, peak demand, Minimum/Maximum, or Event Analysis records.
- M. Furnish Relay Output with four (4) Form C (NO/NC) relay output contacts which shall be capable of being independently programmed for the following functions:
1. Act as a kWh, kVarH, or kVAH pulse initiator output.
 2. Actuate on one (1) or more Event/Alarm conditions, including discrete inputs and Communication Command signal.
- N. Furnish one (1) 0 to 20 mA analog input and four (4) 0 to 20 mA outputs.
- O. The device shall be fully programmable from the faceplate, including alarm relay and power quality (e.g., harmonic distortion) settings. Programming shall be password protected.
- P. Provide an addressable communication card capable of transmitting all data, remotely controlling and programming the device over a compatible two-wire location area network (LAN) to a central personal computer for storage, analysis, display and printout. The network shall also be capable of transmitting data in RS-232c format via a translator module. There shall also be an option to connect the device to an Ethernet network via either a 10Base-T copper cable or fiber optic cable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01039: Verification of Existing Conditions Prior To Beginning Work.

3.2 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations.

3.3 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 Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

3.4 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.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification before final payment is made.

END OF SECTION

SECTION 16471

CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Circuit Breakers.

1.2 REFERENCES

- A. NECA (National Electrical Contractors Association) "Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Indicate voltage, short circuit ampere rating, circuit breaker sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01700.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 CIRCUIT BREAKERS

- A. Replacement circuit breakers shall be of the bolt-in-place type using single pole or common trip, two or three pole. Circuit breakers shall be of the molded case type with thermal magnetic trip and breaker handles indicating "on" - "off" and "trip" positions. Breakers shall have 22,000 ampere interrupting capacity minimum and shall be approved for "switching duty". Circuit breakers shall be General Electric Spectrum to match replaced breakers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install circuit breakers in accordance with manufacturer's instructions.
- B. All circuit breakers shall have a circuit number marker or equipment designation nameplate on or adjacent to the breaker.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Sections 01400 and 16960.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers and lugs.

END OF SECTION

SECTION 16481

ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Magnetic motor starters.
- B. Combination magnetic motor starters.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- C. UL 198E - Class R Fuses.
- D. NECA "Standard of Installation," published by National Electrical Contractors Association.
- E. NEMA AB 1 - Molded Case Circuit Breakers.
- F. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- G. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- H. NEMA KS 1 - Enclosed Switches.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Test Reports: Indicate field test and inspection procedures and test results.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NECA Standard of Installation.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 MAGNETIC MOTOR STARTERS

- A. Full voltage starters shall be combination motor circuit protector type, unless otherwise noted, and motor starter complete with three pole, ambient compensating overload relays, and control circuit transformer. Starters shall be equipped with a spare auxiliary contact in addition to those included in the existing starter, shall be minimum NEMA Size 1, and shall have 120 volt coils.
- B. Two speed starters shall consist of fast and slow contactors in combination with a motor circuit protector and with three pole, ambient compensating overload relays for each winding, and other devices similar to those specified for full voltage starters above. The contactors shall each be equipped with a spare auxiliary contact in addition to those included in the existing unit, shall be NEMA Size 1 minimum, and shall have 120 volt coils. Control transformer, control (auxiliary) relays, selector switches, indicating lights, and other control devices shall match the existing arrangement and shall be as specified hereinafter.
- C. Where included in existing, starters shall include ground fault protective devices. The ground fault protective devices shall include a current transformer, a ground fault relay, and test circuit and shall be suitable for interrupting the starter control circuit. Ground fault monitoring and test devices shall be mounted on the starter door and shall include a trip indicator, a manual reset button, and a test button. Testing with or without tripping shall be possible.
- D. Starters shall be electrically operated and held type, three pole assemblies with coil, contact assemblies, and integral overload protection. Coil shall be warranted for life.
- E. Motor overload protection shall consist of a thermal overload relay of the three pole, ambient compensating, manual reset, and solid state type.
- F. Solid state motor overload protection shall include time-current characteristics and shall be field selectable or adjustable. Accuracy shall be within 2%. Solid state overloads shall monitor three phase motor current utilizing three current sensors. The trip Class 10, 20, and 30 shall be field selectable and provide 10, 20, or 30 second delay at six times the full load running protection respectively. Solid state overloads shall be manually reset with the ability to convert to automatic reset in the field. Overload relay shall have two outputs: 1) an alarm indicator indicating motor is running in overload and, 2) an overload trip indicator.
- G. Oiltight pushbutton and selector switches and push-to-test, transformer type, indicating lights shall be provided as included on existing units. Control devices mounted on doors of NEMA

Type 4 enclosed starters shall be NEMA Type 4 rated. All starters with manual reset overload relays shall have an external overload reset pushbutton mounted on the enclosure door.

- H. Starters for 120 volt, single phase motors shall be combination, non-fused disconnect switch and two pole motor starter complete with single pole overload relay.
- I. Starters shall have NEMA Type 12 enclosures where mounted indoors, stainless steel NEMA Type 4 enclosures where outdoors or below grade indoors, or non-metallic NEMA Type 4X enclosures in corrosive locations. All hardware on the exterior of NEMA Type 4 enclosures, including hinge pins, screws, bolts, nuts, washers, etc., shall be made of stainless steel.
- J. Control circuit transformers shall have fused primary windings and 120 volt, fused, and grounded secondary windings. Control circuit transformers shall have extra capacity where required to carry connected loads.
- K. Fuses shall match existing.
- L. All unit line and load terminals or lugs shall be 75°C rated for copper conductors. Terminal boards or blocks shall be provided for all external connections and shall be readily accessible from the front of the starter enclosure. All wiring to external devices shall be terminated at the terminal blocks, excluding incoming power feeders and motor leads. All wires and terminals shall be tagged to agree with the existing tags.
- M. Each starter shall have a reduced size, approved, “as-built,” schematic wiring diagram, in ladder diagram format, inside each unit, indicating all internal components and wiring terminal strip connections, all 480 V. power wiring, all 120 V. control and power wiring, all instrument wiring, and all external components and wiring (shown dotted). Wiring diagrams shall have a plasticized coating to protect them from dirt, heat, and normal wear and tear.
- N. Motor starters shall be Eaton Cutler-Hammer A200 Series, Allen-Bradley Bulletin 500 Line, or Square D.

2.2 SOLID-STATE REDUCED VOLTAGE MOTOR CONTROL

- A. Replacement Soft Start Controller with bypass contactor shall be as follows:
 - 1. Controller shall be Eaton Cutler-Hammer Type S701/801 or equal, Allen-Bradley, Square D, or General Electric.
 - 2. The solid-state reduced-voltage starter shall be UL and CSA listed. The solid-state reduced-voltage starter shall be an integrated unit with power SCRs, logic board, paralleling bypass contactor, and electronic overload relay enclosed in a single molded housing.
 - 3. The SCR-based power section shall consist of six (6) back-to-back SCRs and shall be rated for a minimum peak inverse voltage rating of 1500 volts PIV.
 - 4. Units using triacs or SCR/diode combinations shall not be acceptable.
 - 5. Resistor/capacitor snubber networks shall be used to prevent false firing of SCRs due to dV/dT effects.

6. The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs and SCR gate firing output circuits.
7. The logic board shall be identical for all ampere ratings and voltage classes and shall be conformally coated to protect environmental concerns.
8. The paralleling run bypass contactor shall energize when the motor reaches 90% of full speed and close/open under one (1) times motor current.
9. The paralleling run bypass contactor shall utilize an intelligent coil controller to limit contact bounce and optimize coil voltage during varying system conditions.
10. The coil shall have a lifetime warranty.
11. Starter shall be provided with electronic overload protection as standard and shall be based on inverse time-current algorithm. Overload protection shall be capable of being disabled during ramp start for long acceleration loads via a DIP switch setting on the device keypad.
12. Overload protection shall be adjusted via the device keypad and shall have a motor full load ampere adjustment from 30 to 100% of the maximum continuous ampere rating of the starter.
13. Starter shall have selectable overload class setting of 5, 10, 20 or 30 via a DIP switch setting on the device keypad.
14. Starter shall be capable of either an electronic or mechanical reset after a fault.
15. Units using bimetal overload relays are not acceptable.
16. Overtemperature protection (on heat sink) shall be standard.
17. Starters shall provide protection against improper line-side phase rotation as standard. Starter will shut down if a line-side phase rotation other than A-B-C exists. This feature can be disabled via a DIP switch on the device keypad.
18. Starters shall provide protection against a phase loss or unbalance condition as standard. Starter will shut down if a 50% current differential between any two phases is encountered. This feature can be disabled via a DIP switch on the device keypad.
19. Starter shall provide protection against a motor stall condition as standard. This feature can be disabled via a DIP switch on the device keypad.
20. Starter shall provide protection against a motor jam condition as standard. This feature can be disabled via a DIP switch on the device keypad.
21. Starter shall be provided with a Form C normally open (NO), normally closed (NC) contact that shall change state when a fault condition exists. Contacts shall be rated 60 VA (resistive load) and 20 VA (inductive load). In addition, an LED display on the device keypad shall indicate type of fault (Overtemperature, Phase Loss, Jam, Stall, Phase Reversal and Overload).
22. The following control function adjustments on the device keypad are required:
 - a. Selectable Torque Ramp Start or Current Limit Start
 - b. Adjustable Kick Start Time: 0-2 seconds
 - c. Adjustable Kick Start Torque: 0-85%
 - d. Adjustable Ramp Start Time: 0.5-180 seconds
 - e. Adjustable Initial Starting Ramp Torque: 0-85%
 - f. Adjustable Smooth Stop ramp Time: 0-60 seconds.
23. Units shall be enclosed in NEMA Type 1 cabinets.
24. Maximum continuous operation shall be at 115% of continuous ampere rating.
25. Provide a run-off remote selector switch with control circuit connections and a red, running indicating light.

2.3 MOTOR PROTECTION RELAY (MPR)

- A. Replacement definite purpose microprocessor-based Motor Protection Relay (MPR) for protection, control, and monitoring of the motors shall be Eaton Cutler-Hammer Type MP-3000. The MPR shall meet UL 991 and 508 standards and be CSA certified.
- B. The true RMS current into the motor shall be constantly monitored, and by means of a protective algorithm, separated into positive and negative sequence components. These components shall be used to determine the heating effects on the stator and rotor of the motor to provide maximum motor protection and utilization. The relay shall be capable of being connected by three-wire conductor to a remote Resistance Temperature Detection Module (RTDM) located at the motor to monitor up to six (6) motor winding, four (4) bearing, and one (1) auxiliary RTD inputs. The MPR shall integrate the temperature input data from the RTDM with the protective algorithm. The protective algorithm curve shall be appropriately shifted right for lower temperatures to allow maximum motor utilization and shifted to the left for higher temperatures to provide maximum motor protection. The MPR shall provide the following protective functions:
 - 1. Motor running time overcurrent protection (IEEE Device 49/51).
 - 2. Adjustable instantaneous overcurrent protection (IEEE Device 50) with adjustable start delay in one-cycle increments.
 - 3. Current unbalance protection (IEEE Device 46).
 - 4. Rotor protection.
 - 5. Underload trip with start and run time delays (IEEE Device 37/2).
 - 6. Jam trip with start and run time delays.
 - 7. Auxiliary overtemperature protection with RTDM.
 - 8. Zero sequence ground fault protection (IEEE Device 50/51G) with adjustable start delay in one-cycle increments.
 - 9. Stator protection with RTDM (IEEE Device 49).
 - 10. Motor bearing overtemperature protection with RTDM (IEEE Device 38).
 - 11. Load bearing overtemperature protection with RTDM (IEEE Device 38).
- C. The following control functions shall be provided by internal solid-state based timers or relays:
 - 1. Incomplete sequence delay (IEEE Device 2/19).
 - 2. Limitation on number of starts per time period in minutes (IEEE Device 66).
 - 3. Anti-backspin time delay (IEEE 2).
 - 4. Programmable transition relay based on current and/or time.
- D. The relay shall include a digital display of the following monitoring functions:
 - 1. Line amperes in each phase (RMS).
 - 2. Percent Motor Full Load Current in each phase.
 - 3. Cumulative running time in hours.
 - 4. Total number of starts and number of starts remaining per hour.
 - 5. Time left since oldest start in minutes.
 - 6. % I²T trip level.
 - 7. Ground Current in amperes.
 - 8. Winding temperature in degrees C or F.
 - 9. Motor bearing temperature in degrees C or F.
 - 10. Load bearing temperature in degrees C or F.

- E. The MPR shall be capable of accommodating external current transformers with ranges from 10/5 through 4000/5 amperes. Provide three (3) current transformers sized per manufacturer's recommendations based on motor full-load amperes and service factor. Where ground fault protection is specified, provide 50/5 ampere zero sequence transformer.
1. Unit shall include terminals for shut down based on external contacts for incomplete sequence of operation and remote trip/remote reset.
 2. The unit shall draw its power from a control power transformer located in the starter or separate source of 120-volt or 240-volt power supply.
 3. Provide separately mounted RTDM, mounted near the motor, to provide up to 6 stator RTDs, 2 motor bearing RTDs, 2 load bearing RTDs, and 1 auxiliary RTD.
- F. The device shall have separate Form C (NO/NC) Trip, Alarm, and Auxiliary contacts with ratings of 10-amperes at 115/240-volt AC or 30-volt DC resistive. The auxiliary relay contact shall be programmable to actuate only on a user selected trip condition. The device shall be capable of providing a 4-20 mA output signal proportional to one of the following user selectable parameters:
1. Average of the three-phase currents
 2. Hottest winding RTD temperature
 3. I²T level
- G. The relay shall be capable of monitoring electrical current, receiving commands from remote sources either by contact closures or digital data, giving commands by means of contact closure to the motor starters and other devices under its control, and displaying information by alphanumeric display to the operator and by digital signals with other equipment.
1. The combination relay and operator panel shall be mounted on the door of the starter. Specific data entry to suit the actual motor application shall be programmed into the device by means of the operator panel pushbuttons.
 2. Entered data shall be stored in non-volatile memory so as not to require battery back-up. Non-volatile memory shall be capable of storing all set-up information even after power failure, all monitored information at the time of a trip, and cause of trip even after power failure. All programmed set-points shall be secured by means of a switch and key.
 3. Alphanumeric display shall read out (in English) complete description of all protective functions e.g., "instantaneous overcurrent" and all monitored and programmable data such as "percent of full load in amps" and "motor bearing temperature".
 4. The MPR shall be user selectable as to being programmable while the motor is running or require a motor shut-down for programming.
- H. Provide an addressable communications card capable of transmitting all data, including trip/alarm data over a two-wire area network to a central computer for storage and/or printout. The network shall also be capable of transmitting data in RS232c format via a translator module.
- I. Universal RTD Module
1. Where existing, provide an electronic Resistance Temperature Detector Module (RTDM) for use associated Motor Protection Relay (MPR) or as a standalone device to monitor motor temperature. The RTDM shall be equal to Eaton Cutler-Hammer/Westinghouse type Universal RTD module having the features and

- functions specified below. The RTDM shall be UL recognized, CSA certified and also meet appropriate ANSI standards.
2. The RTDM shall be capable of monitoring RTDs of the 3-lead type or 2-lead type as provided by the motor manufacturer. The RTDM shall be capable of monitoring up to eleven (11) RTD inputs of four function groups as follows: six (6) for motor windings, two (2) for motor bearings, two (2) for load bearings and one (1) auxiliary input. The RTD shall be field DIP switch programmable to accept any of the following types of RTD inputs:
 - a. 10-ohm copper.
 - b. 100-ohm platinum
 - c. 100-ohm nickel
 - d. 120-ohm nickel
 3. It shall be possible to field-select a different type RTD for each of the four function groups.
 4. The RTDM shall operate from 120-volt AC power (+15%, -15%), 50 Hz or 60 Hz. Power consumption with communication card shall be 7 volt-amperes. Provide appropriate control power transformer when RTDM is located in motor starter assembly or appropriate 120-volt circuit when located at the motor.
 5. The RTDM shall be suitable for location at the MPR or at the motor. The RTD module when located at the motor shall be capable of transmitting all temperature information to the MPR over 3-conductor shielded cable up to a maximum distance of 500 feet or via a fiber optic link up to a maximum distance of 400 feet. Contractor to provide shielded cable or fiber optic link as existing.
 6. The RTDM shall be suitable for operating temperatures of from 0 to 70 degrees C and suitable for humidity of 0 to 95% R.H. non-condensing. It shall be in a NEMA 1 enclosure approximately 8 inches by 5 inches by 2 inches without communication module.

2.4 METER MONITOR AND PROTECTION DEVICE (MMP)

- A. Replacement digital line Meter Monitor and Protection (MMP) device shall have the features and functions specified below. The MMP shall consist of a single microprocessor-based unit; the MMP shall auto range between Units, Kilo-units, and Mega-units for all metered values. The MMP shall provide the adjustable protective alarm functions indicated and shall meet all the requirements of the power monitoring system, including the capability to communicate data via a local area network. The MMP shall be UL listed, CUL and CE certified and also meet ANSI Standard C37.90.1 for surge withstand. Accuracies shall be valid from 3% to 250% of current transformer rating.
- B. The MMP shall provide direct reading metered or calculated values of the items listed below. Accuracy indicated below to be a percentage of the full scale of the device.
 1. AC amperes in each phase, $\pm 0.3\%$ accuracy.
 2. AC voltage, phase-to-phase, phase-to-neutral, $\pm 0.3\%$ accuracy.
 3. Watts, $\pm 0.6\%$ accuracy.
 4. VARs, $\pm 0.6\%$ accuracy.
 5. VA, $\pm 0.6\%$ accuracy.
 6. Power factor, 1.0% (± 1 digit) accuracy.
 7. Frequency, ± 0.1 HZ accuracy

8. Watt Demand (5, 10, 15, 20, 25, 30, 45, 60 minute interval programmable or from utility synchronizing pulse).
 9. Watt hours, $\pm 0.6\%$ accuracy.
 10. VAR hours, $\pm 0.6\%$ accuracy.
 11. VA hours, $\pm 0.6\%$ accuracy.
 12. % THD measures through 31st harmonic.
- C. The MMP shall display minimum and maximum values of the following parameters:
1. Voltage, line-to-line, line-to-neutral
 2. Current, per phase
 3. Power, watts, VARs, and VA
 4. Power factor, displacement and apparent
 5. Frequency
- D. The MMP shall also display peak percent THD and demand parameters.
- E. The MMP shall monitor and display positive and negative Watts, VARs and power factor. The sign convention shall be selectable between mathematical or power engineer's convention. The MMP shall display net energy at the device and shall display reverse, forward, and net energy via the communications port.
- F. The following adjustable protective alarm features shall be provided. Alarm shall be communicated via the communications port or by Form C relay output contacts. Each relay shall be programmable to operate as latched or unlatched (self-resetting), and programmable to operate in mode 1 (energized) or mode 2 (de-energized) when the trigger occurs.
1. Voltage phase loss, if any phase RMS is less than 50% of the nominal line voltage.
 2. Current phase loss, if the smallest phase value is less than 1/16 of the largest phase value.
 3. Line voltage phase unbalance, selectable from 5-40% of nominal in 5% increments.
 4. Voltage phase reversal.
 5. Overvoltage, selectable from 105 to 140% in 5% increments.
 6. Undervoltage, selectable from 95 to 60% in 5% increments.
 7. Time delay (adjustable from 0 to 20 seconds in 1 second intervals) for overvoltage, undervoltage, and phase unbalance trip and alarm settings.
- G. Input ranges of the MMP shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. The 600-volt and below voltage power module shall be detachable from the chassis. Three (3) in-line fuses shall protect the MMP from current overloads. Potential transformer shall be self included and fused up to 600 volts. Above 600 volts, provide fused external potential transformers.
- H. The MMP shall have an operating temperature range of -20°C to 70°C and 0-95% relative humidity non-condensing.
- I. A neutral terminal shall be provided and wired for 4-wire, grounded systems.
- J. In the event of an alarm condition, a built-in reset button shall allow a manual reset of the MMP. The MMP shall also be capable of being remotely reset via its communication port.

The MMP shall have the capability for resetting watt-hours, VAR-hours, VA-hours, Minimum/Maximum values, and demand.

- K. The MMP shall have non-volatile memory and not require battery back-up in the event of a power failure. The MMP shall retain all pre-set parameters, accumulated watt-hours, and watt demand.
- L. Provide an input/output block and modifications to provide the following:
 - 1. The MMP shall offer a load shed feature which activates the pulse initiator relay when a user selected parameter exceeds a pre-programmed range.
 - 2. Synchronizing pulse input shall be provided, and when activated, shall override the pre-set watt demand interval and let the utility control the demand window.
 - 3. Outputs shall have separate trip and alarm contacts with ratings of 10 amperes at 115/240-volt AC or 30-volt DC resistive. The contacts shall be Form C (NO/NC). In addition, provide a separate Form C (NO/NC) contact to provide a kilowatt-hour pulse output. The pulse shall be KYZ type.
- M. Control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit.
- N. The display face shall be membrane type and rated suitable for NEMA Type 3R and NEMA Type 12 mounting. The MMP shall have a durable 6-digit LED display screen. The display screen and LEDs shall indicate two (2) alarm conditions. The cause of a trip or alarm shall be indicated in the display window.
- O. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible two-wire local area network to a central personal computer for storage and/or printout.
- P. MMP shall be Eaton Cutler-Hammer IQ DP4130.

2.5 MANUAL MOTOR STARTERS

- A. The manual motor starters shall be of the toggle switch, "On-Off" type, and shall be horsepower rated with thermal overloads. The starters shall be single pole and the enclosures shall be NEMA Type 1 or explosion proof or NEMA Type 4 to match existing. Provide a pilot lamp and/or a "Hand-Off-Automatic" selector switch (NEMA Type 1 enclosed only) where existing.
- B. The starters shall be Type MS as manufactured by Eaton Cutler-Hammer, Square D Type 2510, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The Contractor shall verify all motor horsepower prior to procurement of starters and installation of motor wiring.

- B. The Contractor shall assume full responsibility for the selection and installation of the proper rating of thermal heater elements in all motor starters.
- C. Install enclosed controllers in accordance with manufacturer's instructions.
- D. Install enclosed controllers plumb.
- E. Height: 5 ft. (1.6 M) to operating handle.
- F. Install fuses in fusible switches.
- G. Select and install overload heater elements or set solid state overload relays in motor controllers to match installed motor characteristics.
- H. Provide engraved plastic nameplates to match existing plates.
- I. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
- J. NEMA Type 4 and Type 4X enclosures in other than corrosive areas shall be equipped with a combination drain and breather. The drain shall be mounted on a bolt-on, gasketed hub. Combination drain and breather shall be Crouse-Hinds ECD Combination Series, Appleton, or equal.
- K. Arc flash and shock hazard warning labels shall be provided on the door of each contactor and starter enclosure and shall be marked per the Owner's study.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Sections 01400 and 16960.
- B. Inspect and test each enclosed controller to NEMA ICS 2.

END OF SECTION

SECTION 16482

MOTOR CONTROL CENTER COMPONENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Replacement motor control center components.

1.2 RELATED SECTIONS

- A. Section 16960 – Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-up of Systems.
- C. Section 16980 - Demonstration and Training.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- C. UL 198E - Class R Fuses.
- D. NECA 402-2001 – Motor Control Centers (ANSI).
- E. NEMA AB 1 - Molded Case Circuit Breakers.
- F. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- G. NEMA ICS 2.3 - Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Include nameplate legends; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time/current curves of all equipment and components.
- C. Wiring diagrams shall be provided.
- D. Test Reports: Indicate field test and inspection procedures and test results.

- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NEMA ICS 2.3.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with NEMA ICS 2.3. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MOTOR CONTROL CENTER COMPONENTS

- A. Each control center assembly is rated 600 volts and consists of one or more stationary structures, each with a grouping of units containing combination line starters and air circuit breakers and such other electrical devices for the control of motor feeder and heating circuits. Service voltage is 480Y/277 volts, 3 phase, 4 wire plus ground or 480 volts, 3 phase, 3 wire plus ground, 60 Hertz.
- B. The control centers are NEMA Type 12, totally enclosed, free standing type.
- C. Terminal boards or blocks shall be mounted on each individual starter unit for all external connections and shall be so located that they are readily accessible from the front of the control center for power and control wiring. Terminal blocks shall be the hinged or "split"

disconnect type. All wiring to external devices shall be terminated at the terminal blocks. All feeder terminals or lugs shall be 75°C rated for copper conductors.

- D. Removable unit enclosure shall be constructed of heavy gauge sheet steel. Construction shall provide isolation and baffling of each unit from the others. As part of the enclosure there shall be included plug-in stabs for power connected to the vertical bus. The stabs shall be fabricated of high spring strength, high conductivity copper alloy, tin plated and mounted on an insulating base.
- E. Units shall contain guide rails for accurate alignment both horizontally and vertically within the structure to eliminate possible damage to bus or stab. The unit shall be provided with a latch lever for padlocking with the stabs disengaged from bus position isolating the unit from the power circuit. During unit removal its door shall remain affixed to the structure to permit closing and fastening over the opening.
- F. Control (auxiliary) relays, time delay relays, and elapsed time meters replaced within motor control centers shall be as specified hereinafter.
- G. Nameplates shall be installed on the door of each replaced unit and shall be attached by means of corrosion resistant screws. The plates shall be 1-1/4" high by 3-1/2" wide (minimum), white laminated plastic with engraved black letters. Letters shall be 1/8" high (minimum), block type. Nameplate engraving shall match existing, except nameplates for spare units shall be furnished blank.
- H. Full voltage starters shall be of the combination magnetic type consisting of a circuit protective device and a starter. The circuit protective device shall be a motor circuit protector type, molded case, air circuit breaker with 65,000 amperes symmetrical interrupting capacity at 480 VAC minimum in combination with the motor starter which shall be comprised of NEMA size contactors; three pole, solid state overload relays; interlocks; etc. The starter door shall be interlocked so that the motor circuit protector must be in the open or off position before the door can be opened. Individual 120 volt control circuit transformers with fused primary and with fused and grounded secondary shall be provided in each unit. Starters shall have a spare auxiliary contact in addition to those included in the existing unit. All coils shall be rated for 120 volts, 60 Hertz operation. Additional control circuit transformer capacity shall be provided as required to safely carry all internal and external loads connected to it.
- I. Provide a UL 508 solid-state overload relay for protection of the motors. The relay shall be Eaton Cutler-Hammer type CEP7 or approved equal. The overload relay shall be self-powered and provide high accuracy through the use of state-of-the-art microelectronic packaging technology. The relay shall be suitable for application with NEMA Size 1 through Size 7 motor starters. The overload relay shall have the following features:
 - 1. Class 10 or 20 fixed tripping characteristics
 - 2. Manual or automatic reset
 - 3. Phase loss protection. The relay shall trip in 2 seconds or less under phase loss condition when applied to a fully loaded motor
 - 4. Visible trip indication
 - 5. One NO and one NC isolated auxiliary contact
 - 6. Test button that operates the normally closed contact
 - 7. Test trip function that trips both the NO and NC contacts

8. A current adjustment range of 3.2:1 or greater
 9. Ambient temperature compensated
 10. Ground fault protection. Relay shall trip at 50% of full load ampere setting
- J. Where provided on existing units, starters shall include ground fault protective devices. The ground fault protective devices shall include a current transformer, a ground fault relay, and test circuit and shall be suitable for interrupting the starter control circuit. Ground fault monitoring and test devices shall be mounted on the starter door and shall include a trip indicator, a manual reset button, and a test button. Testing with or without tripping shall be possible.
- K. Replacement starters shall include oiltight selector switches, pushbutton switches, and push-to-test indicating lights, as provided on the replaced units. Starters shall be NEMA Size 1 minimum.
- L. Main circuit breakers shall be manually operated, 3 pole, 600 VAC rated, with 65 kA symmetrical interrupting rating at 480 V., thermal magnetic, molded case type. Replacement main circuit breakers shall have trip ratings matching the existing breakers.
- M. Replacement branch feeder protection shall be thermal magnetic, molded case, circuit breakers of frame and rating matching existing breakers with 65,000 amperes symmetrical interrupting capacity at 480 VAC minimum. All circuit breaker line and load terminals or lugs shall be 75°C rated for copper conductors.
- N. Replacement oiltight control devices shall be provided to match existing units.
- O. Replacement elapsed time meters shall be of the panel type, 0 to 99999.9 hours, non-resettable, and suitable for panel mounting, with gasketing as required to maintain panel integrity (NEMA 12). Elapsed time meters shall be as manufactured by General Electric Type 240, Simpson, or equal.
- P. Replacement control relays shall be of the heavy duty, industrial type with convertible contacts rated not less than 10 amperes at 600 VAC. The relay coils shall be of molded construction and shall be rated for continuous duty at 120 volts, 60 Hertz, alternating current. The contact arrangement shall match the existing relay. Control relays shall be as manufactured by Square D Class 8501 Type X, Allen-Bradley Bulletin 700 Type P, Cutler-Hammer Type ARB, or equal by General Electric.
- Q. Replacement time delay relays shall be of the solid-state type and shall be heavy duty, industrial type timing relays with contacts rated not less than 7 amperes, non-inductive at 120 VAC. The timer shall be solid state, with digital setpoint and digital timing display, field-selectable for on, off, or interval delay, field-selectable for latching or non-latching operation, and four field-selectable ranges, from 00.01 to 99.99 sec.; 000.1 to 999.9 sec.; 0001. To 9999. Sec.; and 0010 to 9990 seconds. The relay coils shall be of molded construction and shall be rated for continuous duty at 120 volts, 60 Hertz, alternating current. The contact arrangement shall be: Instantaneous – one (1) SPST, N.O. and one (1) SPST, N.C.; Timed – one (1) SPDT, unless otherwise approved. Solid state time delay relays shall be Durant/Eagle Signal Model B856-511, or equal, with plug-in base and HOLD DOWN.

- R. Replacement repeat cycle timers shall be synchronous motor driven, rated 120 volts at 60 Hz. with two single pole, double throw contacts rated at 10 amps at 120 VAC. The dial range shall be 1 to 60 minutes with a repeat accuracy of 18 seconds. The timer shall be suitable for front panel mounting and the panel manufacturer shall provide a bracket within the panel for mounting. The repeat cycle timer shall be Eagle Signal Series HG100, ATC, or equal.
- S. Replacement reset timers shall be motor driven with adjustable settings over entire range and with externally selectable ranges of 0-6 seconds, 0-60 seconds, 0-6 minutes, 0-60 minutes, 0-6 hours, or 0-60 hours. Timers shall be of the plug-in case type suitable for back panel mounting and shall have instantaneous and delayed contacts. Timers shall be Tenor Model 664 or equal.
- T. Replacement electrode relays shall be solid state, 120 VAC powered with one N.O. and one N.C. contact rated 8 amps (min.) at 240 VAC. Electrode relay sensitivity shall be field adjustable. Unit shall be two switch operation suitable for use with level electrodes or float switches. Electrode relays shall be as manufactured by Warrick Controls Series 17 or B/W Controls Series 5300.
- U. Replacement load monitor relays shall be the single phase, current monitoring type. The relay shall have adjustable, 1.0 to 5.0 amps, under current and over current ranges and shall operate on a 120 VAC source. The relay shall have an inherent 1.0 second delay, built in current transformer (CT), one set of Form C contacts each for under and over current rated 10 amps at 120 VAC, and shall automatically reset. Load monitor relays shall be as manufactured by Diversified Electronics, Inc. No. CBA-102-ALE-5, or equal.
- V. Devices on the front of unit shall be mounted as part of the removable unit.
- W. All equipment devices mounted within the units shall be identified as to function and schematic identification abbreviation. Identification plates shall be 1" by 3" engraved white lamincoid with black letters, attached with corrosion resistant screws.
- X. Each starter or circuit breaker shall have a reduced size, approved, "as built", schematic wiring diagram, in ladder diagram format, inside each unit, indicating all internal components and wiring terminal strip connections, all 480 V. power wiring, all 120 V. control and power wiring, all instrument wiring, and all external components and wiring (shown dotted). Wiring diagrams shall have a plasticized coating to protect them from dirt, heat, and normal wear and tear.
- Y. Circuit protective devices shall be provided and set in accordance with the Short Circuit, Flash Hazard, and Protective Devices Coordination Analyses available from the Owner.
- Z. Existing control centers are Cutler-Hammer Advantage and Advantage 2100, Westinghouse Type W, and General Electric 7700 Line and 8000 Line.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under the provisions of Section 01039.

3.2 INSTALLATION

- A. Install motor control centers components in accordance with manufacturer's instructions and per NECA 402-2001 Standards.
- B. Install fuses in fusible switches.
- C. Select and install heater elements or set solid state overload relays in motor starters to match installed motor characteristics. The Contractor shall assume full responsibility for the selection and installation of the proper rating of thermal heater elements or the settings on solid state overload relays in all motor starters to which the Contractor makes the feeder connections and/or completely wires.
- D. Provide labels and engraved plastic nameplates to match those on existing units.
- E. Motor Data: Provide neatly typed label inside each replacement motor starter door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Sections 01400 and 16960.
- B. Inspect and test each replaced or modified controller to NEMA ICS 2.

END OF SECTION

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SECTION 16483

VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clean power type, eighteen (18) pulse variable frequency controllers.
- B. Low Harmonic type, twelve (12) pulse variable frequency controllers.

1.2 RELATED SECTIONS

- A. Section 16960 – Electrical Testing and Equipment.
- B. Section 16970 – Calibration and Start-up of Systems.
- C. Section 16980 – Demonstration and Training.

1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 3.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance and exit locations and requirements; and nameplate legends.
- C. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, schematic diagram, component list and enclosure details.
- D. Connection detail between close-coupled assemblies for the VFD unit with bypass feature.
- E. Test Reports: Indicate field test and inspection procedures and test results.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

- G. Manufacturer's Field Reports: Indicate start-up inspection findings.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Date: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
- C. Maintenance Data: Include routine preventive maintenance schedule.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum ten (10) years documented experience, and with service facilities within 100 miles of project.

1.7 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Accept controllers on site in original packing. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Section 01700.
- B. Furnish one (1) set of replaceable contacts for each type of relay installed in variable frequency controllers furnished under this Contract.
- C. Furnish one (1) control switch assembly of each type installed in variable frequency controllers furnished under this Contract.

- D. Furnish two (2) of each air filter element installed.
- E. Furnish one (1) of each size cooling fan installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. General Electric Company
- B. Eaton Cutler-Hammer
- C. Square D

2.2 VARIABLE FREQUENCY CONTROLLERS (VFD) DESCRIPTION

A. General

1. The variable frequency drive (VFD) motor controller shall convert 460 Volt, three-phase, 60 Hertz utility power to adjustable voltage (0 - 460V) and frequency (0 - 60 Hz) three-phase, AC power for stepless motor speed control with a capability of 10:1 speed range. All general options and modifications shall mount within the adjustable frequency controller enclosure.
2. The VFD shall be rated 460V to match the existing unit. The VFD shall provide a microprocessor-based adjustment of three phase motors. The variable frequency and voltage output shall provide constant volts per hertz excitation for the motor up to 60 hertz. The controllers shall be rated to match the existing. As a minimum the full load output current of the drive shall be equal to the existing motor nameplate full load amperes.
3. The VFD shall have a "Hand-Off-Auto" selector switch mounted on the door and connected to allow control from the keypad and local or remote mounted pushbutton switches, when in the "Hand" position and control from remote contacts, when in the "Auto" position. These controls shall be operable in both the VFD and Bypass modes.
4. The VFD shall utilize a Voltage Source Pulse Width Modulated (PWM) technique for producing adjustable frequency speed control.
5. The VFD shall include output short circuit protection for line-to-line and line-to-ground faults.
6. The harmonics introduced by the variable frequency controllers at the point of common coupling (PCC) shall meet the requirements of IEEE 519-1992 for General Systems. For purposes of this Specification the PCC shall be the utility feeder to the facility.

B. Specific Design Requirements for Clean Power VFD Units (for 100 Hp units and larger).

1. VFD shall be sinusoidal input type which provides clean power operation to the connected power source. Operation of the VFD's shall not add more than 3% total harmonic voltage distortion and no more than 5% total harmonic current distortion to the worst case point of common coupling. VFD control shall also include transient

- voltage suppression to allow reliable operation on a typical industrial power distribution system.
2. VFD shall be of the eighteen (18) pulse rectifier with a delta differential phase shifting transformer and pulse width modulated (PWM) design, and shall provide microprocessor based, software programmable protection and operation of a three phase motor. Six and twelve pulse designs are not acceptable. The use of harmonic filter traps, 12 pulse rectifiers, active filters or active converter sections is not acceptable.
 3. The delta differential transformer shall be a single wound transformer rated 480 Volts +10, -10% with a UL recognized 220 degree C insulation system. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degree C maximum ambient.
 4. Constant speed bypass shall be provided to allow the motor to run across the line in the event of VFD shutdown. The transfer from the VFD to the line shall be accomplished manually by means of a selector switch. The bypass circuitry shall be separately enclosed in a compartment or cabinet from the VFD. The bypass cabinet shall include a door-interlocked input circuit breaker, a VFD output contactor, and a full-voltage starting contactor (both contactors electrically interlocked), a thermal overload relay to provide motor protection, and a control power transformer. All "Hand-Off-Auto" controls shall operate while the unit is in Bypass mode. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power "ON" light, motor "ON VFD" light, and motor "ON LINE" light.
 5. NEMA Type 2 (NEMA Type 1 with ventilation filter) free standing enclosure shall be provided for VFD unit.
 6. RTD signal input to VFD unit and responsive action by VFD to motor winding and bearing temperature.
 7. Fused space heater with thermostat shall be provided inside VFD unit, to minimize the condensation potential upon drive shutdown.
 8. Input circuit breaker, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power. The circuit breaker shall be rated for 65000 AIC.
- C. Specific Design Requirements for Low Harmonic Type VFD Units (For units less than 100 Hp).
1. VFD shall be sinusoidal input type which provides low harmonic (nearly clean) power operation to power source. Operation of VFD shall not add more than 5% total harmonic voltage distortion and no more than 15% total harmonic current distortion to the worst case point of common coupling. VFD control shall also include transient voltage suppression to allow reliable operation on a typical industrial power distribution system.
 2. VFD shall be of the twelve (12) pulse rectifier and pulse width modulated (PWM) design, and shall provide microprocessor based, software programmable protection and operation of a three phase motor.
 3. Constant speed bypass shall be provided to allow the motor to run across the line in the event of VFD shutdown. The transfer from the VFD to the line shall be accomplished manually by means of a selector switch. The bypass circuitry shall be separately enclosed in a NEMA Type 12 compartment or cabinet from the VFD. The bypass cabinet shall include a door-interlocked input circuit breaker, a VFD output

contactor, and a full-voltage starting contactor (both contactors electrically interlocked), a thermal overload relay to provide motor protection, and a control power transformer. All “Hand-Off-Auto” controls shall operate while the unit is in Bypass mode. Mounted on the cabinet door shall be the bypass selector switch, motor fault light, power “ON” light, motor “ON VFD” light, and motor “ON LINE” light.

4. A wall mounted NEMA Type 12 enclosure shall be provided for the VFD unit.
5. Provide an input circuit breaker, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power. The circuit breaker shall be rated for 42,000 AIC minimum.

2.3 DESIGN OF VFD UNIT

- A. Employ microprocessor based inverter logic, isolated from power circuit.
- B. Employ switching power supply operating off DC link.
- C. Design for ability to operate controller with motor disconnected from output.
- D. Design to attempt five (5) automatic restarts, following fault conditions, before lock-out.
- E. Speed droop shall reduce the speed of the drive on transient overload.
- F. Critical speed avoidance circuit.
- G. A door mounted keypad with operational and diagnostic messages display unit (2-line, 24-character min., LCD display).
- H. “Self-Test” software program to verify proper keypad operation.
- I. Minimum efficiency of 96 percent at full load and speed and 80% at 50% speed and load.
- J. Displacement power factor between 1.0 and 0.95 lagging, over entire range of operating speed and load.
- K. Output voltage regulator to maintain correct output v/hz ratio despite incoming voltage variations.
- L. Password security to protect drive parameters from unauthorized personnel.
- M. All program settings shall be stored in non-volatile memory to prevent loss during power outages.
- N. AC input line current limiting fuses rated 200,000 AIC or circuit breaker rated 65,000 AIC for fault current protection of AC and DC converter section.
- O. The controller shall be designed and constructed to operate within the following service conditions:
 1. Elevation: 0 to 3300 feet.

2. Ambient Temperature Range: 0°C to 40°C.
3. Atmosphere: Non-Condensing relative humidity 0 to 95%.
4. AC Line Voltage Variation: -5% to +10%.
5. AC Line Frequency Variation: ± 3 Hertz.
6. AC power: 480V, 3 phase, 60 hz power supply.

2.4 PRODUCT FEATURES

- A. Display: Provide integral display to indicate output voltage, output frequency in hertz, output current, speed demand in percentage, control mode: (manual/automatic), total three-phase kW, time, date, drive temperature, elapsed time meter, motor RPM.
- B. Status indicators for protective functions: Separate indicators for overcurrent, over voltage, under voltage, over frequency, phase loss, over temperature, ground fault, etc.
- C. Volts Per Hertz Adjustment: plus or minus ten percent.
- D. Current Limit Adjustment: 60 to 110 percent of rated.
- E. Acceleration Rate Adjustment: 0.5 to 30 seconds.
- F. Deceleration Rate Adjustment: 1 to 30 seconds.
- G. Provide “Start” and “Stop” pushbuttons, “Local – Remote” selector switch, and manual speed control on the VFD control panel.
- H. Input signals: 4-20 MADC and start/stop signal (120 VAC) from PLC.
- I. Safety Interlocks: Provide terminals for remote contacts to inhibit starting under both manual and auto mode.
- J. Input line fuses or breaker for circuit protection.
- K. An “Emergency Stop” circuit shall utilize dynamic braking.
- L. Motor control circuit shall incorporate control, protective relay, and alarm circuits as required to coordinate with the ancillary, protective, and alarm devices supplied by the pump or motor manufacturer.
- M. Output signals from VFD:
 1. Analog output signal 4-20 MADC proportional to output frequency.
 2. Run relay with two isolated sets of form C contacts.
 3. Dry contacts (2 amps at 120 VAC) to indicate VFD ready, running, and fail on a remote panel. Running contacts shall indicate that the motor is running, whether powered from the VFD or the bypass contactor. Fail contacts shall indicate VFD trouble or motor shutdown due to protective circuits.
- N. Laminated plastic nameplate engraved with the drive’s designation, as existing.

- O. Each controller shall have a reduced size, approved, “as-built,” schematic wiring diagram, in ladder diagram format, inside each unit, indicating all internal components and wiring terminal strip connections, all 480 V. power wiring, all 120 V. control and power wiring, all instrument wiring, and all external components and wiring (shown dotted). Wiring diagrams shall have a plasticized coating to protect them from dirt, heat, and normal wear and tear.
- P. VFD shall include digital communications. Ethernet protocol shall be provided to allow direct communication with a programmable logic controller. An RS-232, RS-422, or RS-485 port shall be provided for communication.

2.5 FABRICATION

- A. All VFD components shall be factory mounted and wired. Free-standing enclosures shall be suitable for mounting on a concrete housekeeping pad.
- B. Enclosures shall be not less than 16-gauge steel with surface thoroughly cleaned and phosphatized prior to painting. They shall be primed with a corrosion-resisting coating. Cabinet finish paint to be ANSI 61 Gray.
- C. Overall dimensions of fabricated VFD unit shall fit within the available space.

PART 3 EXECUTION

3.1 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this Section. All tests shall be in accordance with the latest version of UL and NEMA standards.
 - 1. All printed circuit boards shall be tested under a temperature cycling (0 degrees C to +50 degrees C) 24-hour load test and then functionally tested via fault finder bench equipment prior to unit installation.
 - 2. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The Adjustable Frequency Drive shall trip electronically without device failure.
 - 3. After all tests have been performed, each VFD shall undergo a 12-hour burn-in test. The drive shall be burned in at 100% inductive or motor load for 12 hours without an unscheduled shutdown.
 - 4. After the burn-in cycle is complete, each VFD shall be put through a 30-minute cycling motor load test before inspection and shipping.
- B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 EXAMINATION

- A. Verify conditions under provisions of Section 01039.
- B. Verify that surface is suitable for controller installation.

3.7 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

3.8 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 16980.
- B. Demonstrate operation of controllers in automatic and manual modes.

3.9 TRAINING

- A. The Contractor shall provide a training session for up to three (3) Owner's Representatives for one (1) normal working days at a job site location determined by the Owner.
- B. The training session shall be conducted by a manufacturer's qualified representative.
- C. The training program shall consist of instructions on the proper maintenance and operation of the equipment.

END OF SECTION

SECTION 16496

ENCLOSED TRANSFER SWITCH

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Automatic Transfer Switch.
- B. Manual Transfer Switch.

1.2 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 1 - General Standards for Industrial Control and Systems.
- C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
- C. Submittals shall also include wiring diagrams, and a complete written sequential description of operation under the various modes of operation, describing complete control circuit and equipment operation.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions.
- C. Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or other testing firm acceptable to authority having jurisdiction, as suitable for purpose specified and shown.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 01600.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure, and finish.

1.7 WARRANTY

- A. Furnish a five (5) year comprehensive warranty beginning from the date of delivery of the equipment. The warranty shall cover all parts and labor.

1.8 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Section 01700.
- B. Provide two of each special tool required for maintenance.
- C. Provide two (2) relays of each type installed in the supplied transfer switch(es).
- D. Provide five (5) lamps for each type of indicating light installed in the supplied transfer switch(es).

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

- A. Automatic transfer switches shall be 3 pole, 3 wire, 600 VAC, rated to match the existing, and shall be the product of one manufacturer. The system shall be listed to the latest requirements of Underwriters' Laboratories Standard UL-1008 and rated for the total system load.
- B. All conductors shall be copper and all power terminals or lugs shall be 75°C rated for copper conductors. Terminal boards or blocks shall be provided for all external connections and shall be readily accessible from the front of the switch enclosure. All wiring to external devices shall be terminated at the terminal blocks, excluding normal and emergency source and load conductors. All wires and terminals shall be tagged to agree with schematic and wiring diagrams.

- C. The automatic transfer switch shall be a mechanically held device utilizing two circuit breakers. The breaker handles shall be operated by a transfer mechanism to provide double throw switching action. Mechanisms shall be electrically operated and shall be capable of being operated manually.
- D. The transfer switch shall be mechanically and electrically interlocked so that a maintained neutral position shall not be possible when under electrical operation.
- E. The automatic transfer switch shall provide automatic and manual operation of the circuit breakers to provide transfer and restoration without paralleling of the normal source and the emergency source as specified hereinafter. The transfer switch shall be provided with pilot lights to indicate which source the load is connected to.
- F. An "Auto-Manual" mode selector switch shall be provided to allow automatic or manual operation of the switch. Manual operation shall be from emergency to normal only.
- G. With the transfer switch in the automatic mode, the following sequence of operation shall occur:
 - 1. Upon loss of voltage, sustained low or over voltage, phase reversal, or improper frequency on the normal source for an adjustable period of one to ten seconds and when the emergency source voltage and frequency are within acceptable limits, the normal source circuit breaker shall automatically open and the emergency source breaker shall automatically close, re-establishing electric power to the load.
 - 2. Upon restoration of normal source power and after an adjustable time delay of up to ten minutes, the emergency source breaker shall automatically open and after an adjustable retransfer time delay of one to sixty seconds, the normal source breaker shall automatically close, re-establishing power to the load.
- H. With the transfer switch in the manual mode, operating handles shall provide manual operation of the circuit breakers. The switch shall have a manual neutral position so that both breakers may be open.
- I. Control power transformers and control transfer relays shall be provided to permit the operation described herein. Control devices shall operate at 120 VAC.
- J. The automatic transfer switch shall be complete with all necessary relays and component parts, arranged and connected to transfer the loads indicated.
- K. Single pole, double throw auxiliary interlocks or relays shall be provided and connected on the automatic transfer switch to perform the functions indicated herein. Provide additional auxiliary interlocks or relays with dry and isolated, single pole, double throw contacts for connection to a remote power failure alarm device and remote transfer switch position indicating devices.
- L. A written sequential description of operation under the various modes of operation shall be provided, describing complete control circuit and equipment operation, and logic. Operating instructions shall be permanently affixed to the outside of the enclosure.

- M. The transfer switch shall have frequency monitors and voltage sensitive relays (pre-set at 90%) on all three phases of both sources to initiate transfer with time delay adjustable from one to ten seconds to prevent transfer on momentary dips.
- N. A control transformer shall be supplied with 480/240 volt primary, 120 volt secondary with capacity as required for 120 volt power supply to the transfer switch and auxiliary devices, as herein specified.
- O. A protective cover (door-in-door construction) or external operating handles shall be provided for safe, manual operation of the switch.
- P. The transfer switch shall be UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with the upstream protective devices. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
- Q. The automatic transfer switch shall be housed in a NEMA Type 12 enclosure and shall be Eaton Cutler-Hammer Type ATV4, Hubbell Lexington, Lake Shore Electric Corp., or equal.

2.2 MANUAL TRANSFER SWITCH

- A. Manual transfer switches shall be three pole, double throw, 600 volt rated, quick-make, quick-break, fusible or non-fusible, and rated to match the existing with neutral lug, ground lug, and provisions for padlocking in either position. All power terminals or lugs shall be 75°C rated for copper conductors. Enclosure shall be NEMA Type 1 with switch positions labeled "NORMAL" and "EMERGENCY".
- B. Double throw transfer switches shall be as manufactured by Eaton Cutler-Hammer, Square D, or equal.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under the provisions of Section 01039.
- B. Verify that surface is suitable for transfer switch installation.

3.2 INSTALLATION

- A. Install transfer switches in accordance with manufacturer's instructions.
- B. Provide labels and engraved plastic nameplates to match existing.
- C. Arc flash and shock hazard warning labels shall be provided on the door of each transfer switch and shall be marked per the Owner's study.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Sections 01400 and 16970.

3.4 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 16980.
- B. Demonstrate operation of automatic transfer switches in normal and emergency modes.

END OF SECTION

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SECTION 16960

ELECTRICAL TESTING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Division 16 testing requirements.

1.2 RELATED SECTIONS

- A. Section 01400 - Quality Control: Manufacturer's Field Reports.
- B. Section 16970 - Calibration and Start-up of Systems.

1.3 REFERENCES

- A. All testing methods shall be in conformance with the following documents:
 - 1. National Electrical Code, latest approved edition.
 - 2. Any and all Federal, State, and/or local codes, ordinances, or regulations.
 - 3. NETA Acceptance and Maintenance Specifications and Safety Guidelines.
- B. All equipment shall be tested in conformity with all requirements, as a minimum, of applicable standards of IEEE, NEMA, ISA, ANSI, ICEA, UL, and OSHA, except as modified herein.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit test results under provisions of Section 01700.

PART 2 PRODUCTS

None.

PART 3 EXECUTION

3.1 TESTING

- A. The Contractor shall perform all testing necessary to insure that the purchase and installation of new replacement components under the Contract is satisfactory and in conformity with the requirements of the Contract Documents.
- B. All testing shall be performed prior to start-up of equipment or systems as specified under Section 16970.

- C. All tests shall be witnessed by the Owner's Representative and four (4) copies of all field tests, as specified herein and in other Sections, shall be submitted to the Owner. Twenty-four (24) hours (minimum) written notice shall be given the Owner prior to performing the tests. Such tests shall be scheduled at a time agreed upon by the Owner and the Contractor.
- D. Testing shall include, but shall not be limited to, the following tests:
1. Insulation resistance to ground of all new and reconnected conductors and equipment.
 2. Continuity, connections, and integrity of the equipment's grounding system.
 3. Continuity, polarity, phase sequence, and connection of all new and reconnected current carrying conductors and equipment.
 4. Temperature rise of all connections which show evidence of abnormal heating.
 5. Ground fault detection systems shall be tested in accordance with the NEC, UL, and manufacturer's recommendations.
- E. All improper connections, or materials, and equipment not adapted to the purpose for which it is intended, or material, or equipment found to be faulty while performing the tests, shall be corrected; and any changes or repairs necessary to put the work in satisfactory condition and operation shall be done by the Contractor and re-tested at no additional cost to the Owner.

3.2 CONTRACTOR'S ASSISTANCE

- A. The Contractor shall provide the services of an electrician to assist either the Contractor or the equipment manufacturer's service representatives on any and all field test and adjustments as may be made or required by equipment manufacturers or the Contractor as the equipment is put into service. The Contractor shall make equipment manufacturers' service representatives available as required to assist in testing or putting equipment into operation.

END OF SECTION

SECTION 16970

CALIBRATION AND START-UP OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements for Setup and Calibration of devices and instruments.
- B. Requirements for Start-up of Systems furnished/installed under this Contract.
- C. Sample Forms.

1.2 RELATED SECTIONS

- A. Section 01400 - Quality Control: Manufacturer's Field Reports.
- B. Section 16960 - Electrical Testing and Equipment.

1.3 REFERENCES

- A. All setup, calibration, and workmanship shall be in conformance with the following documents:
 - 1. National Electrical Code, latest approved edition.
 - 2. Any and all Federal, State, and/or local codes, ordinances, or regulations.
- B. All equipment shall be designed, constructed, installed, tested and calibrated in conformity with all requirements, as a minimum, of applicable standards of IEEE, NEMA, ISA, ANSI, ICEA, UL, and OSHA.

1.4 PROJECT RECORD DOCUMENTS

- A. Submit calibration, setup and programming documentation under provisions of Section 01700.

1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01700.
- B. Operation Data: Include bound copies of operating and programming instructions. Include component parts replacement, adjustments, and preventative maintenance procedures and materials.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and use of product(s).

PART 2 PRODUCTS

None.

PART 3 EXECUTION

3.1 START-UP REQUIREMENTS

- A. Setup, calibration and start-up of equipment and/or systems shall be performed as described below, and per the requirements of the Section under which the equipment/system was furnished.
- B. Prior to scheduling Start-up of any equipment and/or system, the Contractor shall have complied with the requirements of Section 16960, Electrical Testing and Equipment, and shall have submitted reports indicating successful completion of testing for the equipment/system being started.
- C. Prior to energizing and operating any equipment or system, the Contractor shall arrange for the manufacturer's representative to inspect the installation for compliance to the manufacturer's recommendations. As a part of this inspection, the Contractor and/or the manufacturer's service personnel shall set all protective devices as required by the Short Circuit, Flash Hazard, and Protective Devices Coordination Analyses available from the Owner.
- D. The Contractor shall energize the equipment/system and perform all setting of equipment limit and safety switches. The calibration of all sensing relays, and all timer/sequencer, etc. settings, along with any programming required for proper operation shall be made at this time. The Contractor shall then start-up the equipment/system and verify the proper operation of all features and functions as required by the Specifications.
- E. After completing the above items, the Contractor shall schedule a "Witnessed" Start-up. Twenty-four (24) hours (minimum) written notice shall be given the Owner's Representative prior to performing any Start-up. Start-up shall be scheduled at a time agreed upon by the Owner and the Contractor.
- F. Start-up and operation of the equipment and/or system shall be performed using the manufacturer's Operation and Maintenance Manual. Any deficiencies in the O & M Manual noted during Start-up shall be corrected prior to scheduling the Owner's Demonstration as specified under Section 16980. Start-up will be witnessed by the Owner's Representative.
- G. Verification of the start-up performance of the equipment and/or system shall be provided in the form of a start-up report, indicating that the Owner's Representative witnessed all functions and operations required of the equipment and/or system. Four (4) copies of all Start-up reports, as specified herein and in other Sections, shall be submitted to the Owner.
- H. All improperly functioning equipment not adapted to the purpose for which it is intended, or material, or equipment found to be faulty while performing the tests, shall be corrected; and any changes or repairs necessary to put the work in satisfactory condition and operation shall

be done by the Contractor at no additional cost to the Owner. Start-up of the repaired equipment/system shall be witnessed by the Owner's Representative.

- I. Successful and approved completion of the Start-up requirements is a prerequisite to determining whether the Work or a portion of the Work is Substantially Complete.

3.2 CONTRACTOR'S ASSISTANCE

- A. The Contractor shall provide the services of an electrician to assist either the Contractor or the equipment manufacturer's service representatives on any and all field tests and adjustments as may be made or required by equipment manufacturers or the Contractor as the equipment is started up. The Contractor shall make equipment manufacturers' service representatives available as required to assist in putting equipment into operation.

END OF SECTION

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INSTRUMENT CALIBRATION CERTIFICATE

1.0 INSTRUMENT IDENTIFICATION

Tag Number _____
Instrument Name _____
DCS Point Reference _____
Manufacturer _____
Model Number _____
Part Number _____
Cal. Range _____
Serial Number _____

2.0 CALIBRATION / TEST EQUIPMENT IDENTIFICATION

Description _____
Manufacturer _____
Model Number _____
Part Number _____
Serial Number _____
Calibration Date _____
Accuracy _____

3.0 INSTRUMENT INSTALLATION

Installed per manufacturers instructions: _____ Yes _____ No
Installed per Contract Specifications: _____ Yes _____ No
Discrepancy Description _____
Wiring Continuity from Instrument to Instrument: _____ N/A _____ OK
Wiring Continuity from Instrument to RIO Cabinet: _____ N/A _____ OK

4.0 INSTRUMENT CALIBRATION – ANALOG / DIGITAL

<u>Level</u>	<u>Input Units</u>	<u>Value at Indicator</u>	<u>Value at DCS/PLC</u>	
0 %	_____	_____	_____	
10 %	_____	_____	_____	
50 %	_____	_____	_____	
80 %	_____	_____	_____	
100 %	_____	_____	_____	

	<u>Setting</u>	<u>Deadband</u>	<u>Activation at Device</u>	<u>Activation at DCS</u>
Point 1	_____	_____	_____	_____
Point 2	_____	_____	_____	_____
Point 3	_____	_____	_____	_____

5.0 INSTRUMENT ADJUSTMENT SEALED

Adjustment Device Sealed With Colored Lacquer _____

6.0 CERTIFICATION

I certify that the above information is correct and that the instrument installation conforms to manufacturer and Contract Specifications, unless otherwise noted.

Technician Signature _____ Date: _____

7.0 ENGINEER REVIEW

Calibration Witnessed: ☐ Yes ☐ No Reviewer Signature _____ Date: _____

DEVICE SETTINGS CERTIFICATE
FOR MOTOR PROTECTION RELAY (MPR)

1.0 TECHNICIAN INFORMATION

Company Name: _____
Address: _____

Contact Person: _____
Phone No.: _____

2.0 EQUIPMENT IDENTIFICATION

Starter or Panel Designation: _____

3.0 DEVICE SETTINGS

Attach Manufacturer's form(s), with settings filled in, whenever available.

MPR SETTINGS			
Device ID		Jam Trip Run Delay in Seconds	
Manufacturer		Underload Trip Level in % of FLA	
Model No.		Underload Trip and Alarm Start Delay in Seconds	
Full Load Amp Rating		Underload Trip Run Delay in Seconds	
Locked Rotor Current in % of FLA		Phase Unbalance Trip Level	
Maximum Allowable Stall Time in Seconds		Phase Unbalance Trip and Alarm Start Delay in Seconds	
Ultimate Trip Current in % of FLA		Phase Unbalance Trip Run Delay in Seconds	
Phase CT Ratio		Ground Fault Alarm Level in % of Ground CT Ratio	
Ground CT Ratio		I ² T Alarm Level in % of Full I ² T Trip Capacity	
50 or 60 Hertz Line Frequency		Jam Alarm Level in % of FLA	
Reversing or Non-reversing Starter		Jam Alarm Run Delay in Seconds	
RTD Temp in Degrees F or Degrees C		Underload Alarm Level in % of FLA	
Winding Temperature Trip		Underload Alarm Run Delay in Seconds	
Winding Temperature Alarm		Phase Unbalance Alarm Level	
Motor Bearing Temperature Trip		Phase Unbalance Alarm Run Delay in Seconds	
Motor Bearing Temperature Alarm		Starts Per Time Allowed	
Load Bearing Temperature Trip		Time Allowed for Starts Count in Minutes	
Load Bearing Temperature Alarm		Time Between Starts in Minutes	
Auxiliary Trip		Number of Cold Starts Allowed	
Auxiliary Alarm		Motor Start Transition Current Level in % of FLA	
Alarm on RTD Failure Diagnostic		Motor Start Transition Time in Seconds	
Ground Fault Trip Level in % of Ground CT Ratio		Transition on Time, Current, Time or Current, or Time and Current	
Ground Fault Start Delay in Cycles		Incomplete Sequence Report Back Time in Seconds	
Ground Fault Run Delay in Cycles		Incomplete Seq. Start Timer Initiated by	
Instantaneous Overcurrent in % of FLA		Long Acceleration Time in Seconds	
Instantaneous Overcurrent Start Delay in Cycles		Zero Speed Switch ON or OFF	
Jam Trip Level in % of FLA		Anti-Backspin Delay Time in Minutes	
Jam Trip and Alarm Start Delay in Seconds			

4.0 CERTIFICATION

I certify that the above information is correct and that the device installation and settings conform to manufacturer and Contract Specification requirements, unless otherwise noted.

Technician Signature _____

Date: _____

5.0 ENGINEER REVIEW

Setting Witnessed: ☐ Yes ☐ No Reviewer Signature _____ Date: _____

DEVICE SETTINGS CERTIFICATE
FOR CIRCUIT BREAKERS

1.0 TECHNICIAN INFORMATION

Company Name: _____
Address: _____

Contact Person: _____
Phone No.: _____

2.0 EQUIPMENT IDENTIFICATION

Panel or Switchgear Designation: _____

3.0 DEVICE SETTINGS

Attach manufacturer's form(s), with settings filled in, whenever available.

BREAKER SETTINGS									
Breaker ID:									
Device Manufacturer									
Device Model No.									
Bus Number									
Curve Shape									
Inv. TM. PU.									
Inv. TM. MULT.									
Short TM. Delay									
Inst. PU.									
Discrim.									
High Load TM.									
Frequency									
C.T. Ratio									
Ground Settings									

4.0 CERTIFICATION

I certify that the above information is correct and that the device installation and settings conform to manufacturer and Contract Specification requirements, unless otherwise noted.

Technician Signature _____ Date: _____

5.0 ENGINEER REVIEW

Setting Witnessed: ☐ Yes ☐ No Reviewer Signature _____ Date: _____

DEVICE SETTINGS CERTIFICATE
FOR VARIABLE FREQUENCY CONTROLLER

1.0 TECHNICIAN INFORMATION

Company Name: _____
Address: _____

Contact Person: _____
Phone No.: _____

2.0 EQUIPMENT IDENTIFICATION

VFD Designations: _____

3.0 DEVICE SETTINGS

Attach manufacturer's form(s), with settings filled in, whenever available.

SETTINGS						
Device ID:	VFD #	VFD #	VFD #	VFD #	VFD #	VFD #
Manufacturer						
Model No.						
Accel Time (seconds)						
Decel Time (seconds)						
Minimum Speed (Hz)						
Maximum Speed (Hz)						
Current Limit (%)						
Manual Torque Boost (%)						
V/Hz Base Speed (Hz)						
RPM at Base Speed						
Output Relay Configured to						
Carrier Frequency (kHz)						
Remote Reference Gain (%)						
Remote Reference Offset (%)						
Electronic Thermal Overload (%)						
Electronic Thermal Overload Trip (on/off)						
Coast Stop Feature (on/off)						
Reverse (on/off)						
RPM Setpoint Feature (on/off)						
Power-Up Start Feature (on/off)						
Password Lockout Feature (on/off)						
Avoidance Frequency (Hz)						
Avoidance Bandwidth (Hz)						
Multi-Speed Preset 1 (Hz)						
Multi-Speed Preset 2 (Hz)						
Multi-Speed Preset 3 (Hz)						
Auto-Restart Number of Attempts						
Auto-Restart Retry Wait Time (seconds)						
Analog Output Configured to						

4.0 CERTIFICATION

I certify that the above information is correct and that the device installation and settings conform to manufacturer and Contract Specification requirements, unless otherwise noted.

Technician Signature _____ Date: _____

5.0 ENGINEER REVIEW

Setting Witnessed: ☐ Yes ☐ No Reviewer Signature _____ Date: _____

SECTION 16980

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Requirements for Demonstration of equipment and/or systems for the Owner's personnel.
- B. Requirements for Training of Owner's personnel in the operation and maintenance of the equipment/system.
- C. Acceptance requirements.

1.2 RELATED SECTIONS

- A. Section 01400 - Quality Control: Manufacturer's Field Reports.
- B. Section 01700 - Contract Closeout.
- C. Section 16960 - Electrical Testing and Equipment.
- D. Section 16970 – Calibration and Start-up of Systems.

1.3 REFERENCES

- A. All equipment and workmanship shall be in conformance with the following documents:
 - 1. National Electrical Code (NEC), latest approved edition.
 - 2. Any and all Federal, State, and/or local codes, ordinances, or regulations.
- B. All equipment shall be designed, constructed, installed, and tested in conformity with all requirements, as a minimum, of applicable standards of IEEE, NEMA, ISA, ANSI, ICEA, UL and OSHA, except as modified herein.

PART 2 PRODUCTS

None.

PART 3 EXECUTION

3.1 DEMONSTRATION OF EQUIPMENT

- A. Demonstration of equipment and systems, and training of the Owner's personnel in the proper operation and maintenance of the equipment and systems, shall be performed as required

under Section 01650, as described below, and per the requirements of the Section under which the equipment/system was furnished.

- B. The following shall occur prior to scheduling demonstration and training of any equipment and/or system:
1. The Contractor shall have fully complied with the requirements of Section 16970, Calibration and Start-up of Systems, and shall have submitted reports indicating successful completion of start-up for the equipment/system being started.
 2. Any deficiencies in the manufacturer's Operation and Maintenance (O&M) Manuals and/or "As-Built" drawings, noted during Start-up shall be corrected prior to scheduling the Owner's Demonstration and Training, as required per Section 16970.
 3. The Contractor shall submit for approval a proposed agenda for said demonstration/training, and shall adhere to the approved agenda for the demonstration and training session(s).
 4. Any and all test equipment, maintenance equipment, tools, or devices, and/or spare parts required to be furnished under Division 16 shall be turned over, and stored as required under Section 01700.
- C. After completing the above items, the Contractor shall schedule the Owner's Demonstration and Training. Seventy-two (72) hours (minimum) written notice shall be given the Owner's Representative prior to performing any Demonstration and/or Training. Such sessions shall be scheduled at a time agreed upon by the Owner and the Contractor. Multiple sessions shall be scheduled to allow attendance by all Owner's Personnel.
- D. The Demonstration shall instruct the Owner's personnel in all facets, features, and functions of the operation of the equipment and/or system. Training shall be performed using the manufacturer's Operation and Maintenance Manual and "As-Built" drawings, and shall familiarize the Owner's personnel in identifying improper operation, troubleshooting for the cause(s), and performing repair, replacement, and recalibration/setup necessary to correct the mis-operation. Use of any test equipment necessary, and a review of any recommended and/or provided spare parts shall be included in the Training.
- E. Verification of the Demonstration and Training for the equipment and/or system shall be provided in the form of a report, indicating that the Owner's personnel attended and witnessed all functions and operations required of the equipment and/or system, and received the required instruction. Demonstration and Training will be witnessed by the Owner's Representative and four (4) copies of all demonstration and training reports, as specified above and in other Sections, shall be submitted to the Owner.
- F. Successful and approved completion of the Demonstration and Training requirements is a prerequisite to determining whether the Work or a portion of the Work is Substantially Complete.

3.2 CONTRACTOR'S ASSISTANCE

- A. The Contractor shall provide the services of an electrician to assist either the Contractor or the equipment manufacturers' service representatives on any and all field set-ups and adjustments as may be required to demonstrate operation of the equipment or system. The

Contractor shall make equipment manufacturers' service representatives available as required to assist in demonstrating equipment operation.

3.3 CLEANUP

- A. Cleanup shall occur as required under Section 01700.

3.4 ACCEPTANCE

- A. Acceptance shall occur after all the above requirements have been satisfied, and as per Section 01700.
- B. Acceptance of equipment and/or systems shall be signified by execution of Guarantees as described below.

3.5 GUARANTEES

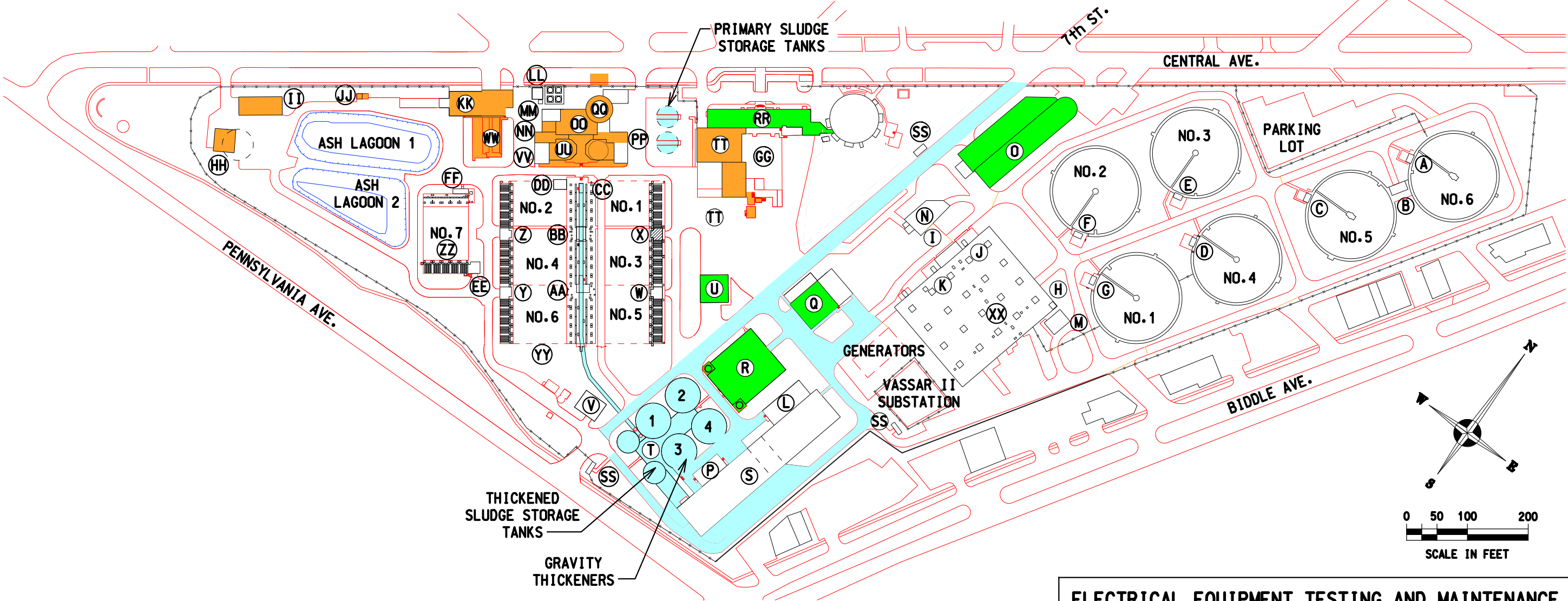
- A. The equipment and installation furnished under Division 16 shall be guaranteed for a period of one (1) year as specified under Section 01700, Contract Closeout.
- B. The Contractor's Guarantee shall be furnished as follows:
1. Provide duplicate copies.
 2. Execute for Owner's signature a certificate of Contractor's guarantee, listing date of acceptance as start of warranty period (except where indicated otherwise under the detailed equipment specifications), for all work and materials provided and installed under this Division.*
 3. Execute and assemble any and all transferable warranty and/or license documents from Subcontractors, suppliers, and manufacturers.
 4. Provide Table of Contents and assemble in three D, side ring binder with durable plastic cover.
- * For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of Owner's acceptance as start of warranty period.
- C. The Owner's dated signature on these documents shall constitute acceptance for warranty purposes.

END OF SECTION

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DESIGN FILE - \\A200707\20070720\ELV\TOURE_1.dgn
USER NAME - temenhiser

DOWNRIVER WASTEWATER TREATMENT FACILITY

- (A) CLARIFIER BLDG. #6
(B) RAS PUMPING STATION
(C) CLARIFIER BLDG. #5
(D) CLARIFIER BLDG. #4
(E) CLARIFIER BLDG. #3
(F) CLARIFIER BLDG. #2
(G) CLARIFIER BLDG. #1
(H) SAMPLE BLDG.
(I) AERATION BLDG.
(J) N. INFLUENT CHAMBER ENTRANCE HOUSE
(K) S. INFLUENT CHAMBER ENTRANCE HOUSE
(L) ELECTRICAL ROOM #1
(M) SECONDARY CHEMICAL BLDG.
- (N) SECONDARY LOW LIFT PUMP STATION
(O) MAINTENANCE BLDG.
(P) ELECTRICAL ROOM #2
(Q) SERVICE BLDG.
(R) DISSOLVED AIR FLOTATION (DAF) BLDG.
(S) SOLIDS HANDLING BLDG.
(T) SOLIDS THICKENING COMPLEX
(U) MAINTENANCE GARAGE
(V) SKIMMINGS BLDG.
(W) SKIMMINGS BLDG. #5
(X) SKIMMINGS BLDG. #1-3
(Y) SKIMMINGS BLDG. #6
(Z) SKIMMINGS BLDG. #2-4
- (AA) PRIMARY TANKS #1-6
(BB) PRIMARY PUMP GALLERY
(CC) PRIMARY PUMP GALLERY ENTRANCE HOUSE
(DD) PRIMARY POLYMER BLDG.
(EE) SKIMMINGS BLDG. #7
(FF) PRIMARY MOTOR CONTROL CENTER #7
(GG) ULTRAVIOLET DISINFECTION
(HH) TUNNEL PUMP STATION
(II) TUNNEL PUMP STATION ELECT. BLDG.
(JJ) RECYCLE SAMPLE BLDG.
(KK) AERATED GRIT BLDG.
(LL) FERRIC CHLORIDE TANKS
(MM) FERRIC CHLORIDE EQUIP. BLDG.
- (NN) WEST GRIT BLDG.
(OO) FINE SCREENS BLDG.
(PP) EAST GRIT BLDG.
(QQ) INFLUENT PUMP STATION
(RR) ADMINISTRATION BLDG.
(SS) WATER METER BLDG. (3 SHOWN)
(TT) OLD SOLIDS HANDLING BLDG.
(UU) DETRITORS
(VV) OLD GREASE BURNER BLDG.
(WW) AERATED GRIT TANKS
(XX) AERATION TANKS
(YY) PRIMARY TANKS #1-6
(ZZ) PRIMARY TANK #7



ELECTRICAL EQUIPMENT TESTING AND MAINTENANCE

JOB NO. 20070720	HUBBELL, ROTH & CLARK, INC.	FIGURE NO. 1
DATE AUGUST, 2011	CONSULTING ENGINEERS 220 BAGLEY DETROIT, MICH. SUITE 420 48226	