



Purchasing Division

Invitation for Bids

IFB-4952-22-SH
Shadow Lake Pump Station Electrical Improvements

Responses Due:

November 16, 2021 prior to 2:30 P.M.

Accepting Electronic Responses Only Through the Rocky Mountain E-Purchasing System (RMEPS)

<https://www.bidnetdirect.com/colorado>

(Purchasing Representative does not have access or control of the vendor side of RMEPS. If website or other problems arise during response submission, vendor **MUST** contact RMEPS to resolve issue prior to the response deadline. 800-835-4603)

NOTE: All City solicitation openings will continue to be held virtually.

Purchasing Representative:

Susan Hyatt
susanh@gjcity.org
970-244-1513

This document has been developed specifically to solicit competitive responses for this solicitation, and may not be the same as previous City of Grand Junction solicitations. All vendors are required to thoroughly review this solicitation prior to responding. Submittal by **FAX, EMAIL or HARD COPY IS NOT ACCEPTABLE** for this solicitation.

Invitation for Bids

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1. Instructions to Bidders

NOTE: It is the Contractor's responsibility to read and review all solicitation documentation in its entirety, and to ensure that they have a clear and complete understanding of not only the scope, construction drawings and specifications, project requirements, etc., but also all other requirements, instructions, rules, regulations, laws, conditions, statements, procurement policies, etc. that are associated with the solicitation process and project/services being solicited.

- 1.1. Purpose:** The City of Grand Junction is soliciting competitive bids from qualified and interested companies for all labor, equipment, and materials required to upgrade One (1) Motor Control Center (MCC) at the Shadow Lake Pump Station in the Redlands. All dimensions and scope of work should be verified by Contractors prior to submission of bids.

IFB Questions:

Susan Hyatt, Senior Buyer
susanh@gjcity.org

The City would like to remind all Contractors, Sub-Contractors, Vendors, Suppliers, Manufacturers, Service Providers, etc. that (with the exception of Pre-Bid or Site Visit Meetings) all questions, inquiries, comments, or communication pertaining to any formal solicitation (whether process, specifications, scope, etc.) must be directed (in writing) to the Purchasing Agent assigned to the project, or Purchasing Division. Direct communication with the City assigned Project Managers/Engineers is not appropriate for public procurement, and may result in disqualification.

- 1.2. Mandatory Pre-Bid Meeting:** **Prospective bidders are required to attend a mandatory pre-bid meeting on Thursday, October 19, 2021 at 2:00 P.M.** Meeting location shall be at the **Shadow Lake Pump Station, located at W Ridges Blvd and Mariposa, Grand Junction, CO 81501.** The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

NOTE: Bidders that are more than **10 minutes** late to the Pre-Bid meeting shall not be eligible to submit a bid response to this solicitation process for this project.

- 1.3. The Owner:** The Owner is the City of Grand Junction, Colorado and is referred to throughout this Solicitation. The term Owner means the Owner or his authorized representative.

- 1.4. Procurement Process:** Procurement processes shall be governed by the most current version of the City of Grand Junction [Purchasing Policy and Procedure Manual](#).

- 1.5. Submission:** **Each proposal shall be submitted in electronic format only, and only through the Rocky Mountain E-Purchasing (BidNet Colorado) website, www.bidnetdirect.com/colorado. The uploaded response shall be a single PDF document with all required information included. This site offers both "free" and "paying" registration options that allow for full access of the Owner's documents and for electronic submission of proposals. (Note: "free" registration may take up to 24**

hours to process. Please Plan accordingly.) Please view our “**Electronic Vendor Registration Guide**” at <http://www.gjcity.org/501/Purchasing-Bids> for details. (Purchasing Representative does not have access or control of the vendor side of RMEPS. If website or other problems arise during response submission, vendor **MUST** contact RMEPS to resolve issue prior to the response deadline. **800-835-4603**)

Please join the Bid Opening for Shadow Lake Pump Station Electrical Improvements IFB-4952-22-SH on GoTo from your computer using the Chrome browser. <https://app.goto.com/meet/710592085>

You can also dial in using your phone.

Dial-In

(646) 749-3335

Access Code

710-592-085

Opening date and time is noted on the front cover of this document.

- 1.6. **Modification and Withdrawal of Bids Before Opening.** Bids may be modified or withdrawn by an appropriate document stating such, duly executed and submitted to the place where Bids are to be submitted at any time prior to Bid Opening.
- 1.7. **Printed Form for Price Bid:** All Price Bids must be made upon the Price Bid Schedule, attached, and should give the amounts both in words and in figures, and must be signed and acknowledged by the bidder.

The Offeror shall specify a unit price in figures for each pay item for which a quantity is given and shall provide the products (in numbers) of the respective unit prices and quantities in the Extended Amount column. The total Bid price shall be equal to the sum of all extended amount prices. When an item in the Price Bid Schedule provides a choice to be made by the Offeror, Offeror's choice shall be indicated in accordance with the specifications for that particular item and thereafter no further choice shall be permitted.

Where the unit of a pay item is lump sum, the lump sum amount shall be shown in the "extended amount" column and included in the summation of the total Bid.

All blank spaces in the Price Bid Schedule must be properly filled out.

Bids by corporations must be executed in the corporate name by the president or vice president or other corporate office accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown below the signature.

Bids by partnerships must be executed in the partnership name and signed by a partner whose title must appear under the signature and the official address of the partnership must be shown below the signature.

All names must be typed or printed below the signature.

The Offeror's Bid shall contain an acknowledgement of receipt of all Addenda, the numbers of which shall be filled in on the Contractor's Bid Form.

The contact information to which communications regarding the Bid are to be directed must be shown.

- 1.8. Exclusions:** No oral, telephonic, emailed, or facsimile bid will be considered
- 1.9. Contract Documents:** The complete IFB and bidder's response compose the Contract Documents. Copies of bid documents can be obtained from the City Purchasing website, <http://www.gjcity.org/501/Purchasing-Bids>
- 1.10. Additional Documents:** The July 2010 edition of the "City Standard Contract Documents for Capital Improvements Construction", Plans, Specifications and other Bid Documents are available for review or download on the Public Works & Planning/Engineering page at www.gjcity.org. Electronic copies may be obtained on a CD format at the Department of Public Works and Planning at City Hall.
- 1.11. Definitions and Terms:** See Article I, Section 3 of the General Contract Conditions in the *Standard Contract Documents for Capital Improvements Construction*.
- 1.12. Examination of Specifications:** Bidders shall thoroughly examine and be familiar with the project Statement of Work. The failure or omission of any Offeror to receive or examine any form, addendum, or other document shall in no way relieve any Offeror from any obligation with respect to his bid. The submission of a bid shall be taken as evidence of compliance with this section. Prior to submitting a bid, each Offeror shall, at a minimum:
 - a. Examine the *Contract Documents* thoroughly;
 - b. Visit the site to familiarize themselves with local conditions that may in any manner affect cost, progress, or performance of the Work;
 - c. Become familiar with federal, state, and local laws, ordinances, rules, and regulations that may in any manner affect cost, progress or performance of the Work;
 - d. Study and carefully correlate Bidder's observations with the *Contract Documents*, and;
 - e. Notify the Purchasing Agent of all conflicts, errors, ambiguities or discrepancies in or among the *Contract Documents* within the designated inquiry period.

On request, the Owner will provide each Offeror access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of a Bid. It shall be the Offeror's responsibility to make or obtain any additional examinations, investigations, explorations, tests and studies and obtain any additional information and data which pertain to the physical conditions (including without limitation, surface, subsurface and underground utilities) at or contiguous to the site or otherwise which may affect cost, progress or performance of the work and which the Offeror deems

necessary to determine its Bid for performing the work in accordance with the time, price and other terms and conditions of the Contract Documents. Location of any excavation or boring made by Offeror shall be subject to prior approval of Owner and applicable agencies. Offeror shall fill all holes, restore all pavements to match the existing structural section and shall clean up and restore the site to its former condition upon completion of such exploration. The Owner reserves the right to require the Offeror to execute an access agreement with the Owner prior to accessing the site.

The lands upon which the Work is to be performed, rights of way, and access thereto, and other lands designated for use by Contractor in performing the Work, are identified on the Drawings.

Information and data reflected in the *Contract Documents* with respect to underground utilities at or contiguous to the site are based upon information and data furnished to the Owner and the Engineer by the owners of such underground utilities or others, and the Owner does not assume responsibility for the accuracy or completeness thereof, unless it is expressly provided otherwise in the *Contract Documents*.

By submission of a Bid, the Offeror shall be conclusively presumed to represent that the Offeror has complied with every requirement of these Instructions to Bidders, that the *Contract Documents* are not ambiguous and are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for performance of the Work.

- 1.13. Questions Regarding Statement of Work:** Any information relative to interpretation of Scope of Work or specifications shall be requested of the Purchasing Representative, in writing, in ample time, prior to the inquiry deadline.
- 1.14. Addenda & Interpretations:** If it becomes necessary to revise any part of this solicitation, a written addendum will be posted electronically on the City's website at <http://www.gjcity.org/501/Purchasing-Bids>. The Owner is not bound by any oral representations, clarifications, or changes made in the written specifications by Owner, unless such clarification or change is provided in written addendum form from the City Purchasing Representative.
- 1.15. Taxes:** The Owner is exempt from State retail and Federal tax. The bid price must be net, exclusive of taxes.
- 1.16. Sales and Use Taxes:** The Contractor and all Subcontractors are required to obtain exemption certificates from the Colorado Department of Revenue for sales and use taxes in accordance with the provisions of the General Contract Conditions. Bids shall reflect this method of accounting for sales and use taxes on materials, fixtures and equipment.
- 1.17. Offers Binding 60 Days:** Unless additional time is required by the Owner, or otherwise specified, all formal offers submitted shall be binding for sixty (60) calendar days following opening date, unless the Bidder, upon request of the Purchasing Representative, agrees to an extension.

- 1.18. Exceptions and Substitutions:** Bidders taking exception to the specifications and/or scope of work shall do so at their own risk. The Owner reserves the right to accept or reject any or all substitutions or alternatives. When offering substitutions and/or alternatives, Bidder must state these exceptions in the section pertaining to that area. Exception/substitution, if accepted, must meet or exceed the stated intent and/or specifications and/or scope of work. The absence of such a list shall indicate that the Bidder has not taken exceptions, and if awarded a contract, shall hold the Bidder responsible to perform in strict accordance with the specifications and/or scope of work contained herein.
- 1.19. Collusion Clause:** Each bidder by submitting a bid certifies that it is not party to any collusive action or any action that may be in violation of the Sherman Antitrust Act. Any and all bids shall be rejected if there is evidence or reason for believing that collusion exists among bidders. The Owner may, or may not, accept future bids for the same services or commodities from participants in such collusion.
- 1.20. Disqualification of Bidders:** A Bid will not be accepted from, nor shall a Contract be awarded to, any person, firm, or corporation that is in arrears to the Owner, upon debt or contract, or that has defaulted, as surety or otherwise, upon any obligation to the Owner, or that is deemed irresponsible or unreliable.

Bidders may be required to submit satisfactory evidence that they are responsible, have a practical knowledge of the project bid upon and that they have the necessary financial and other resources to complete the proposed Work.

Either of the following reasons, without limitation, shall be considered sufficient to disqualify a Bidder and Bid:

- a. More than one Bid is submitted for the same Work from an individual, firm, or corporation under the same or different name; and
 - b. Evidence of collusion among Bidders. Any participant in such collusion shall not receive recognition as a Bidder for any future work of the Owner until such participant has been reinstated as a qualified bidder.
- 1.21. Public Disclosure Record:** If the bidder has knowledge of their employee(s) or sub-contractors having an immediate family relationship with a City employee or elected official, the bidder must provide the Purchasing Representative with the name(s) of these individuals. These individuals are required to file an acceptable "Public Disclosure Record", a statement of financial interest, before conducting business with the City.

2. General Contract Conditions for Construction Projects

- 2.1. The Contract:** This Invitation for Bid, submitted documents, and any negotiations, when properly accepted by the City, shall constitute a contract equally binding between the City and Contractor. The contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The contract may be amended or modified with Change Orders, Field Orders, or Addendums.
- 2.2. The Work:** The term Work includes all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.
- 2.3. Execution, Correlation, Intent, and Interpretations:** The Contract Documents shall be signed by the Owner (City) and Contractor. City will provide the contract. By executing the contract, the Contractor represents that he/she has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents. The Contract Documents are complementary, and what is required by any one, shall be as binding as if required by all. The intention of the documents is to include all labor, materials, equipment and other items necessary for the proper execution and completion of the scope of work as defined in the technical specifications and drawings contained herein. All drawings, specifications and copies furnished by the City are, and shall remain, City property. They are not to be used on any other project, and with the exception of one contract set for each party to the contract, are to be returned to the owner on request at the completion of the work.
- 2.4. The Owner:** The Owner is the City of Grand Junction, Colorado and is referred to throughout the Contract Documents. The term Owner means the Owner or his authorized representative. The Owner shall, at all times, have access to the work wherever it is in preparation and progress. The Contractor shall provide facilities for such access. The Owner will make periodic visits to the site to familiarize himself generally with the progress and quality of work and to determine, in general, if the work is proceeding in accordance with the contract documents. Based on such observations and the Contractor's Application for Payment, the Owner will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in the contract. The Owner will have authority to reject work which does not conform to the Contract documents. Whenever, in his reasonable opinion, he considers it necessary or advisable to insure the proper implementation of the intent of the Contract Documents, he will have authority to require the Contractor to stop the work or any portion, or to require special inspection or testing of the work, whether or not such work can be then be fabricated, installed, or completed. The Owner will not be responsible for the acts or omissions of the Contractor, and sub-Contractor, or any of their agents or employees, or any other persons performing any of the work.
- 2.5. Contractor:** The Contractor is the person or organization identified as such in the Agreement and is referred to throughout the Contract Documents. The term Contractor means the Contractor or his authorized representative. The Contractor

shall carefully study and compare the General Contract Conditions of the Contract, Specification and Drawings, Scope of Work, Addenda and Modifications and shall at once report to the Owner any error, inconsistency or omission he may discover. Contractor shall not be liable to the Owner for any damage resulting from such errors, inconsistencies or omissions. The Contractor shall not commence work without clarifying Drawings, Specifications, or Interpretations.

- 2.6. Sub-Contractors:** A sub-contractor is a person or organization who has a direct contract with the Contractor to perform any of the work at the site. The term sub-contractor is referred to throughout the contract documents and means a sub-contractor or his authorized representative.
- 2.7. Award of Sub-Contractors & Other Contracts for Portions of the Work:** Contractor shall submit with their bid response to the Owner, in writing for acceptance, a list of the names of the sub-contractors or other persons or organizations proposed for such portions of the work as may be designated in the proposal requirements, or, if none is so designated, the names of the sub-contractors proposed for the principal portions of the work. Prior to the award of the contract, the Owner shall notify the successful Contractor in writing if, after due investigation, has reasonable objection to any person or organization on such list. If, prior to the award of the contract, the Owner has a reasonable and substantial objection to any person or organization on such list, and refuses in writing to accept such person or organization, the successful Contractor may, prior to the award, withdraw their proposal without forfeiture of proposal security. If the successful Contractor submits an acceptable substitute with an increase in the proposed price to cover the difference in cost occasioned by the substitution, the Owner may, at their discretion, accept the increased proposal or may disqualify the Contractor. If, after the award, the Owner refuses to accept any person or organization on such list, the Contractor shall submit an acceptable substitute and the contract sum shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued. However, no increase in the contract sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting a name with respect thereto prior to the award.
- 2.8. Quantities of Work and Unit Price:** Materials or quantities stated as unit price items in the Bid are supplied only to give an indication of the general scope of the Work, and are as such, estimates only. The Owner does not expressly or by implication agree that the actual amount of Work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit item of the Work without a change in the unit price except as set forth in Article VIII, Section 70 of the *General Contract Conditions*. The City also reserves the right to make changes in the Work (including the right to delete any bid item in its entirety or add additional bid items) as set forth in Article VIII, Sections 69 through 71 of the *General Contract Conditions*.
- 2.9. Substitutions:** The materials, products and equipment described in the *Solicitation Documents* shall be regarded as establishing a standard of required performance, function, dimension, appearance, or quality to be met by any proposed substitution. No substitution will be considered prior to receipt of Bids unless the Offeror submits a written request for approval to the City Purchasing Division at least ten (10) days prior

to the date for receipt of Bids. Such requests for approval shall include the name of the material or equipment for which substitution is sought and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for evaluation, including samples if requested. The Offeror shall set forth changes in other materials, equipment, or other portions of the Work including changes of the work of other contracts, which incorporation of the proposed substitution would require to be included. The Owner's decision of approval or disapproval of a proposed substitution shall be final. If the Owner approves a proposed substitution before receipt of Bids, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

- 2.10. Supervision and Construction Procedures:** The Contractor shall supervise and direct the work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the contract.
- 2.11. Warranty:** The Contractor warrants to the Owner that all materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards may be considered defective. If required by Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. If within ten (10) days after written notice to the Contractor requesting such repairs or replacement, the Contractor should neglect to make or undertake with due diligence to the same, the City may make such repairs or replacements. All indirect and direct costs of such correction or removal or replacement shall be at the Contractor's expense. The Contractor will also bear the expenses of making good all work of others destroyed or damaged by the correction, removal or replacement of his defective work.
- 2.12. Permits, Fees, & Notices:** The Contractor shall secure and pay for all permits, governmental fees and licenses necessary for the proper execution and completion of the work. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance in any respect, he shall promptly notify the Owner in writing, and any necessary changes shall be adjusted by approximate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he shall assume full responsibility and shall bear all costs attributable.
- 2.13. Responsibility for Those Performing the Work:** The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all sub-contractors, their agents and employees, and all other persons performing any of the work under a contract with the Contractor.
- 2.14. Use of the Site:** The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the site with any materials or equipment.

- 2.15. Cleanup:** The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of work he shall remove all his waste materials and rubbish from and about the project, as well as all his tools, construction equipment, machinery and surplus materials.
- 2.16. Insurance:** The Contractor shall secure and maintain such insurance policies as will provide the coverage and contain other provisions specified in the General Contract Conditions, or as modified in the Special Contract Conditions.

The Contractor shall file a copy of the policies or Certificates of Insurance acceptable to the City with the Engineer within ten (10) Calendar Days after issuance of the Notice of Award. These Certificates of Insurance shall contain a provision that coverage afforded under the policies shall not be canceled unless at least thirty (30) Calendar Days prior written notice has been given to the City.

- 2.17. Indemnification:** The Contractor shall defend, indemnify and save harmless the Owner, and all its officers, employees, insurers, and self-insurance pool, from and against all liability, suits, actions, or other claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property on account of any negligent act or fault of the Contractor, or of any Contractor's agent, employee, sub-contractor or supplier in the execution of, or performance under, any contract which may result from proposal award. Contractor shall pay any judgment with cost which may be obtained against the Owner growing out of such injury or damages.
- 2.18. Miscellaneous Conditions: Material Availability:** Contractors must accept responsibility for verification of material availability, production schedules, and other pertinent data prior to submission of bid. It is the responsibility of the bidder to notify the Owner immediately if materials specified are discontinued, replaced, or not available for an extended period of time.
- 2.19. OSHA Standards:** All bidders agree and warrant that services performed in response to this invitation shall conform to the standards declared by the US Department of Labor under the Occupational Safety and Health Act of 1970 (OSHA). In the event the services do not conform to OSHA standards, the Owner may require the services to be redone at no additional expense to the Owner.
- 2.20. Time:** Time is of the essence with respect to the time of completion of the Project and any other milestones or deadline which are part of the Contract. It will be necessary for each Bidder to satisfy the City of its ability to complete the Work within the Contract Time set forth in the Contract Documents. The Contract Time is the period of time allotted in the Contract Documents for completion of the work. The date of commencement of the work is the date established in a Notice to Proceed. If there is no Notice to Proceed, it shall be the date of the Contract or such other date as may be established therein, or as established as entered on the Bid Form. The Date of Final Completion of the work is the date certified by the Owner when all construction, and all other work associated to include, but not be limited to: testing, QA/QC, receipt of required reports and/or forms, grant requirements (if applicable), punch list items, clean-up, receipt of drawings and/or as-builts, etc., is fully complete, and in accordance with the Contract Documents.

- 2.21. Progress & Completion:** The Contractor shall begin work on the date of commencement as defined in the Contract and shall carry the work forward expeditiously with adequate forces and shall complete it within the contract time.
- 2.22. Payment & Completion:** The Contract Sum is stated in the Contract and is the total amount payable by the Owner to the Contractor for the performance of the work under the Contract Documents. Upon receipt of written notice that the work is ready for final inspection and acceptance and upon receipt of application for payment, the Owner's Project Manager will promptly make such inspection and, when he finds the work acceptable under the Contract Documents and the Contract fully performed, the Owner shall make payment in the manner provided in the Contract Documents.
- 2.23. Bid Bond:** Each Bid shall as a guaranty of good faith on the part of the Bidder be accompanied by a Bid Guaranty consisting of: a certified or cashier's check drawn on an approved national bank or trust company in the state of Colorado, and made payable without condition to the City; or a **Bid Bond** written by an approved corporate surety in favor of the City. The amount of the Bid Guaranty shall not be less than 5% of the total Bid amount. Once a Bid is accepted and a Contract is awarded, the apparent successful bidder has ten calendar days to enter into a contract in the form prescribed and to furnish the bonds with a legally responsible and approved surety. Failure to do so will result in forfeiture of the Bid Guaranty to the City as Liquidated Damages.

Each bidder shall guaranty its total bid price for a period of sixty (60) Calendar Days from the date of the bid opening.

- 2.24. Performance & Payment Bonds:** Contractor shall furnish a Performance and a Payment Bond, each in an amount at least equal to that specified for the contract amount as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These bonds shall remain in effect for the duration of the Warranty Period (as specified in the Special Conditions). Contractor shall also furnish other bonds that may be required by the Special Conditions. All bonds shall be in the forms prescribed by the Contract Documents and be executed by such sureties as (1) are licensed to conduct business in the State of Colorado and (2) are named in the current 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 Audit Staff, Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent must be accompanied by a certified copy of the Authority Act. If the surety on any bond furnished by the Contractor is declared bankrupt, or becomes insolvent, or its rights to do business in Colorado are terminated, or it ceases to meet the requirements of clauses (1) and (2) of this section, Contractor shall within five (5) days thereafter substitute another bond and surety, both of which shall be acceptable to the City.
- 2.25. Retention:** The Owner will deduct money from the partial payments in amounts considered necessary to protect the interest of the Owner and will retain this money until after completion of the entire contract. The amount to be retained from partial payments will be five (5) percent of the value of the completed work, and not greater than five (5) percent of the amount of the Contract. When the retainage has reached five (5) percent

of the amount of the Contract no further retainage will be made and this amount will be retained until such time as final payment is made.

2.26. Liquidated Damages for Failure to Enter Into Contract: Should the Successful Bidder fail or refuse to enter into the Contract within ten Calendar Days from the issuance of the Notice of Award, the City shall be entitled to collect the amount of such Bidder's Bid Guaranty as Liquidated Damages, not as a penalty but in consideration of the mutual release by the City and the Successful Bidder of all claims arising from the City's issuance of the Notice of Award and the Successful Bidder's failure to enter into the Contract and the costs to award the Contract to any other Bidder, to readvertise, or otherwise dispose of the Work as the City may determine best serves its interest.

2.27. Liquidated Damages for Failure to Meet Project Completion Schedule: If the Contractor does not achieve Final Completion by the required date, whether by neglect, refusal or any other reason, the parties agree and stipulate that the Contractor shall pay liquidated damages to the City for each such day that final completion is late. As provided elsewhere, this provision does not apply for delays caused by the City. The date for Final Completion may be extended in writing by the Owner.

The Contractor agrees that as a part of the consideration for the City's awarding of this Contract liquidated damages in the daily amount of **\$500.00** is reasonable and necessary to pay for the actual damages resulting from such delay. The parties agree that the real costs and injury to the City for such delay include hard to quantify items such as: additional engineering, inspection and oversight by the City and its agents; additional contract administration; inability to apply the efforts of those employees to the other work of the City; perceived inefficiency of the City; citizens having to deal with the construction and the Work, rather than having the benefit of a completed Work, on time; inconvenience to the public; loss of reputation and community standing for the City during times when such things are very important and very difficult to maintain.

The Contractor must complete the Work and achieve final completion included under the Bid Schedule in the number of consecutive calendar days after the City gives is written Notice to Proceed. When the Contractor considers the entire Work ready for its intended use, Contractor shall certify in writing that the Work is fully complete. Final Completion date is the date by which the Contractor shall have fully completed all clean-up, and all items that were identified by the City in the inspection for final completion. Unless otherwise stated in the Special Conditions, for purposes of this liquidated damages clause, the Work shall not be finished and the Contract time shall continue to accrue until the City gives its written Final Acceptance.

If the Contractor shall fail to pay said liquidated damages promptly upon demand thereof after having failed to achieve Final Completion on time, the City shall first look to any retainage or other funds from which to pay said liquidated damages; if retainage or other liquid funds are not available to pay said liquidated damages amounts, the Surety on the Contractor's Performance Bond and Payment Bond shall pay such liquidated damages. In addition, the City may withhold all, or any part of, such liquidated damages from any payment otherwise due the Contractor.

Liquidated damages as provided do not include any sums to reimburse the City for extra costs which the City may become obligated to pay on other contracts which were delayed or extended because of the Contractor's failure to complete the Work within the Contract Time. Should the City incur additional costs because of delays or extensions to other contracts resulting from the Contractor's failure of timely performance, the Contractor agrees to pay these costs that the City incurs because of the Contractor's delay, and these payments are separate from and in addition to any liquidated damages.

The Contractor agrees that the City may use its own forces or hire other parties to obtain Final Completion of the work if the time of completion has elapsed and the Contractor is not diligently pursuing completion. In addition to the Liquidated Damages provided for, the Contractor agrees to reimburse the City for all expenses thus incurred.

- 2.28. Contingency/Force Account/Minor Contract Revisions:** Contingency/Force Account/Minor Contract Revisions work will be authorized by the Owner's Project Manager and is defined as minor expenses to cover miscellaneous or unforeseen expenses related to the project. The expenses are not included in the Drawings, Specifications, or Scope of Work and are necessary to accomplish the scope of this contract. Contingency/Force Account/Minor Contract Revisions Authorization will be directed by the Owner through an approved form. Contingency/Force Account/Minor Contract Revisions funds are the property of the Owner and any Contingency/Force Account/Minor Contract Revisions funds, not required for project completion, shall remain the property of the Owner. Contractor is not entitled to any Contingency/Force Account/Minor Contract Revisions funds, that are not authorized by Owner or Owner's Project Manager.
- 2.29. Protection of Persons & Property:** The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain, as required by existing safeguards for safety and protection, and all reasonable precautions, including posting danger signs or other warnings against hazards promulgating safety regulations and notifying owners and users of adjacent utilities. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct by the Contractor in the execution of the work, or in consequence of the non-execution thereof by the Contractor, he shall restore, at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed, or it shall make good such damage or injury in an acceptable manner.
- 2.30. Changes in the Work:** The Owner, without invalidating the contract, may order changes in the work within the general scope of the contract consisting of additions, deletions or other revisions, the contract sum and the contract time being adjusted accordingly. All such changes in the work shall be authorized by Change Order and shall be executed under the applicable conditions of the contract documents. A Change Order is a written order to the Contractor signed by the Owner issued after the execution of the contract, authorizing a change in the work or an adjustment in the

contract sum or the contract time. The contract sum and the contract time may be changed only by Change Order.

- 2.31. Claims for Additional Cost or Time:** If the Contractor wishes to make a claim for an increase in the contract sum or an extension in the contract time, he shall give the Owner written notice thereof within a reasonable time after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall precede in accordance with the regulations on safety. No such claim shall be valid unless so made. Any change in the contract sum or contract time resulting from such claim shall be authorized by Change Order.
- 2.32. Minor Changes in the Work:** The Owner shall have authority to order minor changes in the work not involving an adjustment in the contract sum or an extension of the contract time and not inconsistent with the intent of the contract documents.
- 2.33. Field Orders:** The Owner may issue written Field Orders which interpret the Contract Documents in accordance with the specifications, or which order minor changes in the work in accordance with the agreement, without change in the contract sum or time. The Contractor shall carry out such Field Orders promptly.
- 2.34. Uncovering & Correction of Work:** The Contractor shall promptly correct all work rejected by the Owner as defective or as failing to conform to the contract documents whether observed before or after substantial completion and whether or not fabricated installed or completed. The Contractor shall bear all costs of correcting such rejected work, including the cost of the Owner's additional services thereby made necessary. If within one (1) year after the date of completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the contract documents, any of the work found to be defective or not in accordance with the contract documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of condition. All such defective or non-conforming work under the above paragraphs shall be removed from the site where necessary and the work shall be corrected to comply with the contract documents without cost to the Owner. The Contractor shall bear the cost of making good all work of separate Contractors destroyed or damaged by such removal or correction. If the Owner prefers to accept defective or non-conforming work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the payment or contract sum, or, if the amount is determined after final payment, it shall be paid by the Contractor.
- 2.34. Amendment:** No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting contract. All amendments to the contract shall be made in writing by the Owner.
- 2.35. Assignment:** The Contractor shall not sell, assign, transfer or convey any contract resulting from this IFB, in whole or in part, without the prior written approval from the Owner.

- 2.36. Compliance with Laws:** Bids must comply with all Federal, State, County and local laws governing or covering this type of service and the fulfillment of all ADA (Americans with Disabilities Act) requirements.
- 2.37. Confidentiality:** All information disclosed by the Owner to the Contractor for the purpose of the work to be done or information that comes to the attention of the Contractor during the course of performing such work is to be kept strictly confidential.
- 2.38. Conflict of Interest:** No public official and/or City/County employee shall have interest in any contract resulting from this IFB.
- 2.39. Contract Termination:** This contract shall remain in effect until any of the following occurs: (1) contract expires; (2) completion of services; (3) acceptance of services or, (4) for convenience terminated by either party with a written *Notice of Cancellation* stating therein the reasons for such cancellation and the effective date of cancellation.
- 2.40. Employment Discrimination:** During the performance of any services per agreement with the Owner, the Contractor, by submitting a Bid, agrees to the following conditions:
- 2.40.1.** The Contractor shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, handicap, or national origin except when such condition is a legitimate occupational qualification reasonably necessary for the normal operations of the Contractor. The Contractor agrees to post in conspicuous places, visible to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
- 2.40.2.** The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, shall state that such Contractor is an Equal Opportunity Employer.
- 2.40.3.** Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
- 2.41. Affirmative Action:** In executing a Contract with the City, the Contractor agrees to comply with Affirmative Action and Equal Employment Opportunity regulations presented in the General Contract Conditions.
- 2.42. Immigration Reform and Control Act of 1986 and Immigration Compliance:** The Offeror certifies that it does not and will not during the performance of the contract employ illegal alien workers or otherwise violate the provisions of the Federal Immigration Reform and Control Act of 1986 and/or the immigration compliance requirements of State of Colorado C.R.S. § 8-17.5-101, *et.seq.* (House Bill 06-1343).
- 2.43. Ethics:** The Contractor shall not accept or offer gifts or anything of value nor enter into any business arrangement with any employee, official, or agent of the Owner.

- 2.44. Failure to Deliver:** In the event of failure of the Contractor to deliver services in accordance with the contract terms and conditions, the Owner, after due oral or written notice, may procure the services from other sources and hold the Contractor responsible for any costs resulting in additional purchase and administrative services. This remedy shall be in addition to any other remedies that the Owner may have.
- 2.45. Failure to Enforce:** Failure by the Owner at any time to enforce the provisions of the contract shall not be construed as a waiver of any such provisions. Such failure to enforce shall not affect the validity of the contract or any part thereof or the right of the Owner to enforce any provision at any time in accordance with its terms.
- 2.46. Force Majeure:** The Contractor shall not be held responsible for failure to perform the duties and responsibilities imposed by the contract due to legal strikes, fires, riots, rebellions, and acts of God beyond the control of the Contractor, unless otherwise specified in the contract.
- 2.47. Independent Contractor:** The Contractor shall be legally considered an Independent Contractor and neither the Contractor nor its employees shall, under any circumstances, be considered servants or agents of the Owner. The Owner shall be at no time legally responsible for any negligence or other wrongdoing by the Contractor, its servants, or agents. The Owner shall not withhold from the contract payments to the Contractor any federal or state unemployment taxes, federal or state income taxes, Social Security Tax or any other amounts for benefits to the Contractor. Further, the Owner shall not provide to the Contractor any insurance coverage or other benefits, including Workers' Compensation, normally provided by the Owner for its employees.
- 2.48. Nonconforming Terms and Conditions:** A bid that includes terms and conditions that do not conform to the terms and conditions of this Invitation for Bid is subject to rejection as non-responsive. The Owner reserves the right to permit the Contractor to withdraw nonconforming terms and conditions from its bid prior to a determination by the Owner of non-responsiveness based on the submission of nonconforming terms and conditions.

Items for non-responsiveness may include, but not be limited to:

- a. Submission of the Bid on forms other than those supplied by the City;
- b. Alteration, interlineation, erasure, or partial detachment of any part of the forms which are supplied herein;
- c. Inclusion of unauthorized additions conditional or alternate Bids or irregularities of any kind which may tend to make the Bid incomplete, indefinite, or ambiguous as to its meaning;
- d. Failure to acknowledge receipt of any or all issued Addenda;
- e. Failure to provide a unit price or a lump sum price, as appropriate, for each pay item listed except in the case of authorized alternative pay items;

- f. Failure to list the names of Subcontractors used in the Bid preparation as may be required in the Solicitation Documents;
- g. Submission of a Bid that, in the opinion of the Owner, is unbalanced so that each item does not reasonably carry its own proportion of cost or which contains inadequate or unreasonable prices for any item;
- h. Tying of the Bid with any other bid or contract; and
- i. Failure to calculate Bid prices as described herein.

2.49. Evaluation of Bids and Offerors: The Owner reserves the right to:

- reject any and all Bids,
- waive any and all informalities,
- consider any prompt payment discounts offered by Bidder,
- negotiate final terms with the Successful Bidder,
- take into consideration past performance of previous awards/contracts with the Owner of any Contractor, Vendor, Firm, Supplier, or Service Provider in determining final award. and
- disregard any and all nonconforming, nonresponsive or conditional Bids.

Discrepancies between words and figures will be resolved in favor of words. Discrepancies between Unit Prices and Extended Prices will be resolved in favor of the Unit Prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. The corrected extensions and totals will be shown in the tabulation of Bids.

The Owner may consider the qualifications and experience of Subcontractors and other persons and organizations (including those who are to furnish the principal items of material or equipment) proposed for those portions of the work as to which the identity of Subcontractors and other persons and organizations must be submitted. Operating costs, maintenance considerations performance data, and guarantees of materials and equipment may also be considered by the Owner.

The Owner will conduct such investigations as deemed necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Offeror, proposed Subcontractors and other persons and organizations to do the Work in accordance with the *Contract Documents* to the City's satisfaction within the Contract Time.

The Offeror shall furnish the Owner all information and data requested by the Owner to determine the ability of the Offeror to perform the Work. The Owner reserves the right to reject the Bid if the evidence submitted by, or investigation of such Offeror fails to satisfy the Owner that such Offeror is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein.

By submitting a Bid, each Offeror authorizes the Owner to perform such investigation of the Offeror as the Owner deems necessary to establish the responsibility, qualifications and financial ability of the Offeror and, by its signature thereon, authorizes the Owner to obtain reference information concerning the Offeror and releases the party providing such information and the Owner from any and all liability to the Offeror as a result of such reference information so provided.

The Owner reserves the right to reject the Bid of any Offeror who does not pass any evaluation to the Owner's satisfaction.

If the Contract is to be awarded, it will be awarded to the Offeror who, by evaluation, the Owner determines will best meet the Owner's interests.

The Owner reserves the right to accept or reject the Work contained in any of the Price Bid Schedules or alternates, either in whole or in part.

2.50. Award of Contract: Unless otherwise indicated, a single award will be made for all the bid items in an individual bid schedule. In the event that the Work is contained in more than one Bid Schedule, the City may award Schedules individually or in combination. In the case of two Bid Schedules which are alternative to each other, only one of such alternative Schedules will be awarded. Within forty-five (45) Calendar Days of Bid Opening, the City will issue a Notice of Award to the Successful Bidder which will be accompanied by four (4) unsigned copies of the Contract and the Performance and Payment Bond forms. Within ten (10) Calendar Days thereafter, the Successful Bidder shall sign and deliver four (4) copies of the Contract, Performance Bond, Payment Bond and Certificates of Insurance to the City. Within ten (10) Calendar Days thereafter, the City will deliver two (2) fully executed counterparts of the Contract to the Contractor. No contract shall exist between the Successful Bidder and the City and the Successful Bidder shall have no rights at law or in equity until the Contract has been duly executed by the City.

The Successful Bidder's failure to sign and submit a Contract and other documents set forth in this Paragraph within the prescribed time shall be just cause of annulment of the award, and forfeiture of the Bid Guaranty. The award of Contract may then be made to the next qualified Bidder in the same manner as previously prescribed.

2.51. Ownership: All plans, prints, designs, concepts, etc., shall become the property of the Owner.

2.52. Oral Statements: No oral statement of any person shall modify or otherwise affect the terms, conditions, or specifications stated in this document and/or resulting agreement. All modifications to this request and any agreement must be made in writing by the Owner.

2.53. Patents/Copyrights: The Contractor agrees to protect the Owner from any claims involving infringements of patents and/or copyrights. In no event shall the Owner be liable to the Contractor for any/all suits arising on the grounds of patent(s)/copyright(s) infringement. Patent/copyright infringement shall null and void any agreement resulting from response to this IFB.

- 2.54. Remedies:** The Contractor and Owner agree that both parties have all rights, duties, and remedies available as stated in the Uniform Commercial Code.
- 2.55. Venue:** Any agreement as a result of responding to this IFB shall be deemed to have been made in, and shall be construed and interpreted in accordance with, the laws of the City of Grand Junction, Mesa County, Colorado.
- 2.56. Expenses:** Expenses incurred in preparation, submission and presentation of this IFB are the responsibility of the company and cannot be charged to the Owner.
- 2.57. Sovereign Immunity:** The Owner specifically reserves its right to sovereign immunity pursuant to Colorado State Law as a defense to any action arising in conjunction to this agreement.
- 2.58. Non-Appropriation of Funds:** The contractual obligation of the Owner under this contract is contingent upon the availability of appropriated funds from this fiscal year budget as approved by the City Council or Board of County Commissioners from this fiscal year only. State of Colorado law prohibit obligation of public funds beyond the fiscal year for which the budget was approved. Anticipated expenditures/obligations beyond the end of the current Owner's fiscal year budget shall be subject to budget approval. Any contract will be subject to and must contain a governmental non-appropriation of funds clause.
- 2.59. Cooperative Purchasing:** Purchases as a result of this solicitation are primarily for the City/County. Other governmental entities may be extended the opportunity to utilize the resultant contract award with the agreement of the successful provider and the participating agencies. All participating entities will be required to abide by the specifications, terms, conditions and pricings established in this Bid. The quantities furnished in this bid document are for only the City/County. It does not include quantities for any other jurisdiction. The City or County will be responsible only for the award for its jurisdiction. Other participating entities will place their own awards on their respective Purchase Orders through their purchasing office or use their purchasing card for purchase/payment as authorized or agreed upon between the provider and the individual entity. The City/County accepts no liability for payment of orders placed by other participating jurisdictions that choose to piggy-back on our solicitation. Orders placed by participating jurisdictions under the terms of this solicitation will indicate their specific delivery and invoicing instructions.
- 2.60. Keep Jobs in Colorado Act:** Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works projects. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a). If Contractor claims it is entitled to a waiver pursuant to C.R.S. §8-17-101(1), Contractor shall state that there is insufficient Colorado labor to perform the work such that compliance with Article 17 would create an undue burden that would substantially prevent a project from proceeding to completion and shall include evidence demonstrating the insufficiency and undue burden in its response.

Unless expressly granted a waiver by the Owner pursuant to C.R.S. §8-17-101(1), Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a).

2.60.1. "Public Works project" is defined as:

- (a) any construction, alteration, repair, demolition, or improvement of any land, building, structure, facility, road, highway, bridge, or other public improvement suitable for and intended for use in the promotion of the public health, welfare, or safety and any maintenance programs for the upkeep of such projects
- (b) for which appropriate or expenditure of moneys may be reasonably expected to be \$500,000.00 or more in the aggregate for any fiscal year
- (c) except any project that receives federal moneys.

3. Statement of Work

- 3.1. GENERAL:** The work request is for improvements and upgrades to the existing electrical systems at the Shadow Lake Pump Station in the Redlands, including replacement of the Motor Control Center (MCC).
- 3.2. PROJECT DESCRIPTION:** This project includes the procurement and installation of the Shadow Lake Pump Station MCC equipment and install the PLC equipment.

Shadow Lake Pump Station MCC: The City of Grand Junction Water Services is responsible for the operation and maintenance of the irrigation system for the Ridges development area, as well as providing pressurized irrigation water to the Redlands Mesa 18-hole golf course. Located below the Shadow Lake Reservoir next to Ridges Boulevard, the Shadow Lake Pump Station was constructed in 1987. Much of the electrical system is original to that era. The City would like to replace the MCC with new equipment and reuse the existing PLC equipment to improve the reliability of the irrigation system.

NOTE: The City of Grand Junction has procured the following equipment for this project:

- PLC Equipment

The Contractor for this project shall procure all remaining equipment and install this equipment as shown on the construction drawings (included in Appendix C) and in the construction specifications (included in Appendix B). Any additional wiring, conduit and electrical equipment necessary to complete the work shall be procured and installed by the Contractor.

The work for this project is scheduled to occur during the late fall and early winter, after the irrigation water has been turned off for the season.

3.3. SPECIAL CONDITIONS & PROVISIONS:

3.3.1 Mandatory Pre-Bid Meeting: Prospective bidders are required to attend a mandatory pre-bid meeting on Thursday, October 19, 2021 at 2:00 P.M. Meeting location shall be at the Shadow Lake Pump Station, located at W Ridges Blvd and Mariposa, Grand Junction, CO 81501. The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

NOTE: Bidders that are more than **10 minutes** late to the Pre-Bid meeting shall not be eligible to submit a bid response to this solicitation process for this project.

3.3.2 QUESTIONS REGARDING SOLICITATION PROCESS/SCOPE OF WORK:

Susan Hyatt, Senior Buyer
City of Grand Junction
susanh@gjcity.org

3.3.3 Project Manager: The Project Manager for the Project is Kirsten Armbruster, Project Engineer, who can be reached at (970) 244-1421. During Construction, all

notices, letters, submittals, and other communications directed to the City shall be addressed and mailed or delivered to:

City of Grand Junction
Department of Public Works and Planning
Attn: Kirsten Armbruster, Project Engineer
250 North Fifth Street
Grand Junction, CO 81501

3.3.4 Affirmative Action: The Contractor is not required to submit a written Affirmative Action Program for the Project.

3.3.5 Pricing: Pricing shall be all inclusive to include but not be limited to: all labor, equipment, supplies, materials, freight (F.O.B. Destination – Freight Pre-paid and Allowed to each site), travel, mobilization costs, fuel, set-up and take down costs, and full-time inspection costs, and all other costs related to the successful completion of the project.

The Owner shall not pay nor be liable for any other additional costs including but not limited to: taxes, shipping charges, insurance, interest, penalties, termination payments, attorney fees, liquidated damages, etc.

3.3.6 Freight/Shipping: All freight/shipping shall be F.O.B. Destination – Freight Pre-Paid and Allowed to the project site(s), Grand Junction, CO.

Contractor must meet all federal, state, and local rules, regulations, and requirements for providing such services.

3.3.7 Contract: A binding contract shall consist of: (1) the IFB and any amendments thereto, (2) the bidder's response (bid) to the IFB, (3) clarification of the bid, if any, and (4) the City's Purchasing Department's acceptance of the bid by "Notice of Award" or by "Purchase Order". All Exhibits and Attachments included In the IFB shall be incorporated into the contract by reference.

A. The contract expresses the complete agreement of the parties and, performance shall be governed solely by the specifications and requirements contained therein.

B. Any change to the contract, whether by modification and/or supplementation, must be accomplished by a formal contract amendment signed and approved by and between the duly authorized representative of the bidder and the City Purchasing Division or by a modified Purchase Order prior to the effective date of such modification. The bidder expressly and explicitly understands and agrees that no other method and/or no other document, including acts and oral communications by or from any person, shall be used or construed as an amendment or modification to the contract.

3.3.8 Time of Completion: The scheduled time of Completion for the Project is **87 Calendar Days** from the starting date specified in the Notice to Proceed.

Completion is achieved when site cleanup and all punch list items (resulting from the final inspection) have been completed. Completion shall have the meaning set forth in Article I, Section 3 (Definitions and Terms) of the General Contract Conditions.

3.3.9 Working Days and Hours: The working days and hours shall be as stated in the General Contract Conditions or as mutually agreed upon in the preconstruction meeting with the following exception:

All work shall be performed between the hours of 7:00 AM to 5:00 PM.

3.3.10 Licenses and Permits: Contractor is responsible for obtaining all necessary licenses and permits required for Construction, at Contractors expense. See Section 2.12. Contractor shall supply to Owner all copies of finalized permits.

3.3.11 Permits: The following permits are required for the Project and will be obtained by the City at no cost to the Contractor:

- None

The following permits are required for the Project and shall be obtained and paid for by the Contractor, with the costs included in the total bid price for the Project:

- Mesa County Building Permit
- Any coordination with Xcel Energy for the shut-down prior to work commencing. Xcel Energy requires three weeks' notice for any shut-down/startup.

3.3.12 City Furnished Materials: The City will furnish the following materials for the Project:

- PLC Equipment

3.3.13 Project Newsletters: A newsletter for the Project will be prepared and distributed by the City (if needed). It will include general information about the Project including interruptions in utility services, street closures, parking restrictions, project schedule, and the names and telephone numbers of the contacts for the City and Contractor. The newsletter will be mailed approximately one week before the Contractor commences work.

The Contractor will be responsible for notifying all businesses and / or residents located adjacent to the work. Door hanger notifications shall be distributed at least two (2) working days prior to the day the work is scheduled to begin.

3.3.14 Project Sign: Project signs, if any, will be furnished and installed by the City.

3.3.15 Authorized Representatives of the City: Those authorized to represent the City shall include Purchasing Agent, Engineers, and Inspectors employed by the City, only.

3.3.16 Stockpiling Materials and Equipment: All stockpiling/storage shall be in accordance with General Contract Condition Section 51.

3.3.17 Traffic Control: The Contractor shall provide and maintain traffic control in accordance with the approved Traffic Control Plan and the Manual on Uniform Traffic

Control Devices. A Traffic Control Plan shall be prepared by the Contractor and reviewed by the City two days prior to the pre-construction meeting.

3.3.18 Clean-Up: The Contractor is responsible for cleaning up all loose materials that have been deposited or swept into gutters, and onto sidewalks and driveways as a result of sidewalk operations. The costs for all clean-up work shall be considered incidental and will not be paid for separately.

3.3.19 Quality Control Testing: Supplier shall perform quality control testing on concrete. The City will perform all other necessary QA/QC.

3.3.20 Schedule of Submittals: Contractor shall deliver these submittals at least two days prior to the pre-construction meeting:

- Project Schedule

3.3.21 Uranium Mill Tailings: It is anticipated that radioactive mill tailings will not be encountered on this Project.

3.3.22 Fugitive Petroleum or Other Contamination: It is anticipated that soil contamination from fugitive petroleum or other contaminants will not be encountered with the Project.

3.3.23 Excess Material: All excess materials shall be disposed in accordance with General Contract Condition Section 50.

3.3.24 Existing Utilities and Structures: Utilities were **not** potholed during design of this project. The location of existing utilities and structures shown on the Plans is approximate with the information gathered during design. It is the responsibility of the Contractor to pothole/locate and protect all structures and utilities in accordance with General Contract Condition Section 37.

3.3.25 Incidental Items: Any item of work not specifically identified or paid for directly, but which is necessary for the satisfactory completion of any paid items of work, will be considered as incidental to those items, and will be included in the cost of those items.

3.3.26 Survey: The Contractor shall give the City survey crew a minimum of 72 hours' notice for all requested survey.

3.3.27 Work to be Performed by the City (Prior to Construction):

- None

3.3.28 Existing Concrete Sidewalks, Pans, Fillets, Curbs and Gutters: The existing sidewalks, pans, fillets, curb and gutter are in good serviceable condition. In most instances the installation of new sidewalk and pavement will be adjacent to existing concrete. The Contractor will need to protect all concrete adjacent to construction. If the concrete is damaged during construction the Contractor will be responsible for its replacement at no cost to the City. The Contractor, the City Project Inspector, and/or the City Project Manager will walk and record any concrete that is deemed to be damaged before construction has started.

3.4. SCOPE OF WORK:

The contractor shall follow the Project Specific Specifications provided in Appendix B. These Specifications modify the City of Grand Junction Standard Contract Documents for Capital Improvement Construction.

The Contractor shall also follow the Construction Drawings in Appendix C.

3.5. Attachments:

- Appendix A: Project Submittal Form
- Appendix B: Project Manual / Specifications
- Appendix C: Construction Drawings

3.6. Contractor Bid Documents: For Contractor’s convenience, the following is a list of forms/items to be submitted with the Contractor’s bid response. However, should a form/item not be listed in this section, but required in the solicitation documents, it is the Contractor’s responsibility to ensure all forms/items are submitted.

- Contractor’s Bid Form
- Price Bid Schedule
- References

3.7. IFB TENTATIVE TIME SCHEDULE:

Invitation For Bids available on or about	October 11, 2021
Mandatory Pre-Bid Meeting	October 19, 2021
Inquiry deadline, no questions after this date	October 27, 2021
Addendum Posted	October 29, 2021
Submittal deadline for proposals	November 16, 2021
City Council Approval	December 15, 2021
Notice of Award & Contract execution	December 16, 2021
Bonding & Insurance Cert due	December 28, 201
Preconstruction meeting	January 4, 2022
Work begins no later than	January 5, 2022
Final Completion	April 1, 2022
Holidays:	Martin Luther King Day
	President’s Day

4. Contractor's Bid Form

Bid Date: _____

Project: IFB-4952-22-SH Shadow Lake Pump Station Electrical Improvements

Bidding Company: _____

Name of Authorized Agent: _____

Email _____

Telephone _____ **Address** _____

City _____ **State** _____ **Zip** _____

The undersigned Bidder, in compliance with the Invitation for Bids, having examined the Instruction to Bidders, General Contract Conditions, Statement of Work, Specifications, and any and all Addenda thereto, having investigated the location of, and conditions affecting the proposed work, hereby proposes to furnish all labor, materials and supplies, and to perform all work for the Project in accordance with Contract Documents, within the time set forth and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this Contractor's Bid Form is a part.

The undersigned Contractor does hereby declare and stipulate that this offer is made in good faith without collusion or connection to any person(s) providing an offer for the same work, and that it is made in pursuance of, and subject to, all terms and conditions of the Instructions to Bidders, the Specifications, and all other Solicitation Documents, all of which have been examined by the undersigned.

The Contractor also agrees that if awarded the Contract, to provide insurance certificates within ten (10) working days of the date of Notification of Award. Submittal of this offer will be taken by the Owner as a binding covenant that the Contractor will be prepared to complete the project in its entirety.

The Owner reserves the right to make the award on the basis of the offer deemed most favorable, to waive any formalities or technicalities and to reject any or all offers. It is further agreed that this offer may not be withdrawn for a period of sixty (60) calendar days after closing time. Submission of clarifications and revised offers automatically establish a new thirty day (30) period.

Prices in the bid proposal have not knowingly been disclosed with another provider and will not be prior to award.

- Prices in this bid proposal have been arrived at independently, without consultation, communication or agreement for the purpose of restricting competition.
- No attempt has been made nor will be to induce any other person or firm to submit a bid proposal for the purpose of restricting competition.
- The individual signing this bid proposal certifies they are a legal agent of the offeror, authorized to represent the offeror and is legally responsible for the offer with regard to supporting documentation and prices provided.
- Direct purchases by the City of Grand Junction are tax exempt from Colorado Sales or Use Tax. Tax exempt No. 98-03544. The undersigned certifies that no Federal, State, County or Municipal tax will be added to the above quoted prices.
- City of Grand Junction payment terms shall be Net 30 days.
- Prompt payment discount of _____ percent of the net dollar will be offered to the Owner if the invoice is paid within _____ days after the receipt of the invoice. The Owner reserves the right to consider any such discounts when determining the bid award that are no less than Net 10 days.

RECEIPT OF ADDENDA: the undersigned Contractor acknowledges receipt of Addenda to the Solicitation, Specifications, and other Contract Documents.

State number of Addenda received: _____.

It is the responsibility of the Bidder to ensure all Addenda have been received and acknowledged.

By signing below, the Undersigned agree to comply with all terms and conditions contained herein.

Company: _____

Authorized Signature: _____

Title: _____

The undersigned Bidder proposes to subcontract the following portion of Work:

<u>Name & address of Sub-Contractor</u>	<u>Description of work to be performed</u>	<u>% of Contract</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

The undersigned Bidder acknowledges the right of the City to reject any and all Bids submitted and to waive informalities and irregularities therein in the City's sole discretion.

By submission of the Bid, each Bidder certifies, and in the case of a joint Bid each party thereto certifies as to his own organization, that this Bid has been arrived at independently, without collusion, consultation, communication, or agreement as to any matter relating to this Bid with any other Bidder or with any competitor.

Appendix A

PROJECT SUBMITTAL FORM

PROJECT: **Shadow Lake Pump Station Electrical Improvements IFB-4952-22-SH**

CONTRACTOR:

PROJECT ENGINEER: Kirsten Armbruster

Description	Date Received	Resubmittal Requested	Resubmittal Received	Date Accepted
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ELECTRICAL IMPROVEMENTS

Wire materials				
Conduit materials				
Junction Box materials				
Switchgear Shop Drawings				

EROSION CONTROL / STORMWATER MANAGEMENT

PERMITS, PLANS, OTHER

Construction Schedule				
Mesa County Building Permit				

Appendix B

Project Manual / Specifications

SECTION 01 00 00

GENERAL

PART 1 GENERAL

1.1 PROJECT SPECIFIC REQUIREMENTS

- A. The Standard Specifications for the MCC Replacement project are as follows:
 - a 26 01 26 Electrical Field Testing
 - b 26 05 00 Electrical
 - c 26 05 73 Engineering Studies
 - d 26 24 19 Motor Control Centers
 - e 26 29 23 Variable Frequency Motor Controller
- B. Standard Details for the MCC Replacement project are found in the contract drawing package Electrical Detail Sheets.
- C. Project specific requirements shall take precedence over general conditions or standard documents.
- D. Warranty period for specific Work items are not intended to supplement the general Contractor's Warranty and Guarantee.

1.2 DEFINITIONS

- A. The definitions here shall supplement, or replace, those found in the City of Grand Junction General Contract Conditions.
 - 1. As-Built Documents: See Project Record Documents.
 - 2. Owner: See City.
 - 3. Project Record Documents: Contract documents marked by the Contractor to identify changes that were made during construction.
 - 4. Request for Information (also known as RFI): A question or inquiry about the Work submitted by the Contractor for clarification by the Owner or Engineer.

1.3 REFERENCES

- A. References to industry standards shall refer to the latest edition or version of each as of the date of the first specification publish date, unless otherwise noted.

1.4 ADMINISTRATIVE

- A. Requests for Information (RFI): Contractor shall submit RFIs to the Engineer for any condition which is believed to be at variance with the Contract Documents, or for situations where it is

unclear what the Contract Documents are implementing. RFIs shall be submitted in writing to the Engineer and shall include a location, date requested, date required and indicate which repair item or item(s) are impacted by the request. Allow a minimum of 4 working days for review by Engineer.

- B. Maintain at least one copy of each referenced standard, this Project Manual (Specifications), Drawings and/or Figures at the job site. In addition, maintain copies of all site visit reports (SVR) and Sketches (SKs) issued by the Engineer during Construction.
- C. Provide a project superintendent at the Site a minimum of eight hours per day during the progress of the Work. The superintendent shall be literate and fluent in English.
- D. Photograph existing conditions that are important to the construction or that deviate substantially from the Contract Documents; significant conditions that will be concealed by the Work; finish surfaces that might be misconstrued as damage caused by removal or other Work operations; and immediate follow-up when on-site events result in construction damage or loss. Photographs shall be of sufficient quality as to depict the condition being photographed. Provide photographs to Owner or Engineer upon request, either during project or after completion.

1.5 TEMPORARY FACILITIES AND CONTROLS

- A. Contractor to furnish and pay for all temporary facilities and controls listed below which are not explicitly designated as responsibility of Owner.
- B. Comply with Owner's limitations and restrictions for Site use and accessibility.
 - 1. Comply with all security procedures.
- C. Project has special requirements for coordinating Work because of the following conditions:
 - 1. Owner will occupy premises outside of Work area during construction period.
 - a. Cooperate with Owner to minimize conflicts and facilitate Owner usage.
 - b. Perform Work to avoid interference with Owner's day-to-day operations. Notify Owner's Representative at least 72 hours in advance of activities that will affect Owner's operations.
 - c. Maintain vehicular, pedestrian, and emergency and normal access to portions of facility that are in use. Keep entrances and exits clear of stored materials and construction equipment.
 - d. Short interruptions in access may be permitted if approved in advance in writing by the Owner's Representative.
 - e. Schedule deliveries to minimize interruptions.
 - f. Do not disturb Site outside of Work area.
 - g. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted and then only after arranging to provide temporary utility services according to requirements indicated.
 - h. Notify Owner not less than 7 days in advance of proposed utility interruptions.
 - i. Do not proceed with utility interruptions without Owner's written permission.
- D. Staging:
 - 1. Staging areas must be coordinated with Owner prior to mobilization.

2. Confine materials and equipment to the staging and work areas. Contractor assumes full responsibility for the protection and safekeeping of items stored on site.
 3. Do not unreasonably encumber Site with materials or equipment.
 4. Do not load Project structure with weight that will endanger Project structure.
- E. Parking: Construction personnel shall park on-site in areas designated by the Owner's Representative.
- F. Water Service: Use of Owner's existing water service will be permitted.
1. Provide connections and extensions of service as required for construction operations.
 2. Provide additional water as necessary.
- G. Sanitary Facilities: Use of Owner's existing bathroom will be permitted.
1. Provide disposable supplies, including toilet tissue, paper towels, and paper cups. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 2. Service toilets at least twice weekly.
- H. Electric Power Service: Use of Owner's existing electric 120V electric outlets will be permitted. Any power requirements above existing 120V outlets will need to be provided.
1. As necessary, provide additional electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Do not overload Owner's service.
 2. Comply with NECA 200 and NFPA 70.
 3. Maintain temporary service in safe condition and utilize in safe manner.
- I. Use of Existing Stairs and Elevators: Use of Owner's existing stairs and elevators will be permitted, as long as stairs and elevators are cleaned and maintained in condition acceptable to Owner's Representative.
1. Coordinate daily usage with Owner's Representative and with requirements for facility operations.
 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs, elevator cars, and entrance doors and frame, and to maintain means of egress.
 3. At Substantial Completion, restore stairs and elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
- J. Lighting: Owner will provide existing lighting at existing locations.
1. Provide additional lighting, as necessary, with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 2. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- K. Provide insulation or temporary heating as necessary for curing, drying, and protection of installed construction.
1. Select equipment that will not have harmful effect on completed installations or elements being installed.
 2. Maintain temporary heating on 24-hour basis until no longer needed.

3. Unless noted otherwise, insulation is considered incidental to construction and will not be paid for separately.
 4. Unless otherwise specified, temporary heating will not be considered part of Work and will be paid as additional Work item. Notify Owner's Representative in advance of need for temporary heating and estimated added cost. Do not proceed with temporary heating until authorized in writing by Owner's Representative.
- L. Snow removal: The contractor shall be required to remove snow from the work area.
- M. Equipment:
1. Direct equipment exhaust away from occupied spaces and vent equipment operating within structure to outside.
 2. Operate equipment at noise levels conforming to requirements of city, state, and federal laws and codes, and Owner limitations.
- N. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of public authorities having jurisdiction. Construction debris shall be removed in a manner that avoids overloading adjacent structural members.
- O. Removed Equipment: The contractor shall coordinate with Owner on if any of the removed equipment associated with the scope deemed salvage. Salvaged equipment shall be removed in a manner which does not damage the equipment and be turned over to the owner for spare or future use.
- P. Protection:
1. Limit access to work areas.
 2. Contractor shall provide protective barriers, caution tape, etc. to ensure the safety of contractor personnel and operations staff during the Work. All barriers shall comply with local, state, and federal regulations and laws.
 3. Provide adequate signage to direct/inform contractor personnel and operations staff of any hazards.
 4. Prevent construction debris and other materials from coming into contact with operations staff and/or operating process areas that could be harmed by such contact.
 5. Existing Drains:
 - a. Verify that drains in or near Work area are open and free flowing prior to start of Work.
 - b. Lawfully remove construction effluent from Site. Do not allow construction debris to flow into existing drains or sewer systems.
 - c. Rout or replace clogged drain lines at completion of Work.
 6. Confine dust, debris and fumes to Work area and prevent from entering areas outside of the Work area.
 7. Protect finished surfaces against damage.
 8. Contractor shall be responsible for maintaining the water tightness of the areas of the structure being worked on during the course of the work. Providing temporary protection of the existing construction or structure from the weather until removed portions are

completely replaced with new construction. The costs of damage and repairs shall be made at no cost to the Owner.

9. Maintain all protection in operable condition for the full duration of the project.
- Q. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241. Coordinate with Owner's safety team.
1. Provide portable, UL-rated fire extinguishers with class and extinguishing agent as required by locations and classes of fire exposures.
 2. Prohibit smoking on Site.
 3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of public authorities having jurisdiction.
 4. Store combustible materials in approved safety containers and enclosures, away from building if possible.
 5. Develop and supervise overall fire-prevention and -protection program for personnel at Site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

PART 2 PRODUCTS

2.1 GENERAL

- A. The products specified are believed to have properties adequate for successful completion of the Work. If the Contractor has found these products to be unacceptable or has had difficulty using these materials, the Contractor shall notify the Engineer in writing, and provide a request for substitution of material for which the Contractor has had successful experience.
- B. No product substitutions will be allowed unless otherwise noted. Engineer's approval must be obtained for all substitutions prior to being awarded the project. Submit requested substitutions with bid form.

2.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Site in original containers and packaging with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, lot number, directions for storing, and complete manufacturer's written instructions.
- B. Keep materials dry and do not allow materials to be exposed to moisture during transportation, storage, handling, or installation. Reject and remove from Site new materials which have been exposed to moisture to their detriment.
- C. Store and handle materials in accordance with manufacturer's written instructions, safety requirements, and all applicable laws and regulations. Remove from Site, and replace at no cost to Owner, any materials that are damaged or otherwise negatively affected by not being stored or handled in accordance with manufacturer's written instructions.
- D. Store materials in original, undamaged containers and packaging in clean, dry, location on raised platforms and protected from weather, within temperature range required by manufacturer.

Protect stored materials from direct sunlight and sources of ignition. Manufacturer's standard packaging and covering alone is not considered adequate weather protection.

- E. Locate materials in a secure location approved by Owner's Representative.
- F. Conspicuously mark damaged or opened containers, containers with contaminated materials, damaged materials, and materials that cannot be used within stated shelf life and remove from Site as soon as possible. Replace discarded materials in a timely manner at no cost to Owner.
- G. Limit stored materials on structures so as to preclude damage to materials and structures.
- H. Maintain copies of all applicable Safety Data Sheets (SDS) with materials in storage area, such that they are available for ready reference on Site.

PART 3 EXECUTION

3.1 DISCOVERY, FIELD VERIFICATION AND CHANGES IN WORK

- A. Contractor shall verify all quantities. Quantities shown are for estimating purposes only.
- B. Do not scale drawings. The Contractor shall field verify the existing dimensions and existing conditions prior to starting the work. Dimensions of the new construction shall be adjusted as necessary to fit the existing conditions. The Engineer shall be notified in writing of any significant deviations from the dimensions or conditions shown on these drawings.
- C. During rehabilitation work, existing conditions may be encountered which are not known or are at variance with the Contract Documents. Such conditions may interfere with the Work and may consist of damage or deterioration of the substrate or surrounding materials or mis-location of embedded elements such as reinforcing steel, which may interfere with proper execution of the Work. Promptly report to Engineer as a request for information any of these conditions.
- D. Existing equipment being replaced with similar control features shall be field investigated prior to disconnecting & removal. Contractor shall clearly identify items for reconnection and ensure at minimum existing control and functionality is maintained.

3.2 EXAMINATION FOR MATERIAL COMPLIANCE

- A. Examine substrates and conditions with installer and manufacturer's representative, where appropriate, for compliance with requirements and for other conditions affecting installation or performance of the material.
 - 1. Verify dimensions so that proper installation of material for optimal performance is maintained.
 - 2. Ensure that work done by other trades is complete.
 - 3. Verify that areas and conditions under which Work is to be performed permit proper and timely completion of Work.
 - 4. Notify Engineer in writing of conditions which may adversely affect installation or performance of the material and recommend corrections.

5. Do not proceed with Work until adverse conditions have been corrected and reviewed by Engineer.
6. Commencing Work constitutes acceptance of Work surfaces and conditions.

3.3 CLEANING

- A. Immediately clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- B. At the end of each workday, broom-clean Site and Work areas and place all items to be discarded in appropriate containers.
- C. After completing Work:
 1. Clean all materials resulting from Work that are not intended to be part of the finished Work using appropriate cleaning agents and procedures. Exercise care to avoid damaging surfaces.
 2. Repair at no cost to Owner all items damaged during the Work.
 3. Remove and legally dispose of debris and surplus materials from Site.

3.4 PROTECTION

- A. Take precautions to ensure safety of people (including building users, passers-by, and workers) and protection of property (including adjacent building elements, landscaping, and motor vehicles).
 1. Erect temporary protective canopies and walls, as necessary, at walkways and at points of pedestrian and vehicular access that must remain in service during Work.
- B. Cover adjacent surfaces with materials that may be damaged.
- C. Protect paving and sidewalks, and adjacent building areas from mechanical damage due to scaffolding and other equipment.
- D. Prevent dust, debris, coating overspray/spatter, and other construction materials from coming into contact with pedestrians, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
- E. Limit access to Work areas.
- F. Comply with manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products.
- G. Assume responsibility for injury to persons or damage to property due to Work, and remedy at no cost to Owner.
- H. Protect from damage, all elements of completed work and original construction to remain.
- I. Protect Work during and after completion from contact with contaminating substances and from damage, so materials are without deterioration or damage at time of Substantial Completion.

- J. Ensure energized equipment is clearly identified during construction. Hazards associated with temporary electrical connections shall be clearly identified and protective barriers be installed to prevent access by unqualified personnel.
- K. Lock-Out-Tag-Out “LOTO” means shall be used to clearly identify and prevent energization of portions of the system to ensure personnel & workers are working on equipment in an electrically safe, deenergized condition.
- L. A safety review shall be performed at the beginning of each workday to ensure all workers and operations staff are made aware of any potential hazards associated with that day’s work. In the event which site conditions change all personnel shall be updated on any new/changing potential hazards.

END OF SECTION

SECTION 01 33 00**SUBMITTAL PROCEDURES****PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for submitting shop drawings, product data, samples, and other submittals.
- B. Reference the Schedule of Submittals for a summary of required submittals.

1.2 SUBMITTALS

- A. General:
 - 1. Identification: Include a permanent label or title block on the submittal or cover sheet, with the following information.
 - a. Project name.
 - b. Date.
 - c. Names of Engineer, Contractor, subcontractor, manufacturer, supplier, and firm or entity that prepared submittal, as appropriate.
 - d. Identification information, such as the number and title of the appropriate Specification section, Drawing number and detail references, location(s) where product is to be installed, or other necessary information.
 - e. Label each submittal with Specification section number followed by decimal point and then sequential number (e.g., 06100.01). On resubmittals, include alphabetic suffix after another decimal point (e.g., 06100.01.A).
 - f. Provide space approximately 6 by 8 inches on or beside the label or title block for the Contractor's approval stamp and the action stamp of the Engineer.
 - 2. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
 - 3. Submit one electronic copy of prints in PDF format. Prints shall have white background and dark lettering and line work. Prints will be returned electronically.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not use reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions, including notation of those established by field measurement.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Shopwork manufacturing instructions.
 - f. Templates and patterns.
 - g. Schedules.

- h. Notation of coordination requirements.
 - i. Relationship to adjoining construction clearly indicated.
 - j. Seal and signature of professional Engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8 1/2 by 11 inches but no larger than 30 by 42 inches.
 3. Submit one electronic copy of prints in PDF format. Prints shall have white background and dark lettering and line work. Prints will be returned electronically.
- C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Clearly mark each copy of the submittal to show which products and options are applicable. Delete information which is not applicable. Supplement standard information with project-specific information.
 2. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts, product specifications, schematic drawings, installation instructions, and written recommendations.
 - b. Compliance with referenced standards.
 - c. Testing by recognized testing agency.
 - d. Include manufacturer's literature including written instructions for evaluating, preparing, and treating substrate.
 - e. Technical data including tested physical and performance properties
 - f. Mixing and application or placement instructions.
 3. Include temperature ranges for storage and application of materials, and special cold weather application requirements or limitations.
 4. Include Globally Harmonized System (GHS) Safety Data Sheets or, if not yet available, Material Safety Data Sheets. For information only.
- D. Samples: Submit physical samples to illustrate functional and aesthetic characteristics of the product, for review of materials and workmanship, for compatibility with other elements, and for comparison with the actual installed elements.
1. Samples shall be of sufficient size to show the general visual effect.
 2. Include sets of at least three samples that show the full range of color, pattern, texture, graining, and finish.
 3. Transmit samples that contain multiple, related components, such as accessories, together in one submittal package.
 4. Identification: Attach a label on an unexposed side of each sample that includes the following:
 - a. Generic description of sample.
 - b. Product name, name of manufacturer, and sample source.
 - c. Number and title of appropriate Specification section.
 5. Samples for Initial Selection: Submit two full sets of units or sections of units from the supplier's product line, showing the full range of colors, textures, and patterns available. Engineer will retain one set and return one set with the options selected.
 6. Samples for Verification: Submit full-size units or samples of the size indicated, prepared from the same material to be used for the Work, cured and finished in the manner specified,

and physically identical with material or product proposed for use, and that show the full range of color and texture variations expected.

- a. Submit the number of samples required by the Contractor plus one that will be retained by the Engineer. Mark up and retain one returned sample as a Project Record Document.
7. Maintain approved samples at the Site, available for quality-control comparisons during construction. Samples may be used to determine final acceptance of construction associated with the sample.
- E. Delegated Design:
1. Where required by the Contract Documents, in addition to shop drawings, product data, and other required submittals, submit a statement, signed and sealed by responsible design professional, for each product and system specifically assigned to the Contractor to be designed or certified by a design professional.
 - a. Indicate that products and systems comply with performance and design criteria in the Contract Documents.
 - b. Include a list of codes, loads, and other factors used in performing these services, and signed and sealed design calculations where required.
 - c. Electronic submittals in PDF format are preferred; however, print copies will be accepted. Submit number of prints needed by contractor plus two for retention by the Owner and Engineer.

1.3 SUBMITTAL PROCEDURE

- A. Coordinate the preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals requiring concurrent review, and related activities that require sequential activity.
 2. Allow sufficient time for submittal and resubmittal review. Failure to provide sufficient time for submittal and resubmittal reviews will not be a basis for extension of the Contract Time.
- B. Review Time:
1. Allow five working days for the review of each submittal and resubmittal.
 2. Allow additional time if coordination with subsequent submittals is required. The Engineer will advise the Contractor when the submittal being processed must be delayed for coordination.
 3. Time for review shall commence when the Engineer receives the submittal.
- C. Contractor Review:
1. Review each submittal, coordinate with other Work, and check for compliance with the Contract Documents. Verify field dimensions and conditions. Identify variations from the Contract Documents and product or system limitations that may be detrimental to the successful performance of completed Work. Note corrections.
 2. Before submitting to the Engineer, stamp with a uniform approval stamp including the reviewer's name; the date of Contractor's approval; and a statement certifying that the submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3. **Submittal Log:** Maintain submittal log that lists submitted items per specification section. Record dates submitted, dates returned, and disposition of each item based on Engineer's review. Submit final log showing approved materials at Substantial Completion.
- D. **Transmittal:** Package each submittal individually and appropriately for transmittal and handling.
- E. **Engineer Action:**
1. Engineer will not review submittals that are received from sources other than the Contractor or that do not bear the Contractor's approval stamp and will return them without action to the Contractor.
 2. Engineer will not return submittals requested for information only.
 3. Engineer will review each submittal for conformance with the design concept of the Project and compliance with the Contract Documents. Engineer will make marks to indicate corrections or modifications required, and stamp with an action stamp. The action stamp will include the reviewer's name, date of review, and required Contractor action. Contractor actions may include making corrections or modifications to the submittal or resubmitting the submittal, or both.
- F. **Resubmittals:** Make resubmittals in the same form and number of copies as the initial submittal.
1. Note the date and content of previous submittal.
 2. Note the date and content of the revision in the label or title block and clearly indicate the extent of the revision and changes made.
 3. Resubmit until the Engineer indicates that no resubmittal is required.
 - a. No resubmittal is required when submittal is marked "No Exceptions Taken" or "Make Corrections Indicated".
- G. **Distribution:** Furnish copies of the final submittals to the Site file, the record documents file, manufacturers, subcontractors, suppliers, fabricators, installers, public authorities having jurisdiction, and others as necessary for performance of construction activities. Show the distribution on the transmittal forms.
- H. Use only the final submittals with the Engineer's action stamp, for construction.
1. Only items marked "No Exceptions Taken" or "Make Corrections Indicated" shall be used for construction.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for quality assurance and quality control, testing, special inspections and mockups.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated, and do not relieve the Contractor of responsibility for compliance with requirements of the Contract Documents.
 - 1. Specified tests, inspections, and related actions performed by others do not limit the Contractor's other quality assurance and quality control procedures that facilitate compliance with requirements of the Contract Documents.
 - 2. Requirements for the Contractor to provide quality assurance and quality control services required by the Engineer, Owner, or public authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections:
 - 1. See sections in Divisions 26 and Drawings sheets for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during the execution of the Work to guard against defects and deficiencies and substantiate that the proposed construction will comply with requirements.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after the execution of the Work to evaluate that the actual products incorporated into the Work and the completed construction comply with requirements.
 - 1. Services do not include contract enforcement activities performed by the Engineer, such as observations.
- C. Testing Agency (also known as Third Party Testing Agency): Entity responsible for performing specified testing or special inspections in Divisions 26 and on the Construction Drawings.
- D. Special Inspector: A qualified person employed or retained by an approved agency (such as the testing agency) and approved by the building official as having competence necessary to inspect a particular type of construction requiring special inspection.
- E. Special Inspection: Review of completed work or work in progress performed by the Special Inspector, or where specifically identified, by the Engineer. Items typically required by the governing building code.

1.3 COMPLIANCE CRITERIA

- A. General: If compliance with two or more standards is specified and standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
- B. Minimum Quantity or Quality Level: Quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.
- C. Refer uncertainties to the Engineer for a decision before proceeding.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 QUALITY CONTROL

- A. Reference the Special Inspection Schedule on the Construction Drawings for special inspection requirements for this section.
- B. Owner Responsibilities: The Owner will engage a qualified testing agency to perform all special inspections and select testing as explicitly identified in the Contract Documents.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and descriptions of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to the Contractor.
- C. Testing Agency/Special Inspector Responsibilities: Cooperate with the Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Determine location from which test samples will be taken and in which in-situ tests are conducted.
 - 2. Notify the Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from requirements.
 - 4. Submit a certified written report of each test, inspection, and similar quality control service.
 - 5. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 - 6. Do not perform any duties of the Contractor.

- D. Engineer Responsibilities: Engineer may perform some testing on completed on in-process work as noted in the Contract Documents.
- E. Tests and inspections not explicitly assigned to the Owner or Engineer, and testing and inspecting requested by the Contractor and not required by the Contract Documents, are the Contractor's responsibility. Unless otherwise indicated, provide quality control services specified and those required by public authorities having jurisdiction, whether specified or not.
- F. Coordination: Coordinate the sequence of activities to accommodate the required quality assurance and quality control services with a minimum of delay and to avoid the necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
 2. Notify the testing agency sufficiently in advance of operations to permit assignment of personnel.
- G. Associated Services: Cooperate with the Engineer and testing agencies performing required tests, inspections, and similar quality control services, and provide reasonable auxiliary services as requested. Provide the following:
1. Submittals of concrete mix designs and other materials and products necessary for the testing agency to test and evaluate field work.
 2. Access to the Work.
 3. Incidental labor and facilities necessary to facilitate tests and inspections.
 4. Adequate quantities of representative samples of materials that require testing and inspecting. Assist the testing agency in obtaining samples.
 5. Facilities for storage and field curing of test samples.
 6. Security and protection for samples and for testing and inspecting equipment at Site.
- H. Repair and Protection:
1. On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 2. Provide materials and comply with installation requirements specified in other sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 3. Protect construction exposed by or for quality control services.
 4. Repair and protection are the Contractor's responsibility, regardless of assignment of responsibility for quality control services.

END OF SECTION

SECTION 01 70 20

PROJECT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements for contract closeout, including final cleaning; Substantial Completion and final completion procedures.
- B. Related Sections:
 - 1. Divisions 26 for special cleaning and specific closeout requirements for Work in those sections, including warranties.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

- A. During Work, maintain one set of Drawings and reviewed shop drawings, Specifications, WJE site visit reports, and product data for recording deviations of as-built construction from design information. Include addenda and Contract modifications.
 - 1. Accurately document and record changes and modifications as soon as possible after they occur, in understandable manner.
 - 2. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Record and check markup before enclosing concealed installations.
 - 3. Include:
 - a. Dimensional changes.
 - b. Revisions to Drawing details and details not on Drawings.
 - c. Changes made by Change Order or Engineer's written orders or direction based on Site Visit Reports or Construction Observation Reports. Note Change Order numbers, Site Visit Report Item numbers or similar identification.
 - d. Field records for variable and concealed conditions.
 - e. Record information on Work that is shown only schematically or omitted from Drawings.
 - f. Actual products and materials used.

- 1) Include product data, specifically marked for Project, and cross-referenced to Specifications, Drawings, and Change Orders.
 - 2) Include names of manufacturer and Installer, and other information necessary to provide record of selections made.
 - 3) Include significant changes in product delivered to Site and changes in manufacturer's written instructions for installation.
4. Mark record document most capable of showing actual physical conditions completely and accurately. Cross-reference on other record documents.
 5. Mark record documents with erasable, red-colored media. Use other colors to distinguish between changes for different categories of Work at the same location.
- B. Store Record Documents and samples in field apart from Contract Documents used for construction. Do not use Record Documents for construction purposes. Maintain Record Documents in good order and in clean, dry, legible condition, protected from deterioration and loss. Provide access to Record Documents for Engineer's reference during normal working hours.
- C. Prepare final document markup in digital format for submission.
1. Incorporate changes and additional information previously marked on record prints. Erase, redraw, and add details and notations where applicable.
 2. Refer questions to Engineer for resolution.
 3. For new details and drawings, bind new sheets as necessary to appropriate document.
 4. Identify and date each Record Drawing. Include names of project, Engineer, and Contractor, and designation "PROJECT RECORD DOCUMENT" in prominent location.
 5. Organize PDF information into separate electronic files that correspond to each sheet of Drawings, report or item. Name each file with identification of item contained.

3.2 FINAL CLEANING

- A. General: Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations. Return adjacent surfaces and areas to condition existing before Work began.
- B. In areas disturbed by construction activities, complete the following cleaning operations before requesting inspection for certification of Substantial Completion. Clean each surface or unit to the condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions. Employ experienced workers or professional cleaners.
1. Remove tools, construction equipment, machinery, and surplus material from Site.
 2. Clean Site, yard, and grounds, including landscaped areas, of rubbish, waste materials, litter, and other foreign substances.
 - a. Broom clean paved areas. Remove petrochemical spills, stains, and other foreign deposits.
 - b. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
 3. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of stains, films, and similar foreign substances. Polish surfaces to achieve specified finish. Avoid disturbing natural weathering of exterior surfaces.

- a. Touchup and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that show evidence of repair or restoration.
 - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
4. Clean and restore transparent and reflective surfaces, such as mirrors and glass in doors and windows, to their original condition. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
5. Remove labels that are not permanent.
6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
7. Sweep floors broom clean.
8. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove paint and mortar droppings and other foreign substances.
9. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - a. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
10. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
11. Leave Project clean and ready for use by Owner.

END OF SECTION

SECTION 26 01 26

ELECTRICAL FIELD TESTING

PART 1 - GENERAL

1.01. DESCRIPTION

- A. This section includes field testing, cleaning, adjusting, and lubrication of electrical equipment and wiring systems.

1.02. REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American National Standards Institute (ANSI):
 - a. C2, National Electrical Safety Code.
 - b. C62.33, Standard Test Specifications for Varistor Surge-Protective Devices.
 - 2. Institute of Electrical and Electronics Engineers (IEEE):
 - a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.
 - b. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
 - c. 118, Standard Test Code for Resistance Measurement.
 - d. 400, Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. AB 4, Guideline for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
 - b. WC 7, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
 - 4. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
 - 5. National Fire Protection Association (NFPA):

- a. 70, National Electrical Code (NEC).
- b. 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.03. SUBMITTALS

- A. Submit schedules and sample copies of inspection forms.
- B. Quality Control Submittals: Within 30 days after completion of test and prior to substantial completion of project, submit test or inspection reports and certificates for each electrical item tested.
- C. Contract Closeout Submittals:
 - 1. Operation and Maintenance Data:
 - a. After test or inspection reports and certificates have been reviewed by Owner's Representative and returned, insert a copy of each in operation and maintenance manual.

1.04. SEQUENCING AND SCHEDULING

- A. Perform inspection and electrical tests after equipment has been installed.
- B. Perform tests with apparatus de-energized whenever feasible.
- C. Notify Owner's Representative at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 - MATERIALS

(NOT USED)

PART 3 - EXECUTION

3.01. GENERAL

- A. Tests and inspection shall establish that:
 - 1. Electrical equipment is operational within industry and manufacturer's tolerances.
 - 2. Installation operates properly.

3. Equipment is suitable for energization.
 4. Installation conforms to requirements of contract documents and NFPA 70, NFPA 70E, and ANSI C2.
- B. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.
 - C. Set, test, and calibrate protective relays, circuit breakers, and other applicable devices as required to coordinate with next upstream and downstream devices.
 - D. Verify nameplate data for conformance to contract documents.
 - E. Realign equipment not properly aligned and correct un-levelness.
 - F. Properly anchor electrical equipment that is found to be inadequately anchored.
 - G. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations or as otherwise specified.
 - H. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.
 - I. Provide proper lubrication of applicable moving parts.
 - J. Inform Owner's Representative of working clearances not in accordance with NFPA 70.
 - K. Investigate and repair or replace:
 1. Electrical items that fail tests.
 2. Active components not operating in accordance with manufacturer's instructions.
 3. Damaged electrical equipment.
 - L. Electrical Enclosures:
 1. Remove foreign material and moisture from enclosure interior.
 2. Vacuum and wipe clean enclosure interior.
 3. Remove corrosion found on metal surfaces.
 4. Repair or replace, as determined by Owner's Representative, door and panel sections having dented surfaces.

5. Repair or replace, as determined by Owner's Representative, poor fitting doors and panel sections.
6. Repair or replace improperly operating latching, locking, or interlocking devices.
7. Replace missing or damaged hardware.

M. Finish:

1. Provide matching paint and touch up scratches and mars.
2. If required due to extensive damage, as determined by Owner's Representative, refinish the entire assembly.

3.02. LOW-VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect each individual exposed power cable for:
 - a. Physical damage.
 - b. Proper connections in accordance with single-line diagram.
 - c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
 - d. Color coding conformance with specifications.
 - e. Proper circuit identification.
2. Inspect mechanical connections for:
 - a. Proper lug type for conductor material.
 - b. Proper lug installation.
 - c. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.
3. Inspect shielded instrumentation cables for:
 - a. Proper shield grounding.
 - b. Proper terminations.
 - c. Proper circuit identification.

4. Inspect control cables for:
 - a. Proper termination.
 - b. Proper circuit identification.
5. Cables Terminated Through Window Type CTs: Verify that neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests for Conductors No. 6 and Larger:

1. Insulation Resistance Tests:
 - a. Utilize 1,000-volt d-c megohmmeter for 600-volt insulated conductors.
 - b. Test each conductor with respect to ground and to adjacent conductors per IEEE 118 procedures for one minute.
 - c. Evaluate ohmic values by comparison with conductors of same length and type.
 - d. Investigate values less than 50 megohms.
2. Continuity test by ohmmeter method to ensure proper cable connections.

3.03. GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in motor control centers and panelboard assemblies for proper connection and tightness.
2. Ground bus connections in motor control centers and panelboard assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

B. Electrical Tests:

1. Two-Point Direct Method Test:
 - a. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system

neutral and derived neutral points.

- b. Equipment ground resistance shall not exceed main ground system resistance by 0.50 ohm.

END OF SECTION

SECTION 26 05 00

ELECTRICAL

PART 1 - GENERAL

1.01. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Sections "General Requirements", apply to this Section.

1.02. SUMMARY

- A. This Section includes the following:
 - 1. Raceways.
 - 2. Cables.
 - 3. Cable Tray
 - 4. Supporting devices for electrical components.
 - 5. Electrical identification.
 - 6. Wiring Devices.
 - 7. Enclosures
 - 8. Control Devices
 - 9. Panelboards
 - 10. Transformers
 - 11. Disconnect Switches.
 - 12. Surge Protective Device (SPD)
 - 13. Grounding
 - 14. Cutting and patching for electrical construction.
 - 15. Touchup painting.

1.03. DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. PVC-RGS: PVC-Coated Rigid Galvanized Steel Conduit.
- C. RGS: Rigid Galvanized Steel Conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.04. SUBMITTALS

- A. Full fabrication and installation drawings, complete with engineering data including but not limited to: materials, devices, parts, and accessories shall be submitted for review.
- B. Contractor shall be responsible for submitting complete and accurate drawings, data, operating manuals, test reports, and samples for all equipment provided and installed as part of this contract. All materials and equipment shall be submitted to the Engineer for approval prior to ordering. Submittals shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications.
- C. Submittal data shall be presented in a clear, precise, and thorough manner. The Contractor's submittals shall be bound in an appropriately sized 3-ring binder, tabbed by specification section with arrows and circles clearly identifying relevant products. Non-pertinent data shall be deleted or crossed out.
- D. Contractor shall provide electrical as-built drawings displaying all equipment, assembly drawings, control wiring diagrams, instruments, cable, and conduit as installed.

1.05. QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 and the following standards where appropriate:
 - 1. ANSI American National Standards Institute
 - 2. ASTM American Society for Testing and Materials.
 - 3. AWG American Wire Gauge.
 - 4. ICEA Insulated Cable Engineers Association

5. IEEE Institute of Electrical and Electronic Engineers
6. IESNA Illuminating Engineering society of North America
7. NEISA National Electrical Installation Standards.
8. NEMA National Electrical Manufacturers Association
9. NFPA National Fire Protection Association
10. UL Underwriters' Laboratories.

1.06. COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
2. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work. Coordinate installing large equipment requiring positioning before closing in the building.
3. Contractor shall consult the local electric utility regarding their service installation requirements; installation of the service equipment shall be in compliance with these requirements. Contractor shall be responsible for installing all service equipment components except as installed by the utility as directed in the utility service installation requirements. Contact information for the electric utility is as follows:

Name of electric utility Xcel Energy

4. Contractor shall coordinate activities and timing of service entrance installation with the utility. Contractor shall complete and submit service applications to the electric utility as necessary.
5. It is recognized that the Drawings are diagrammatic in showing certain physical relationships that must be established within the electrical work, and in its interface with other work including utilities and mechanical work, and that such establishment is the exclusive responsibility of the Contractor.

PART 2 - MATERIALS

2.01. RACEWAYS

- A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
- B. PVC-Coated Rigid Galvanized Steel Conduit
- C. (PVC-RGS): Rigid Steel conduit with 40 mils PVC coating. OCAL, PERMA-COAT, RoBroy or approved equal.
- D. RGS: ANSI C80.1, Heavy wall, hotdip galvanized, manufactured in accordance with UL 6.
- E. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- F. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- G. Raceway Fittings: Specifically designed for the raceway type with which used.

2.02. CABLES

- A. All cables of each type shall be from the same manufacturer.
- B. Lighting & Receptacle Cable: Lighting & Receptacle cable shall be provided only in lighting and receptacle circuits. Lighting cable shall have THHN-THWN insulation with nylon jacket. Cable shall meet the construction requirements of NEMA WC 70 (ICEA S-95-658) and UL 6 standards with a maximum operating temperature of 90°C dry, 75°C wet.
- C. Conductors 12 AWG and smaller shall be solid. Conductors 10 AWG and larger shall be stranded.
- D. Low Voltage Power Cable: Cable in power circuits operating at 600 volts or less, shall be 600 volt XHHW-2. Cable shall meet the construction requirements of NEMA WC 70 (ICEA S-95-658) with a maximum operating temperature of 90°C wet/dry. Insulation shall be cross-linked thermosetting polyethylene, conforming to ICEA S-95-658, paragraph 3.6.
- E. Signaling & Control Cable: Cable for instrumentation, metering, and other signalling and control equipment shall be two- or three-conductor instrument cable twisted for magnetic noise rejection and protected from electrostatic noise by a total coverage shield. Cables shall be 16 AWG, 7 strand, concentric lay, uncoated copper with a maximum operating temperature of 90°C dry, 75°C wet. Cable shall be either twisted pair or triad with 1-1/2 inch to 2-1/2 inch lay.
 - 1. Insulation: Polyvinyl Chloride
 - 2. Shield: 7-strand, 20AWG, tinned copper

3. Conductor Jacket: Nylon, UL 62
4. Cable Assembly: Flame retardant polyvinyl chloride, UL 1277

Insulated conductors shall meet the requirements of UL 62 for type TFN. Jacket shall meet the requirements of UL 1227.

- F. VFD Cable: VFD cable shall have XLPE insulated conductors and black (sun and oil resistant) PVC jacket and have the following characteristics:
 1. CABLES SHALL BE RATED FOR 2000V.
 2. SHALL BE UL 1277 LISTED.
 3. SHALL BE TYPE TC-ER
 4. HAVE AN OPERATING TEMPERATURE RANGE OF -40 DEGREES C TO +90 DEGREES C
 5. CABLES LESS THAN 1 AWG SHALL BE 4-CONDUCTOR (3) STRANDED TINNED COPPER CIRCUIT CONDUCTORS PLUS (1) GROUND WIRE WITH A TINNED COPPER BRAID SHIELD (85% COVERAGE) AND A TINNED COPPER DRAIN WIRE
 6. CABLES OVER 1 AWG SHALL BE 3 STRANDED TINNED COPPER CIRCUIT CONDUCTORS PLUS (3) SYMMETRICAL BARE COPPER WIRES, TWO SPIRAL COPPER TAPE SHIELDS (100% COVERAGE).
 7. MANUFACTURER SHALL BE SOUTHWIRE, BELDEN, OR EQUAL.
 8. Contractor shall be responsible for ensuring conduit sizing is adequate for the submitted VFD cable.
- G. Multiconductor Control Cable: Cable for control, indication, and alarm circuits as indicated on the drawings as multiconductor shall be 14 AWG, concentric lay, uncoated copper with type THHW/THWN insulation with a maximum operating temperature of 90°C dry, 75°C wet. Cable shall meet the requirements of UL 83, UL 1277, and ICEA S-58-679. The cable assembly jacket shall be flame-retardant polyvinyl chloride applied over a tape-wrapped cable core.
- H. Multiconductor Power Cable: Cable for power as indicated on the drawings as multiconductor shall be concentric lay, uncoated copper, strand class B with type XHHW/XLP insulation with a maximum operating temperature of 90°C dry, 75°C wet. Cable shall meet the requirements of UL 1277, and ICEA S-95-658. The cable assembly jacket shall be flame-retardant polyvinyl chloride applied over a tape-wrapped cable core.
- I. Tray Cable: Cable for power & controls shall conform to UL standards for Type TC power & control tray cables.

J. Ethernet Unshielded Twisted Pair (UTP) Cable. Ethernet cables and connectors shall be provided for a complete and working system, and/or as shown on the Drawings. Cable for Ethernet wiring shall be UTP Cat-6 cable.

1. Category 6 UTP Cable shall meet the following requirements:

- a. 24 AWG
- b. 4 pair solid strand FEP Teflon insulation
- c. 100 Ohm impedance
- d. 1-250 MHz frequency range
- e. Min attenuation 19.9 Db
- f. 100 Ohm impedance
- g. Min NEXT 44.3dB/100MHz
- h. Min PS-NEXT 42.3dB/100MHz
- i. Min ELFEXT 27.8dB/100MHz
- j. Min PS-ELFEXT 24.8dB/100MHz
- k. Min return loss 20.1 dB/100 MHz
- l. Max delay skew 45 ns
- m. Max propagation delay 540 ns
- n. Plenum rated cable shall have FEP insulation jacketing and FEP insulation for conductors. Nonplenum rated cable shall have PVC insulation jacketing and polyethylene insulation for conductors. Cat-6 cable shall be Belden 1872 or equal.

K. Fiber-Optic Cables and Connectors

1. Cables: Factory fabricated, jacketed, low loss, glass type, fiber optic, multimode, graded index, operating at 850 and 1300 nm.
2. Dimensions: 62.5-micrometer core diameter, 125-micrometer cladding diameter.
3. Maximum Attenuation: Minus 3.75 dB/km at 850 nm; minus 1.5 dB/km at 1300 nm.

4. Minimum Modal Bandwidth: 160 MHz/km at 850 nm; 500 MHz/km at 1300 nm.
5. Operating Temperature Range: Minus 20 to plus 70 deg C.
6. Cable Connectors: Quick-connect, simplex- and duplex-type SC couplers with self-centering, axial alignment mechanisms. Insertion loss not more than 0.7 dB.

L. Coaxial Cable

1. Cables: Factory fabricated, jacketed, low loss, solid conductor, shielded, operating at 900Mhz.
2. Impedance: 50 Ohm.
3. Jacket: UV Resistant Polyethylene, rated for outdoor use.
4. Operating Temperature Range: Minus 20 to plus 70 deg C.
5. Cable Connectors: Connectors shall be coordinated with radio units and antenna.
6. Exact cable requirements shall be coordinated with antenna and radio equipment.

2.03. CABLE TRAY:

- A. Cable tray shall be by one manufacturer and shall consist of straight sections, fittings, and accessories per NEMA VE1-2006/CSA C22.2 No. 126.1-02. Cable tray must be listed by UL as equipment grounding conductor. There shall be no burrs, projections or sharp edges to damage the cable insulation.
- B. All siderails, and rungs shall be of extruded aluminum type 6063-T6. Siderails shall be of I-beam construction.
- C. Ladder tray shall incorporate two siderails connected by lateral rungs. Rungs shall provide minimum 1" bearing surface and have slots perpendicular to the centerline of the rung on 1" centers for attachment of cable ties.
- D. Rungs shall be at 9" spacing and not be below the bottom of the siderail.
- E. Siderail height shall be 6".
- F. All cable tray straight sections shall be supplied in 12' lengths.
- G. Cable tray shall be 24" or as indicated on the drawings.
- H. For all fittings requiring a radius, that radius shall be 12", 24", or 36" as required and shall be measured to the nearest perpendicular surface.

- I. Aluminum splice plates shall be designed to snap into tray siderail and shall be supplied with four square neck carriage bolts and hex nuts for attachment.

2.04. SUPPORT AND CHANNELS

- A. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
 1. Channel Thickness: 12 gauge minimum
 2. Mounting Hardware: 304 Stainless Steel
 3. Indoor Exposed Dry Locations: Hot Dipped Galvanized after fabrication
 4. Wash-down, Non-Corrosive: Hot Dipped Galvanized Steel after fabrication
 5. Exterior or Wet locations: 316 Stainless Steel
 6. Wash-down, Corrosive: 316 Stainless Steel

2.05. ELECTRICAL IDENTIFICATION

- A. Cable: Power, signal, and control circuits shall be identified at the point of termination with heat-shrink, tube type, pre-printed wire markers. Wire numbers shall be as indicated on the drawings and equipment manufacturer drawings.
- B. Conduit: Conduits shall be provided with type 316 stainless steel, laser etched conduit tags. Tags shall be permanently fastened with stainless steel straps. Conduit identification as indicated on the drawings.
- C. Equipment: Equipment including panels, control stations, disconnect switches, starters, and breakers shall be provided with 316 stainless steel, laser etched identification tags. Equipment identification as indicated on the drawings.
- D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
 2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.06. WIRING DEVICES

1. Receptacles

- a. Convenience Receptacles shall be duplex face, 125 Volt, 20 Amp. Hubbell "5362I", Leviton "5362-I" or approved equal for non-hazardous locations and Emerson "EFS" or approved equal for hazardous locations.
- b. In floor receptacles shall have a PVC floor box with 2-1-1/2" hubs for low voltage and 2-1" hubs for power. The box dimensions shall be no less than 5" diameter and 6" height. The box shall include reducers and closure plugs. The cover assembly shall meet UL514A and UL514C and be of aluminum construction and color. Sub plates shall allow for a minimum of 2-120V receptacles and two data ports. Manufacturer shall be HUBBELL or equal.
- c. Ground Fault Circuit Interrupter (GFCI) shall be duplex face, 125 Volt, 20 Amp. Hubbell "GF5362I", Leviton "N7899-I" or approved equal.

2. Device Plates

- a. Surface-Mounted | Non-Weatherproof: Galvanized or cadmium-plated
- b. Flush-Mounted | Non-Weatherproof: AISI Type 302 stainless steel, Hubbell "S series" or Leviton "8400 40 series"; nylon or polycarbonate, Hubbell "NP series", or Leviton "807nn I series".
- c. Device plate mounting hardware shall be countersunk and finished to match the plate.
- d. Switches | Weatherproof: Appleton "FSK 1VS", Crouse Hinds "DS185" or O Z Gedney "FS 1 WSCA".
- e. Receptacles | Weatherproof: Appleton "FSK WRD", Crouse Hinds "WLRD1", or O Z Gedney "FS 1 WDCA".
- f. Flush-mounted, weatherproof plates shall be provided with adapter plates, Appleton "FSK-SBA" or Crouse-Hinds "FS031".
- g. GFCI | Weatherproof: Appleton "FSK WGFI" or O Z Gedney "FS 1 GFCA".
- h. Weatherproof, in-use, receptacle covers shall be die cast aluminum. Covers for standard convenience outlets shall be Hubbell "WP8M" or Thomas and

Betts Red Dot "CKMUV". Covers for ground fault interrupter receptacles shall be Hubbell "WP26M" or Thomas and Betts Red Dot "CKMUV".

2.07. PANELBOARDS

- A. Totally enclose power-distribution and lighting panelboards in a steel cabinet, dead-front circuit breaker type with copper buses. Surface mounted as indicated on drawings.
- B. Ensure panelboards conform to NEMA PB-1 and UL 489. Provide branch circuit panels with buses fabricated for bolt-on type circuit breakers.
- C. Provide four-wire distribution and lighting panelboards with an isolated full-capacity neutral bus.
- D. Panelboards to be rated for one of the following:
 - 1. 120/208V, three-phase, 60Hz
 - 2. 277/480V three-phase, 60Hz
- E. Provide panelboards with a separate grounding bus bonded to the enclosure. Ensure grounding bus is a solid bus bar of rectangular cross section equipped with binding screws.
- F. Ensure each panelboard, as a unit, has a short-circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule.
- G. Panelboards shall be rated NEMA Type 1, Type 3R, or Type 4X as indicated on drawings.
- H. Finish panelboards with baked enamel. Finish color shall be No. 61 gray.
- I. Provide an outer door cover, hinged on one side on surface mounted panelboards to provide gutter space access. Provide a center door for circuit breaker/switch access only.

2.08. TRANSFORMERS

- A. Provide dry type, enclosed and ventilated transformers as indicated:
- B. Transformers shall be designed, constructed and rated in accordance with UL, CSA, NEMA, ANSI, IEEE, and OSHA standards.
- C. Transformers rated 15 KVA and larger, single and three phase shall be ventilated type, incorporating a 220 degree C insulation system and designed not to exceed 150 degree C temperature rise above a 40 degree C ambient under full load conditions.

- D. Transformers shall be a 'Low Sound' designed transformers with average sound levels 3dB below NEMA ST-20 standards.
- E. Transformer enclosure shall be dry-type 600 volt class, KVA rating as indicated. Contractor to provide all necessary lugs for the transformer.
- F. Three phase transformers to terminate in copper bus bar.
- G. Transformers installed indoors shall be rated NEMA Type 1, transformer installed outdoors shall be rated NEMA 3R, with rain shield.
- H. Transformer enclosure finish must be ASA 61 gray powder polyurethane paint.
- I. Efficiency as specified in NEMA TP-1

2.09. SERVICE ENTRANCE | POWER

- A. Contractor shall contact the serving utility regarding their service entrance design and installation requirements. All service entrance equipment and installation practices shall be in compliance with these requirements.
- B. Service Entrance equipment including switchgear, disconnecting means, test cabinet, meter CT's, grounding materials and alike shall be provided by the contractor for a complete installation in accordance with the serving utilities requirements including all underground services.

2.10. ENCLOSURES

- A. Junction boxes, pull boxes, and wire troughs shall meet the requirements as follows:
 - 1. Indoor locations: Boxes shall be constructed of sheet steel, galvanized after fabrication, and rigidly supported by hot-dip galvanized hardware and framing materials, including nuts and bolts.
 - 2. Outdoor and corrosive locations: Boxes shall be NEMA Type 4X, stainless steel, rigidly supported by stainless steel framing materials. Mounting hardware including nuts, bolts, and anchors, shall be stainless steel.
 - 3. Hazardous locations: Boxes shall be NEMA Type 7, Rated for Class 1 Division 1 & 2 locations, cast stainless steel rigidly supported. Mounting hardware including nuts, bolts, and anchors, shall be stainless steel.
 - 4. All enclosure penetrations shall maintain enclosure NEMA rating.

2.11. CONTROL DEVICES

- A. The contractor shall furnish and install control devices as indicated on the schematics and one line diagrams and as specified herein. Control devices shall function as intended on the drawings.
 - 1. Pilot Devices: 30.5 mm, heavy-duty, oiltight construction
 - 2. Pilot Lights: Full voltage, type LED lamps
 - 3. Indoor: NEMA type 4X 316 stainless steel enclosure
 - 4. Outdoor: NEMA type 4X 316 stainless steel enclosure

2.12. DISCONNECT SWITCHES

- A. Unless otherwise indicated, disconnect switches shall be fusible, 600 volts, with current ratings as indicated on the drawings.
 - 1. Indoor: NEMA type enclosure to match area designations as indicated on the drawings.
 - 2. Outdoor: NEMA type 3R/12, stainless steel
 - 3. Damp location: NEMA type 3R/12, stainless steel
 - 4. Caustic Areas: NEMA type 4X enclosure, molded reinforced polyester
 - 5. Hazardous locations : NEMA type 7 enclosure, cast stainless steel.
 - 6. Quick-make/quick-break mechanism
 - 7. Horsepower rated
 - 8. Pad lockable in "off" position
 - 9. Switch position clearly marked
 - 10. Defeatable door interlock
 - 11. Switches shall be UL listed and meet the latest edition of NEMA KS1.

2.13. SURGE PROTECTIVE DEVICE (SPD)

- A. SPD devices shall be furnished and installed for the electrical equipment as indicated on the drawings. All new lighting and power panels shall be furnished with integral SPD devices.

- B. SPD shall be as standard product of a manufacturer regularly engaged in the production of SPD devices and shall be the manufacturer's latest approved design.
- C. Common Mode SPDs shall not be utilized. Common Mode SPDs may fail in a short circuit condition. In this case, the AC power neutral conductor becomes bonded to the ground or equipment grounding conductor causing undesired current on the ground or equipment grounding conductor. This may create a personnel safety hazard and could constitute an NFPA 70 violation by creating a neutral to ground bond at a location other than the main service disconnect.
 - 1. Manufactured by MaxiVolt, Eaton, or approved equal.
 - 2. SPD shall be rated for 480 VAC, 3 Phase, 3 Wire.
 - 3. SPD shall have an MCOV of 600 VAC L-L.
 - 4. SPD shall have a Clamping Voltage of 942 VAC L-L.
 - 5. SPD shall have a VPL of 1360 VAC L-L
 - 6. SPD shall have a short circuit current rating of 100,000 amps.
 - 7. SPD shall provide Line to Line (L→L) protection modes only. In no case shall the SPD have Line to Ground (L→G) protection modes.
 - 8. SPD shall have a capacitive filtering system connected in each Line to Neutral (L→N) mode and/or Line to Line (L→L) mode to provide UL 1283 EMI/RFI noise attenuation.
 - 9. SPD shall have operating temperature of -40C to 85C degrees and operate reliably in environments with 1 to 95% humidity (non-condensing).
 - 10. SPD shall have a frequency range of 50 to 400 Hertz.
 - 11. SPD shall provide EMI-RFI Noise attenuation < 40 db.
 - 12. SPD shall be listed by a NRTL with field-replaceable 5 amp fuses. Thermal fusing and/or thermally protected MOVs are not allowed.
 - 13. SPD enclosure shall be a NEMA 4 rated, non-metallic enclosure to reduce risk of shock and be suitable for both indoor and outdoor installations. Enclosure shall be painted with a catalyst based paint to ensure durability and longevity.
 - 14. SPD protection circuit shall include normally off red indication lights.
 - 15. SPD capacitance shall be 1 to 1.5 microfarads per line.

16. SPD shall utilize open air PCB construction only. No potting material allowed.
17. SPD components shall be properly spaced for dielectric strength.
18. SPD components shall have a response time of less than one (1) nanosecond.
19. SPD lead conductors shall be 14 AWG multi-stranded, no longer than 30 inches and permanently soldered to protection circuit.
20. SPD shall be RoHS compliant.

D. Units shall conform to the following standards.

1. ANSI/IEEE C62.41 and C62.45
2. ANSI/IEEE C62.1 and C62.11
3. NEMA LS1 Guidelines
4. NFPA 20, 70, 75, and 78
5. UL 1449 and 1283

2.14. GROUNDING

- A. Ground rods shall be $\frac{3}{4}$ inch diameter & 10 feet long, with a copper jacket bonded to a steel core.

PART 3 - EXECUTION

3.01. ELECTRICAL EQUIPMENT INSTALLATION

1. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
2. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
3. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
4. Right of Way: Give to raceways and piping systems installed at a required slope.

3.02. RACEWAY APPLICATION

A. Use the following raceways for outdoor installations:

1. Exposed: PVC-RGS.
2. Concealed: RGS.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.

B. Use the following raceways for indoor installations:

6. Exposed: RGS.
7. Concealed: EMT.
8. Connection to Vibrating Equipment: LFMC.
9. Damp or Wet Locations: RGS.

3.03. RACEWAY AND CABLE INSTALLATION

- A. Contractor shall be responsible for routing all conduits to best fit field conditions. This shall include all conduits indicated on the one-lines and cable & conduit schedules. Where conduit routing is shown on plans, it shall be considered a general guideline and shall be field verified to avoid interferences.
- B. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- C. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- D. Use temporary raceway caps to prevent foreign matter from entering.
- E. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel.
- F. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

- G. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 2-inch concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to PVC coated rigid steel conduit before rising above floor.
- H. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
- I. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- J. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- K. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 48-inch LFMC conduit.
- L. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.04. WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Cables shall not be spliced without engineer's approval.
- C. Size and install junction boxes as required equipped with adequately rated terminal blocks for extending existing conductors.
- D. Stranded conductor cable shall be terminated by lugs or pressure type connectors. Wrapping stranded cables around screw type terminals is not acceptable.

- E. Spare cables ends shall be taped, coiled, and identified.
- F. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.05. COMMUNICATION WIRING INSTALLATION

- A. Fiber cable ends shall be cleaned according to manufacturer recommendation prior to adding connectors.
- B. Ethernet and Fiber cable shall contain all connectors required for a functional system according to manufactures recommendations.
- C. Ensure exterior of cable/casing is not painted.

3.06. SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Paint cut ends of steel channel with Zinc-rich primer prior to installation.
- C. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- D. Support parallel runs of horizontal raceways together on trapeze or bracket-type hangers.
- E. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- F. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- G. Install 1/4-inch (6-mm) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- H. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

- I. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- J. Simultaneously install vertical conductor supports with conductors.
- K. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- L. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- M. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- N. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.07. IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
- D. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.

4. Neutral: White.
 5. Ground: Green.
- E. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Brown.
 2. Phase B: Orange.
 3. Phase C: Yellow.
 4. Neutral: White with a colored stripe or gray.
 5. Ground: Green.
- F. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- G. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch (9-mm) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.08. FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.09. CONCRETE BASES

- A. Coordinate concrete work with the electrical details.
- B. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.10. GROUNDING

- A. The electrical system and equipment shall be grounded in compliance with the National Electrical Code and the following requirements.

1. Ground cable splices, joints, ground rod connections, and equipment bonding connections shall comply with IEEE 837 requirements. Connections shall be exothermic weld, or irreversible high-compression connections. Mechanical connections will not be acceptable. Cable connections to bus bars shall be made with high-compression two-hole lugs. All connections shall be made using a manufacturer approved tool.
2. Ground cable passing through exterior building walls shall enter 3 feet below finished grade and shall be sealed with a water stop. Unless otherwise noted bare cable shall include filling space between strands with solder and soldering a 12 inch copper disc between cables.
3. Ground cable installed near the base of a structure shall be no closer than 24 inches.
4. All powered equipment, including lighting fixtures, receptacles, panels, junction boxes, cabinets, equipment enclosures, and equipment racks shall be grounded by a copper ground conductor in addition to the conduit connection.
5. Ground termination on any structure, piping, equipment or instrument shall be clean and free of paint. Paint must be removed in order to provide a clean grounding surface. All contact surfaces shall be thoroughly cleaned with an electrical joint compound before connections are made.
6. The grounding system shall be bonded to piping by a bolted connection. The connection shall be made to the first flange inside the building, on either incoming or discharge pipe, with a copper bar or strap.
7. Grounding conductors shall be routed as directly as possible, avoiding unnecessary bends. The minimum bend radius shall be not less than the minimum for that size cable.
8. The ground system resistance shall comply with the National Electrical Code. The grounding system design shown on drawings is the minimum design for each building. Each system shall comply with the maximum resistance of 10 ohms to ground. Contractor shall confirm the system grounding resistance with the results of the test. Systems exceeding the maximum resistance specified shall be supplemented with additional grounding provisions and retested until the maximum specified resistance is achieved.
9. The grounding system of each new building shall be tested to determine the resistance to earth. All testing shall be performed by an independent NETA accredited testing organization. Testing shall be completed after not less than three full days without precipitation and without other moistening or chemical treatment to the soil.

10. Grounding systems shall be tested for the resistance to earth utilizing the three-point fall of potential test as defined by IEEE 81. Testing shall be completed prior to installation of the electrical distribution equipment to ensure ground system is isolated from utility and other systems. Test results shall be documented on a graphical plot with resistance in ohms on the vertical axis and distance in feet on the horizontal axis. The results shall clearly indicate a system resistance plateau which confirms a valid test procedure.
- B. Ground rods and interconnecting cables shall be buried below the frost line, or at a minimum of 30 inches below grade, whichever is deeper.

3.11. SURGE PROTECTIVE DEVICE (SPD) INSTALLATION

- A. Do not energize or connect service entrance equipment or branch panelboards to their power sources until SPD's are installed and connected.
- B. SPD shall be installed with the shortest lead conductor length possible and lead conductor shall be free of sharp bends. If a circuit breaker is required, a 30 amp maximum is permitted.
- C. Connections
 1. Tighten electrical connection and terminals according to manufactures published torque tightening values. If manufacture's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Replace fuses when prompted by indication lights. If SPD will not re-fuse, replace SPD.

3.12. CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.13. FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 1. Raceways.
 2. Cables.

3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Concrete bases.
 6. Electrical demolition.
 7. Cutting and patching for electrical construction.
 8. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
 2. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.14. TESTING

- A. A client witnessed Site Acceptance Test (SAT) shall be performed on panels and radio network associated with this project once equipment is installed and operational. Engineer and The City of Grand Junction shall be provided two weeks' notice prior to SAT.

3.15. REFINISHING AND TOUCHUP PAINT

- A. Refinish and touch up paint.
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.16. CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 73

SHORT-CIRCUIT/COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or an approved engineering firm.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584.
- C. The scope of the studies shall include all distribution equipment supplied by the equipment Manufacturer under this contract.

1.02 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
 - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
 - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
 - 6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
 - 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
 - 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
 - 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
 - 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

- C. The National Fire Protection Association (NFPA)
 - 1. NFPA 70 - National Electrical Code, latest edition
 - 2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS FOR REVIEW/APPROVAL

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.04 SUBMITTALS FOR CONSTRUCTION

- D. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Five (5) bound copies of the complete final report shall be submitted. In addition, (5) Electronic copies shall be provided on CD in PDF format.
- E. The contractor is required to provide the study project files to the Owner in electronic format.
- F. The report shall include the following sections:
 - 1. Executive Summary.
 - 2. Descriptions, purpose, basis and scope of the study
 - 3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties
 - 4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
 - 5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
 - 6. Details of the incident energy and flash protection boundary calculations
 - 7. Recommendations for system improvements, where needed
 - 8. One-line diagram
- G. Arc flash labels

1.05 QUALIFICATIONS

- H. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

- I. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

1.06 COMPUTER ANALYSIS SOFTWARE

- J. List of approved software programs
 - 1. ETAP
 - 2. SKM

PART 2 - PRODUCTS

2.1 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
 - 1. Calculation methods and assumptions
 - 2. Selected base per unit quantities
 - 3. One-line diagram of the system being evaluated
 - 4. Source impedance data, including electric utility system and motor fault contribution characteristics

5. Tabulations of calculated quantities
 6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
 2. Incoming switchgear
 3. Unit substation primary and secondary terminals
 4. Low voltage switchgear
 5. Low voltage switchboard
 6. Motor control centers
 7. Standby generators and automatic transfer switches
 8. Branch circuit panelboards
 9. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
 2. Adequacy of switchgear, switchboard, motor control centers, and panelboard bus bars to withstand short-circuit stresses
 3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on color log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
 1. Electric utility's overcurrent protective device

2. Medium voltage equipment overcurrent relays
 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
 6. Conductor damage curves
 7. Ground fault protective devices, as applicable
 8. Pertinent motor starting characteristics and motor damage points, where applicable
 9. Pertinent generator short-circuit decrement curve and generator damage point.
 10. Electronic overload settings of all devices.
 11. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all 240 volt and 208 volt panelboards.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to

represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

- G. For each equipment location with a separately enclosed main device calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- H. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- I. Miscoordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- J. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

2.6 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
 - 1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
 - 2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
 - 3. Reactor data, including voltage rating, and impedance.
 - 4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ($X''d$), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
 - 5. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.

- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
 - a. Voltage
 - b. Calculated fault current magnitude and angle
 - c. Fault point X/R ratio
 - d. Equivalent impedance
 2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
 - a. Voltage
 - b. Calculated symmetrical fault current magnitude and angle
 - c. Fault point X/R ratio
 - d. Calculated asymmetrical fault currents
 - i. Based on fault point X/R ratio
 - ii. Based on calculated symmetrical value multiplied by 1.6
 - iii. Based on calculated symmetrical value multiplied by 2.7
 - e. Equivalent impedance
 3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
 - a. Voltage
 - b. Calculated symmetrical fault current magnitude and angle
 - c. Fault point X/R ratio
 - d. No AC Decrement (NACD) Ratio
 - e. Equivalent impedance
 - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
 - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
- C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
 - a. Current transformer ratio
 - b. Current setting
 - c. Time setting
 - d. Instantaneous setting
 - e. Recommendations on improved relaying systems, if applicable.
 2. Circuit Breakers:
 - a. Adjustable pickups and time delays (long time, short time, ground)
 - b. Adjustable time-current characteristic
 - c. Adjustable instantaneous pickup

- d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and flash protection boundary calculations
- 1. Arcing fault magnitude
 - 2. Protective device clearing time
 - 3. Duration of arc
 - 4. Working distance
 - 5. Incident energy
 - 6. Hazard Risk Category
 - 7. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.

3.2 ARC FLASH WARNING LABELS

- A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels shall be based on recommended overcurrent device settings and shall be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. The label shall include the following information, at a minimum:
 - 1. Location designation
 - 2. Nominal voltage
 - 3. Flash protection boundary
 - 4. Hazard risk category
 - 5. Incident energy
 - 6. Working distance
- D. Labels shall be machine printed, with no field markings.

- E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
 - 1. For each 600, 480, and applicable 208 volt panelboard, one arc flash label shall be provided.
 - 2. For each motor control center, one arc flash label shall be provided.
 - 3. For each low voltage switchboard, one arc flash label shall be provided.
 - 4. For each switchgear, one flash label shall be provided.
 - 5. For medium voltage switches one arc flash label shall be provided

- F. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

- A. The contractor of the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

END OF SECTION

SECTION 26 24 19

MOTOR-CONTROL CENTERS

PART 1 - GENERAL

1.1 REFERENCES

- A. The following is a list of standards which shall be followed for this section.
1. Institute of Electrical and Electronics Engineers (IEEE): C2, National Electrical Safety Code (NESC)
 2. National Electrical Safety Code (NESC)
 3. National Electrical Contractors Association (NECA)
 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC)
 5. Underwriters Laboratories, Inc. (UL)
 6. National Electrical Manufacturers Association (NEMA)
 7. International Electrical Testing Association (NETA)

1.2 SUMMARY

- A. This Section includes motor-control centers for use on ac circuits rated 600 V and less.

1.3 SUBMITTALS

- A. Product Data shall include dimensions, ratings, and data on features and components.
- B. Shop Drawings for each motor-control center specified in this section. Include complete and accurate dimensioned plans, elevations, conduit entrance locations, and component lists. Show ratings, including short-circuit ratings, protective device data, and horizontal and vertical bus ampacities.
1. Schedule of features, characteristics, ratings, nameplate information, and factory settings of individual motor-control center units.
 2. Wiring Diagrams: Interconnecting wiring diagrams pertinent to class and type specified for motor-control center. Schematic diagram of each type of controller unit indicated.
- C. Certified Factory Test Reports.
- D. NETA test reports

E. Installation Data shall include shipping splits, lifting locations, anchoring details, weight, and any other special handling instructions.

F. Operation and Maintenance Data.

Submittal data shall be presented in a clear, precise and thorough manner. The Contractor's submittals shall be bound in an appropriately sized 3-ring binder, tabbed by specification section with arrows and circles clearly identifying relevant products. Non-pertinent data shall be deleted or crossed out.

1.4 QUALITY ASSURANCE

A. The manufacturer of the motor-control center shall have a minimum of 20-years experience in the manufacturing and assemble of NEMA low voltage motor-control centers.

B. The manufacturer shall have ISO 9001 registered facilities for the design, manufacture, and testing of motor-control centers.

C. Motor-control center sections and individual motor-control center units shall be designed and manufactured in accordance with UL 845 requirements.

D. Motor-control center sections and individual units shall have applied UL Listing Mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits of lengths that can be moved past obstructions in delivery path as required.

B. Store so condensation will not occur on or in motor-control centers. Provide temporary heaters as required to prevent condensation.

C. Handle motor-control centers according to NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers." Use factory-installed lifting provisions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. List of approved manufacturers

1. Eaton
2. Siemens

3. Schneider Electric
4. Or approved equal.

2.2 IDENTIFICATION

A. Nameplates

1. The motor-control center shall have a 2.0 x 8-inch engraved nameplate. The lettering shall be 3/16-inch high, black on white background.
2. Each unit shall have a 1.0 x 2.5-inch engraved nameplate. The lettering shall be 3/16-inch high, black on white background.

2.3 RATINGS

- A. The motor-control center shall be 600-volt class suitable for operation on a three-phase, 60Hz system. The system operating voltage and number of wires shall be as indicated on the drawings.
- B. The motor-control center shall be service entrance rated.

2.4 CONSTRUCTION

- A. Motor-control center enclosure shall be rated for the environment to which it is installed, at minimum NEMA Type 1 gasketed.
- B. Structures
 1. The structure shall be totally enclosed, dead-front, free-standing assemblies consisting of one or more vertical sections bolted together to form a ridged, free-standing assembly. They shall be 90 inches high and 20 inches deep, except where larger dimensions are required. The systems shall be designed to allow for the addition of future sections at either end and permit the interchanging of units.
 2. Each section shall be equipped with two full metal side sheets to isolate each vertical section and to help reduce the likelihood of fault propagation between sections.
 3. Units shall be constructed to remove units without opening adjacent doors, disconnecting adjacent units, or disturbing the operation of other units in the motor-control center. Units requiring the same size compartment shall be interchangeable.
 4. The sections & overall enclosure shall incorporate means to prevent rodents from entering.

C. Wireways

1. A full length vertical wireway shall be adjacent to each vertical unit and shall be covered by a hinged door. Wireways shall contain tie bars for cable supports and be isolated from vertical and horizontal buses.
2. Horizontal wire ways shall be located at the top and bottom of motor-control center and extend the full depth. Wireways shall be continuous across the length of the motor-control center with removable covers, except where access need to be denied due to electrical isolation requirements.

D. Paint

1. All interior and exterior surfaces shall be painted ANSI 49 medium light gray. The vertical wireways and unit back plates shall be painted high visibility gloss white. All unpainted parts shall be plated for corrosion resistance.

E. Lifting Angles

1. Each vertical section and/or shipping split shall be provided with removable lifting angles mounted to the top of the enclosure. Lifting eyes are not acceptable.

2.5 WIRING/TERMINATIONS

A. Wiring shall be NEMA Class IIS and NEMA Type B. Wire sizes as follows:

1. Control Wire: 14 AWG minimum.
2. Power Wire: 12 AWG minimum.
3. All wires shall be labeled with heat shrink type labels, wrap around labels are not acceptable.

2.6 BUSES

A. Ratings

1. All power buses shall be braced for 65,000 amperes RMS symmetrical minimum.

B. Horizontal power bus

1. Each structure shall contain a fully rated main horizontal bus, with minimum ampacity as shown on the drawings. The bus shall be rated at 50 degrees C temperature rise over a 40 degrees C ambient in compliance with UL standards. The bus material shall be copper with tin plating. It shall be properly supported, braced, and isolated from the vertical bus.
2. For standard sections the horizontal bus shall be continuous within each shipping section and shall be supported and braced.
3. Horizontal bus splices shall have at least two bolts on each side.

C. Vertical power bus

1. Each vertical section shall contain a vertical bus and be rated with a minimum ampacity of 600 amperes or as shown on the drawings. The bus shall be rated at 50 degrees C temperature rise over a 40 degrees C ambient in compliance with UL standards. The bus material shall be copper with tin plating. It shall be properly supported and braced. The bus shall be isolated and insulated by means to effectively isolate the vertical buses to prevent any fault-generated gases to pass from one phase to another.
2. Vertical bus shall be isolated from the horizontal bus except where necessary to attach to the horizontal bus. This connection shall be made with at least two bolts.
3. The vertical bus shall include a shutter mechanism that will allow the unit stabs to engage the vertical bus and provide complete isolation of the vertical bus when a unit is removed.
4. Top and bottom bus covers for insulation and isolation at bus ends.

D. Ground bus

1. Each structure shall contain a ground bus system consisting of a horizontal ground bus connected to vertical ground buses mounted in each vertical section.
2. The ground bus material shall be non-insulated copper with tin plating and be sized 1 by ¼ inch at minimum. Rating of bus shall be 300 amperes for power bus ratings less than 2,000 amperes and 600 amperes for power bus ratings 2,000 amperes and greater.
3. The bus shall be located in the top or bottom of the enclosure and extend the entire length.
4. Unit ground stabs shall be provided on all unit inserts. The ground stab shall establish unit insert grounding to the vertical ground bus before the plug-in power stabs engage the power bus. The grounding shall be maintained until after the plug-in power stabs are disengaged.
5. Ground bus shall be pre drilled and furnished with lugs for connection to equipment grounds.

E. Neutral bus

1. Neutral bus shall be full size.

2.7 UNIT INFORMATION

A. Draw-out units

1. Each draw-out unit shall consist of a unit assembly, unit support pan and unit door assembly.

2. NEMA Size 5 and feeder breakers through 400 amperes shall be draw-out units.
3. A color coded operating mechanism shall be mounted on the primary disconnect of each unit. It shall be mechanically interlocked with the unit door to prevent access, unless the disconnect is in the "OFF" position. A defeater shall be provided for qualified personnel to bypass this interlock. With the door open, an interlock shall be provided to prevent the unit while in the "ON" position. Padlocking capabilities shall be provided to positively lock the disconnect in the "OFF" position with up to three (3) padlocks with the door open or closed.
4. Units shall have short-circuit current ratings equal to or greater than short-circuit current rating of motor-control center section.
5. Units shall be equipped with pull-apart terminal strips or draw-out terminal boards for external control connections.
6. Constructed to be completely enclosed and isolated from adjacent units, buses and wires ways, except for conductor entries into the unit, and to contain any fault within the unit compartment.
7. Held in place by screws or other positive locking means after unit is inserted.
8. Integral unit ground stabs.
9. Pilot Devices
 - a. 30 millimeter size.
 - b. Heavy-Duty, oil-tight, rated to match or exceed enclosure NEMA rating.
 - c. Run/Start indication, Red.
 - d. Stopped/Off/Ready indication, Green.
 - e. Overload test/reset button.
10. Relays and timers
 - a. Coils shall be 120 VAC, 60 Hz rated for continuous duty at 40 deg. C.
 - b. Contacts shall be rated 10 amperes minimum at 120VAC.
 - c. NEMA rated
11. Contactors
 - a. Coils shall be 120 VAC, 60 Hz rated for continuous duty.
 - b. Mechanically held with disconnecting contacts.

B. Power Stabs

1. Unit stabs for engaging the power bus shall be tin-plated copper and provided with stainless back-up springs to provide and maintain a high pressure connection to the vertical bus. The power cable termination at the plug-in stab shall be a maintenance-free crimp type connection.
2. Wiring from the unit disconnecting means to the plug-in stabs shall not be exposed on the rear of the unit. A separate isolated pathway shall be provided for each phase to minimize the possibility of unit fault conditions reaching the power bus system.

3. The power cable termination at the plug-in stab shall be a maintenance-free crimp type connection.
4. Spaces and blank units shall be fully bused and equipped with guide rails or equivalent, ready for insertion of draw-out units.
5. Spare units shall indicate type, sizes, and ratings of installed equipment and be indicated "spare".

2.8 OVERCURRENT PROTECTION

A. Main Overcurrent Protection

1. Interrupting rating of 65,000 amperes RMS symmetrical minimum, slash rating is not acceptable.
2. Provide thermal magnetic trip unit for 300 amperes and smaller frames; provide electronic trip unit for 400 amperes and larger frames. Electronic trip unit shall feature the following adjustable settings for coordination:
 - a. Instantaneous trip
 - b. Long and short time pickup levels
 - c. Long and short time adjustments with I²t response
 - d. Ground fault pickup level, time delay, and I²t response
3. Provide a removable protective barrier to reduce the possibility of contact with line terminals.

B. Feeder Overcurrent Protection.

1. Protective devices shall be molded case circuit breakers with inverse time, instantaneous tripping characteristics, and short circuit interrupting rating 65,000 amperes RMS symmetrical minimum.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
3. Circuit Breakers 200 amperes and larger shall have interchangeable trip units within frame size.
4. Circuit Breakers 400 amperes and larger shall have field-adjustable, short-time and continuous-current settings.

C. Motor Starter Overcurrent Protection

1. The overcurrent protection for across the line starter shall be motor circuit protectors (MCP).

2. The unit short circuit current rating shall be greater or equal to 65,000 amperes RMS symmetrical.
3. Units shall be shipped as the motor circuit protector set a lowest setting per UL.
4. Minimum frame size shall be 150 amperes.

2.9 COMBINATION MOTOR STARTERS

- A. Starters shall be combination type rated for 600 volts with thermal-magnetic circuit breaker and control power transformer. The unit shall be equipped with two (2) indicating lights, Hand-Off-Auto (HOA) selector switch, and one (1) normally open "N.O." and one (1) normally closed "N.C." auxiliary contacts.
- B. Starters shall be NEMA size, design, and rating. Minimum size shall be NEMA Size 1.
- C. Coordinate thermal magnetic circuit breaker, and overload trip ratings with current ratings of installed motor.
- D. Starters shall be provided with a 3-pole solid state overload relay that includes the following:
 1. Self-powered
 2. Selectable trip classes 10, 20, or 30.
 3. Overload protection.
 4. Phase loss and phase imbalance protection.
 5. Trip current adjustment range of 5:1 or greater.
 6. Visual trip status indication.
 7. Push-to-trip test and Reset button. Reset button shall be extended and accessible from outside of the unit door.
 8. Thermal memory circuit to model the heating and cooling effects of motor "ON" and "OFF" periods.
 9. One (1) normally open "N.O." and one (1) normally closed "N.C." auxiliary contact.
- E. The motor starter shall have a control power transformer to provide secondary 120 V control power within each unit. The control power transformer shall be sized with adequate capacity to operate connected pilot, indicating control devices, plus 100 percent spare capacity. The control power transformer shall be fused on the primary and secondary. Minimum size: 150 VA.

2.10 Variable Frequency Drives

- A. Section Not Used

2.11 SURGE PROTECTIVE DEVICE (SPD)

- A. SPD devices shall be furnished and installed for the electrical equipment as indicated on the drawings. All new motor control centers shall be furnished with integral SPD devices.
- B. SPD shall be as standard product of a manufacturer regularly engaged in the production of SPD devices and shall be the manufacturer's latest approved design.
- C. Common Mode SPDs shall not be utilized. Common Mode SPDs may fail in a short circuit condition. In this case, the AC power neutral conductor becomes bonded to the ground or equipment grounding conductor causing undesired current on the ground or equipment grounding conductor. This may create a personnel safety hazard and could constitute an NFPA 70 violation by creating a neutral to ground bond at a location other than the main service disconnect.
 - 1. Manufactured by MaxiVolt, Eaton, or approved equal.
 - 2. SPD shall be rated for 480 VAC, 3 Phase, 3 Wire.
 - 3. SPD shall have an MCOV of 600 VAC L-L.
 - 4. SPD shall have a Clamping Voltage of 942 VAC L-L.
 - 5. SPD shall have a VPL of 1360 VAC L-L
 - 6. SPD shall have a short circuit current rating of 100,000 amps.
 - 7. SPD shall provide Line to Line (L²L) protection modes only. In no case shall the SPD have Line to Ground (L²G) protection modes.
 - 8. SPD shall have a capacitive filtering system connected in each Line to Neutral (L²N) mode and/or Line to Line (L²L) mode to provide UL 1283 EMI/RFI noise attenuation.
 - 9. SPD shall have operating temperature of -40C to 85C degrees and operate reliably in environments with 1 to 95% humidity (non-condensing).
 - 10. SPD shall have a frequency range of 50 to 400 Hertz.
 - 11. SPD shall provide EMI-RFI Noise attenuation < 40 db.
 - 12. SPD shall be listed by a NRTL with field-replaceable 5 amp fuses. Thermal fusing and/or thermally protected MOVs are not allowed.
 - 13. SPD enclosure shall be a NEMA 4 rated, non-metallic enclosure to reduce risk of shock and be suitable for both indoor and outdoor installations. Enclosure shall be painted with a catalyst based paint to ensure durability and longevity.
 - 14. SPD protection circuit shall include normally off red indication lights.

15. SPD capacitance shall be 1 to 1.5 microfarads per line.
16. SPD shall utilize open air PCB construction only. No potting material allowed.
17. SPD components shall be properly spaced for dielectric strength.
18. SPD components shall have a response time of less than one (1) nanosecond.
19. SPD lead conductors shall be 14 AWG multi-stranded, no longer than 30 inches and permanently soldered to protection circuit.
20. SPD shall be RoHS compliant.

D. Units shall conform to the following standards.

1. ANSI/IEEE C62.41 and C62.45
2. ANSI/IEEE C62.1 and C62.11
3. NEMA LS1 Guidelines
4. NFPA 20, 70, 75, and 78
5. UL 1449 and 1283

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. All factory tests required by the latest ANSI, NEMA and UL standards shall be performed.
- B. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.2 INSTALLATION

- A. Install motor-control centers according to NEMA ICS 2.3 and manufacturer's written instructions.
- B. Anchor each motor-control center assembly to steel-channel sills arranged and sized according to manufacturer's written instructions.
- C. Install motor-control centers on concrete housekeeping bases.
- D. Install fuses as required in each fusible switch as indicated.
- E. Tighten motor-control center bus joint, electrical connector, and terminal bolts according to manufacturer's published torque-tightening values. Where

manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Cleaning

1. Inspect interior and exterior of motor-control centers. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

G. Field Quality Control

1. The Contractor shall perform field adjustments of the short circuit and overload devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, protective device coordination study, manufacturer's instruction leaflets, and the contract documents.
2. Testing shall be completed by an International Electrical Testing Association (NETA) accredited company and conform to NETA standard ATS 2014, Section 7.16.1.1 "Motor Control, Motor Starters, Low Voltage". No options required.
3. Contractor is responsible for generation of a field report on tests performed, test values experienced, etc., and make the report available to owner upon request.

3.3 SURGE PROTECTIVE DEVICE (SPD) INSTALLATION

- A. Do not energize or connect service entrance equipment or feeders to their power sources until SPD's are installed and connected.
- B. SPD shall be installed with the shortest lead conductor length possible and lead conductor shall be free of sharp bends. If a circuit breaker is required, a 30 amp maximum is permitted.
- C. Connections
 1. Tighten electrical connection and terminals according to manufactures published torque tightening values. If manufacture's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Replace fuses when prompted by indication lights. If SPD will not re-fuse, replace SPD.

3.4 PRODUCT SUPPORT

- A. Manufacturer's representative shall provide onsite assistance with the following:
 1. Functional and performance testing.
 2. Startup.

3. Training of owner's personnel.

B. Schedule training with at least 7 days advance notice.

END OF SECTION

SECTION 26 29 23

VARIABLE-FREQUENCY MOTOR CONTROLLER

PART 1 - GENERAL

1.01. REFERENCES

- A. The following is a list of standards which shall be followed for this section.
 - 1. Institute of Electrical and Electronics Engineers (IEEE): IEEE 519 Standard Practices and Requirements for Harmonic Control in Electrical Power Systems.
 - 2. National Electrical Safety Code (NESC)
 - 3. National Electrical Contractors Association (NECA)
 - 4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC)
 - 5. Underwriters Laboratories, Inc. (UL)
 - 6. National Electrical Manufacturers Association (NEMA)

1.02. SUMMARY

- A. This Section includes the Variable Frequency Drive (VFD) systems and all components required to meet the performance, protection, safety, and certification criteria of this specification.
- B. Installation of VFDs in standalone enclosures and enclosed in motor-control centers shall be in accordance with this specification.

1.03. SUBMITTALS

- A. Product Data shall include dimensions, weight, ratings, conduit entry locations, major components list, and data on features and components.
- B. Wiring Diagrams.
 - 1. Power wiring diagrams shall include amperage ratings, circuit breaker frame sizes, circuit breaker continuous amp rating, etc. as required for approval.
 - 2. Control wiring diagrams shall include control devices, pilot devices, etc. as required for approval.
- C. Product Data Sheets.

1. VFD and operator interface publications.
 2. All other major components included with VFD system.
 3. Installation data.
 4. Special handling instructions.
- D. Operation and Maintenance Data.
1. Service and contact information.
 2. VFD and operator interface user manuals.
 3. Troubleshooting / Service manuals
- E. Certified Factory Test Reports.
1. Test procedures shall be per manufactures standards.
- F. Submittal data shall be presented in a clear, precise and thorough manner. The Contractor's submittals shall be bound in an appropriately sized 3-ring binder, tabbed by specification section with arrows and circles clearly identifying relevant products. Non-pertinent data shall be deleted or crossed out.

1.04. QUALITY ASSURANCE

- A. The VFD and all associated option equipment shall be UL listed or recognized.
1. Enclosure shall have applied UL Listing Mark.
- B. The manufacturer shall have ISO 9001 registered facilities for the design, manufacture, and testing of VFD's.
- C. The VFD shall be factory pre-wired, assembled and tested as a complete package.

1.05. DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall coordinate the shipping of equipment with the manufacturer.
- B. Contractor shall store the equipment in a clean dry space at an ambient temperature range of -13 °F to 130 °F. The equipment shall be protected from dirt water construction debris and traffic.

PART 2 - MATERIALS

2.01. MANUFACTURERS

- A. All VFDs shall be a product of the same manufacturer and compatible with the supplied motor control center as specified in Specification 26 24 19.
- B. List of approved manufacturers
 - 1. Eaton
 - 2. Siemens
 - 3. Schneider Electric
 - 4. Or approved equal.

2.02. VARIABLE-FREQUENCY DRIVES

- A. General
 - 1. The Variable-Frequency Drives shall be solid state, with a Pulse Width Modulated (PWM) output. The VFD package as specified herein shall be completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier (to prevent line notching), capacitors, and Insulated Gate Bipolar Transistors (IGBT) as the output-switching device.
 - 2. The VFD shall have dual 5% impedance DC link reactor on the positive and negative rails of the DC bus to minimize power line harmonics and protect the VFD from power line transients. The chokes shall be non-saturating. Swinging chokes that do not provide full harmonic filtering throughout the entire load range are not acceptable. VFDs with saturating (non-linear) DC link reactors shall require an additional 3% AC line reactor to provide acceptable harmonic performance at full load, where harmonic performance is most critical.
 - 3. The VFD shall incorporate phase to phase and phase to ground MOV protection on the AC input line.
 - 4. The VFD shall include a pump control option.
 - 5. The VFD full load output current rating shall meet or exceed NEC Table 430-250. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 120% of rated torque for up to 0.5 second while starting.

6. The VFD shall be capable of continuous full load operation under the following environmental operating conditions:
 - a. -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VFD full load current.
 - b. Altitude 5200 feet above sea level.
7. Humidity less than 95%, non-condensing.
8. VFD enclosure shall be rated IP55 or housed in an enclosure rated for the environment as indicated on the drawings. Enclosure shall be adequately sized for VFD and VFD accessories for heat dissipation.
9. The VFD circuit boards shall be coated to protect against corrosion.
10. The VFD shall include a Human Interface Module (HIM), including backlit LCD digital display and keypad for local control. The HIM shall be suitable for the area. HIM shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switch between manual and auto modes. The VFD shall function normally when the keypad is removed while the VFD is running. No warnings or alarms shall be issued as a result of removing the keypad.
11. The HIM shall be capable of displaying the following operating information. The display shall be in complete English words (alpha-numeric codes are not acceptable).
 - a. Output Frequency
 - b. Motor Current
 - c. Calculated Motor Power (kW)
 - d. Output Voltage
 - e. Analog Input Values
 - f. Analog Output Values
 - g. Digital Input Status
 - h. Digital Output Status
 - i. Keypad reference Values
 - j. Motor Speed (RPM, %, or Engineering Units)

- k. Calculated Motor Torque
 - l. DC Bus Voltage
12. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start). This feature shall be disabled by default.
 13. The VFD shall have heat sink cooling fans that are designed for easy replacement.
 14. The VFD shall be capable of being programmed through the HIM or from a computer through a data connection and drive software.
 15. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
 16. VFDs located in a standalone enclosure or with in an MCC shall be in a NEMA Type 1 enclosure at minimum unless otherwise specified. The VFD enclosure shall be part of a complete package assembly including, but not limited to disconnection means, door mounted HIM, adequate ventilation, etc. and comply with UL 508C requirements.
 17. Unless otherwise indicated, provide the following types of VFDs:
 - a. Rated less than 100 Hp: 6-pulse
 - b. Rated 100 Hp or greater: 6-pluse with passive harmonic filter.
- B. Control Logic
1. Ability to operate with motor disconnected.
 2. All adjustments shall be stored in nonvolatile memory (EEPROM).
 3. Provide multiple programmable stop modes.
 4. Provided acceleration and deceleration adjustments.
 5. The VFD program access shall have selectable user levels and have the option for password protection to prevent unwanted program changes.
- C. Process PID Control
1. The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.

2. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference.
3. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
4. Protection shall be provided for a loss of feedback or reference signal.

D. Specifications

1. Input voltage 480 VAC +/- 10%, 3 phase, 48-63 Hz.
2. Voltage tolerance + or - 10% of the specified line voltage.
3. Output Frequency 0 to 150 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.

E. Protection

1. The VFD shall be provided with a main input protection/disconnecting device. This device shall protect the VFD and provide a single location to disconnect power to the VFD and any associated line filters.
2. The VFD shall have the following protection circuits. In the case of a protective trip the VFD shall announce the fault condition on the HIM.
 - a. Overload Protection
 - b. The VFD shall provide internal class 10 adjustable overload protection.
 - c. Overload protection shall be speed sensitive and adjustable.
 - d. Over current
 - e. Over voltage
 - f. Under voltage
 - g. Over temperature
 - h. Ground Fault either running or at start

2.03. HARMONIC DISTORTION CONTROL

- A. The VFD installation shall comply to IEEE 519 at the point of common coupling, including harmonic voltage distortion and total harmonic voltage distortion.
- B. Calculations shall be provided; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFDs shall include a minimum of 5% impedance reactors, no exceptions.

2.04. WIRING/TERMINATIONS

- A. Separate terminal blocks shall be provided for control and power wiring.
- B. Wiring between the VFD and sine wave filter shall be VFD rated cable sized per motor, VFD, and sine wave filter nameplate data. Cable shall have insulation rating to withstand voltage spikes associated with PWM drives. The cable between the sine wave filter and motor shall be XHHW cable and sized according to engineering drawings.

2.05. INPUT AND OUTPUTS

- A. The input and output option modules shall consist of both analog and digital I/O. All digital input and output functions shall be full programmable. It shall be possible to add optional modules to the VFD in the field to expand its inputs and outputs.
- B. Analog
 - 1. A minimum of (2) programmable analog inputs shall be provided and accept current or voltage signals (0-20mA, 4-20mA, or 0-10V).
 - 2. A minimum of (2) programmable analog outputs shall be provided and output current or voltage signals (0-20mA, 4-20mA, or 0-10V).
- C. Digital
 - 1. A minimum of (5) programmable digital inputs shall be provided. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC / 115VAC.
 - 2. A minimum of (2) programmable relay output shall be provided, consisting of N.O. or N.C contacts. Output contacts shall be rated for 240VAC / 24VDC at 2 amperes.

2.06. COMMUNICATIONS

- A. The VFD shall be compatible with the following communication protocols in addition to hardwired input and output signals.

1. Ethernet TCP/IP
- B. Ethernet Profinet I/O communications shall be supplied providing the following information:
1. Communications fail
 2. Phase loss
 3. Low voltage
 4. Running
 5. Overload
 6. Trip
 7. Control power
 8. In auto mode
 9. Start / Stop command
 10. Reset command
 11. Current

PART 3 - EXECUTION

3.01. EXAMINATION

- A. Verify that location is ready to receive equipment.
- B. Verify that the building environment can be maintained within the service conditions required by the manufacturer of the VFD.

3.02. INSTALLATION

- A. Installation shall be the responsibility of the contractor. The contractor shall install the drive in accordance with all the manufacturer requirements as outlined in the installation manual.
- B. The contractor shall complete power and control wiring to the VFD in accordance with NEC code 430.122 and the manufacturer requirements as outlined in the installation manual.

3.03. START-UP

- A. At a minimum, the start-up service shall include:
 - 1. Perform pre-Power Check.
 - 2. Megger Motor Resistances: Phase-to-Phase and Phase-to-Ground.
 - 3. Verify system grounding per manufacturer's specifications.
 - 4. Verify power and signal grounds.
 - 5. Check connections.
 - 6. Check environment.

- B. Drive Power-up and Commissioning:
 - 1. Measure Incoming Power Phase-to-Phase and Phase-to-Ground.
 - 2. Measure DC Bus Voltage.
 - 3. Measure AC Current Unloaded and Loaded.
 - 4. Measure Output Voltage Phase-to-Phase and Phase-to-Ground.
 - 5. Verify input reference signal.
 - 6. All measurements shall be recorded.
 - 7. Drive shall be tuned for system operation.
 - 8. Drive parameter listing shall be provided.

3.04. PRODUCT SUPPORT

- A. Manufacturer's representative shall provide onsite assistance with the following:
 - 1. Installation and installation inspection.
 - 2. Functional and performance testing.
 - 3. Startup.
 - 4. Training of owner's personnel.

- B. Schedule training with at least 7 days advance notice.

C. Warranty

1. The VFD Product Warranty shall be 36 months from the date of factory shipment. The warranty shall include all parts, labor, travel time and expenses. A toll free 24/365 technical support line shall be available.

END OF SECTION

Appendix C

Construction Drawings

LOW TENSION AND SIGNAL

- WALL MOUNTED COMBINATION DATA PORT GENERAL NETWORK / PLANT NETWORK
- WALL MOUNTED DATA PORT
- UTILITY COLUMN MOUNTED DATA PORT
- FLOOR MOUNTED DATA PORT
- CEILING MOUNTED SPEAKER F-FLUSH MTD. S-SURFACE MTD.
- WALL MOUNTED SPEAKER
- SPEAKER HORN
- PUSH BUTTON
- BELL
- BUZZER
- CARD READER
- WIRELESS ACCESS POINT

LIGHTING

- CEILING MOUNTED FIXTURE TYPE:1 PANEL:A-B SWITCH-b CIRCUIT-2
- WALL MOUNTED FIXTURE
- SURFACE MTD. FLUORESCENT FIXTURE
- WALL MTD. FLUORESCENT FIXTURE
- RECESSED FLUORESCENT FIXTURE
- INDICATOR LIGHT
- EXIT LIGHT: WALL OR SURFACE MOUNT, ARROW AS (ARROW AS INDICATED ON DRAWINGS)
- EMERGENCY LIGHT
- WALL MOUNTED FLOODLIGHTS
- POLE MOUNTED FLOODLIGHTS
- PHOTOCELL
- TIME CLOCK CONTROLLED CEILING MTD. RECESSED EMERG. BATTERY PACK

CONDUIT AND WIRING

- SURFACE MOUNTED PANEL
- FLUSH MOUNTED PANEL
- CONDUIT (RUN IN WALLS, CEILING, OR ABOVE GRADE)
- CONDUIT (RUN IN SLAB, UNDERGROUND OR BEHIND OBSTRUCTION)
- CONDUIT (CAPPED)
- CONDUIT (TURNS AS INDICATED)
- FLEX CONDUIT (NOT ALWAYS SHOWN)
- GROUND CONDUCTOR

UNDERGROUND CONCRETE ENCASED DUCTBANK

DETAIL CROSS REFERENCE

SINGLE LINE & SCHEMATIC

- POTHEAD OR CABLE/BUS-JUNCTION
- CAPACITOR
- POWER TRANSFORMER
- POWER CIRCUIT BREAKER
- LOW VOLTAGE CIRCUIT BREAKER
- LOAD BREAK SWITCH
- FUSED DISCONNECT SWITCH
- FUSED DISCONNECT (AIR)
- FUSE
- GROUND ROD
- GROUND TEST WELL
- FUSE LINK
- BUSDUCT
- POTENTIAL TRANSFORMER
- CURRENT TRANSFORMER
- ZERO SEQUENCE CURRENT TRANSFORMER
- BUSHING TYPE CURRENT CURRENT TRANSFORMER
- DISCONNECT DRAW-OUT TYPE TEST BLOCK
- WITHDRAW
- GROUND CONNECTION
- BOLTED CONNECTION THERMAL OVERLOAD. IF 'E' IS SHOWN - SOLID STATE OVERLOAD
- INCOMING LINE
- OUTGOING LINE
- KEY INTERLOCK
- TRANSFORMER CONNECTION
- ARRESTOR
- PHASE
- EMERGENCY STOP
- NORMALLY CLOSED PUSHBUTTON
- NORMALLY OPEN PUSHBUTTON
- TEMPERATURE SWITCH
- NO ON TIME DELAY SWITCH
- NC ON TIME DELAY SWITCH
- CONTACTOR:NORMALLY CLOSED

CONTACTOR: NORMALLY OPEN

HEATER

FLOAT SWITCH

PRESSURE SWITCH (CLOSING ON RISING PRESSURE)

PRESSURE SWITCH (OPENING ON RISING PRESSURE)

ANALOG SIGNAL

DIGITAL SIGNAL

MOTORS AND CONTROL

- MOTOR CONTROL CENTER
- COMBINATION STARTER
- FUSED DISCONNECT SWITCH
- UNFUSED DISCONNECT SWITCH
- MANUAL MOTOR STARTER P-c/w PILOT LIGHT K-KEY OPERATED
- THERMOSTAT
- EXHAUST FAN
- RESISTANCE TEMPERATURE DETECTOR
- MOTOR
- GENERATOR

OUTLETS AND DEVICES

- WALL MTD. DUPLEX RECEPTACLE (CCT. A-B-1)
- DOUBLE DUPLEX RECEPTACLE
- SPECIAL PURPOSE RECEPTACLE
- SPLIT FED RECEPTACLE
- SPECIAL RECEPTACLE E - EMERGENCY G - GROUND H - HOUSEKEEPING S - SAFETY IP- ISOLATED POWER IG- ISOLATED GROUND
- UTILITY COLUMN MTD. RECEPTACLE
- FLOOR MOUNTED RECEPTACLE 20 AMPS 20A
- SWITCH (X:SWITCH LABEL; Y: 3-3 WAY, 4-4 WAY, Y:T TIMED SWITCH) SINGLE POLE SWITCH (X:SWITCH LABEL)
- WALL MOUNTED JUNCTION BOX
- WALL MOUNTED SINGLE FACED CLOCK
- WALL MOUNTED CLOCK OUTLET
- SECURITY CAMERA

GENERAL NOTES:

- INFORMATION SHOWN ON THE DRAWINGS IS DIAGRAMTIC. DATA PRESENTED ON THE DRAWINGS IS AS ACCURATE AS PLANNING CAN DETERMINE, BUT ACCURACY IS NOT GUARANTEED AND FIELD VERIFICATION OF ALL DIMENSIONS, LOCATIONS, LEVELS, ETC., TO BEST SUIT FIELD CONDITIONS IS REQUIRED. REVIEW ALL ARCHITECTURAL, CIVIL, STRUCTURAL AND MECHANICAL DRAWINGS AND ALL SPECIFICATIONS AND ADJUST ALL WORK TO CONFORM TO ALL CONDITIONS SHOWN THEREIN.
- WHERE WIRE AND CABLE ROUTING IS NOT SHOWN, AND DESTINATION ONLY IS INDICATED, DETERMINE EXACT ROUTING AND LENGTHS REQUIRED BY FIELD VERIFICATION.
- THE CITY OF GRAND JUNCTION SHALL BE RESPONSIBLE FOR PROCURING THE FOLLOWING EQUIPMENT:
 - PLC EQUIPMENT

ABBREVIATIONS:

#	NUMBER	MAU	MAKEUP AIR UNIT
A	AMPS (AMPERES)	MCC	MOTOR CONTROL CENTER
ABBR	ABBREVIATION	MCP	MOTOR CIRCUIT PROTECTOR
AC	ALTERNATING CURRENT	MDF	MAIN DISTRIBUTION FRAME
A/C	AIR CONDITIONING	MDP	MAIN DISTRIBUTION PANEL
AFF	ABOVE FINISHED FLOOR	MH	MAN HOLE
AFG	ABOVE FINISHED GRADE	MM	MULTIMODE
AHU	AIR HANDLING UNIT	MOV	MOTOR OPERATED VALVE
AIC	AMPS INTERRUPTING CURRENT	MUX	MULTIPLEXER
ATS	AUTOMATIC TRANSFER SWITCH	MSH	MOTOR SPACE HEATER
AUTO	AUTOMATIC	MTS	MOTOR TEMPERATURE SWITCH
AUX	AUXILIARY	N	NEUTRAL
AWG	AMERICAN WIRE GAUGE	NC	NORMALLY CLOSED
BATT	BATTERY	NEC	NATIONAL ELECTRIC CODE
BFC	BELOW FINISHED CEILING	NEMA	NATIONAL ELECTRIC MANUFACTURES ASSOCIATION
BFF	BELOW FINISHED FLOOR	NIC	NOT IN CONTRACT
BFG	BELOW FINISHED GRADE	NO	NORMALLY OPEN
C	CONDUIT	NTS	NOT TO SCALE
CAP	CAPACITOR	O/L	OVERLOAD
CB	CIRCUIT BREAKER	OS	OCCUPANCY SENSOR
CKT	CIRCUIT	PB	PULL BOX
CO	CONDUIT ONLY	PH, Ø	PHASE
COMM	COMMUNICATION	PLC	PROGRAMMABLE LOGIC CONTROLLER
CR	CONTROL RELAY	PR	PAIR
CS	CONTROL STATION	PRI	PRIMARY
CT	CURRENT TRANSFORMER	PSS	PANIC SHUTDOWN SYSTEM
CU	COPPER	PVC	POLYVINYL CHLORIDE
DC	DIRECT CURRENT	QTY	QUANTITY
DCS	DISTRIBUTED CONTROL SYSTEM	REC	RECEPTACLE
DISC	DISCONNECT	RGS	RIGID GALVANIZED STEEL CONDUIT
DS	DOOR SWITCH	RMS	ROOT MEAN SQUARE
DWG	DRAWING	RM	ROOM
E	EXISTING	RTU	REMOTE TERMINAL UNIT
E-STOP	EMERGENCY STOP	SDBC	SOFT DRAWN BARE COPPER
EF	EXHAUST FAN	SEC	SECONDARY
EM	EMERGENCY	SPD	SURGE PROTECTION DEVICE
EMT	ELECTRICAL METALLIC TUBING CONDUIT	SS	SOFT START
F	FUSE	ST	SHUNT TRIP
FA	FIRE ALARM	SW	SWITCH
FACP	FIRE ALARM CONTROL PANEL	SWBD	SWITCHBOARD
FATC	FIRE ALARM TERMINATION CABINET	SWGR	SWITCHGEAR
FBO	FURNISHED BY OWNER	SHD	SHIELD
FLA	FULL LOAD AMPS	T, XFMR	TRANSFORMER
FLEX	FLEXIBLE METAL CONDUIT	TD	TIME DELAY RELAY
FLMC	FLEXIBLE LIQUIDTIGHT METALLIC CONDUIT	TC	TRAY CABLE OR TIME CLOCK
FO	FIBER OPTIC	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
FREQ	FREQUENCY	TYP	TYPICAL
FVR	FULL VOLTAGE REVERSING	UG	UNDERGROUND
FVNR	FULL VOLTAGE NON-REVERSING	UH	UNIT HEATER
G	GROUND	UL	UNDERWRITER LABORATORY
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	UON	UNLESS OTHERWISE NOTED
GRC	GALVANIZED RIGID CONDUIT	UPS	UNINTERRUPTIBLE POWER SUPPLY
HH	HAND HOLE	V	VOLT
HMI	HUMAN TO MACHINE INTERFACE	VA	VOLTAMPERES
IDF	INTERMEDIATE DISTRIBUTION FRAME	VFD	VARIABLE FREQUENCY DRIVE
IDS	INTRUSION DETECTION SYSTEM	W	WATTS
IG	ISOLATED GROUND	WP	WEATHERPROOF AND IN-USE COVER
LAN	LOGICAL AREA NETWORK	WT	WATERTIGHT
LC	LIGHTING CONTACTOR		
LTG	LIGHTING		

SPECIAL AREA DESIGNATIONS

THE DESIGNATIONS BELOW ARE LOCATED ON THE ELECTRICAL DRAWINGS TO DEFINE INSTALLATION REQUIREMENTS FOR THAT AREA. DESIGNATIONS ARE LOCATED WITHIN THE ROOM. ALL INDOOR AREAS NOT INDICATED BELOW ARE CLASSIFIED TYPE 1 AND MINIMUM NEMA TYPE 1 ENCLOSURES.



INDOOR WET LOCATIONS; VAULTS, HOSEDOWN, BASEMENTS, ETC. MINIMUM TYPE 4 ENCLOSURES FOR EQUIPMENT AND GASKETED FITTINGS FOR ALL CONDUITS.



INDOOR, DRY, DIRTY AREAS, DUSTY. ENCLOSURES AND EQUIPMENT SHALL BE MINIMUM TYPE 12 GASKETED.



CORROSIVE STORAGE AND CHEMICAL FEED AREAS. CONDUIT SYSTEMS SHALL BE RIGID STEEL CONDUIT AND ACCESSORIES. ENCLOSURES AND BOXES SHALL BE TYPE 4X 316 STAINLESS STEEL.



CLASS 1, DIVISION 1, GROUP C AND D AS DEFINED BY NEC. ALL EQUIPMENT AND CONDUIT SYSTEMS SHALL BE RATED FOR USE IN THIS AREA.



CORROSIVE STORAGE AND CHEMICAL FEED AREAS. CONDUIT SYSTEMS SHALL BE PVC-COATED RIGID STEEL CONDUIT AND ACCESSORIES. ENCLOSURES AND BOXES SHALL BE TYPE 4X PLASTIC.



CLASS 1, DIVISION 2, GROUP C AND D AS DEFINED BY NEC. ALL EQUIPMENT AND CONDUIT SYSTEMS SHALL BE RATED FOR USE IN THIS AREA.

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	REFERENCE DRAWING		REVISION		

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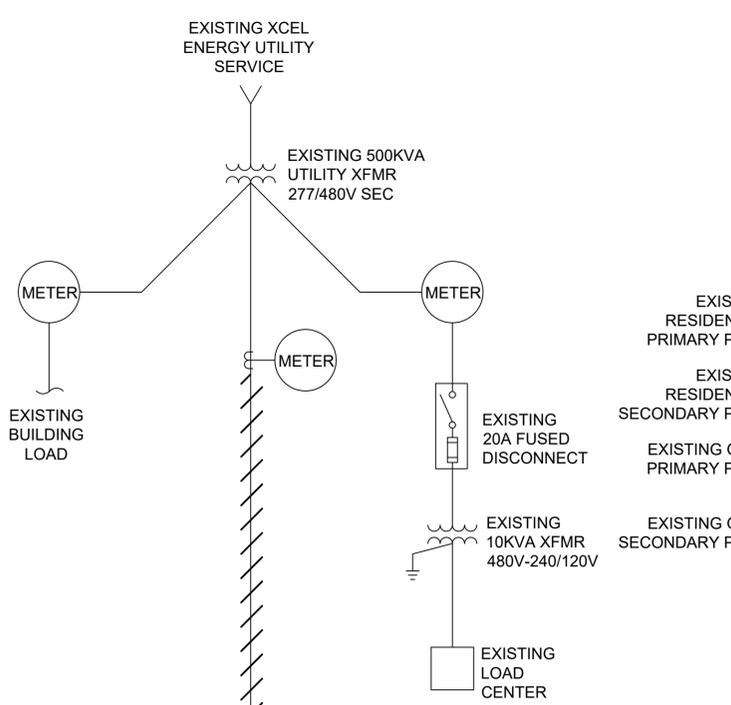
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CLIENT: CITY OF Grand Junction COLORADO

CONSULTANT: MAGNA ENGINEERING

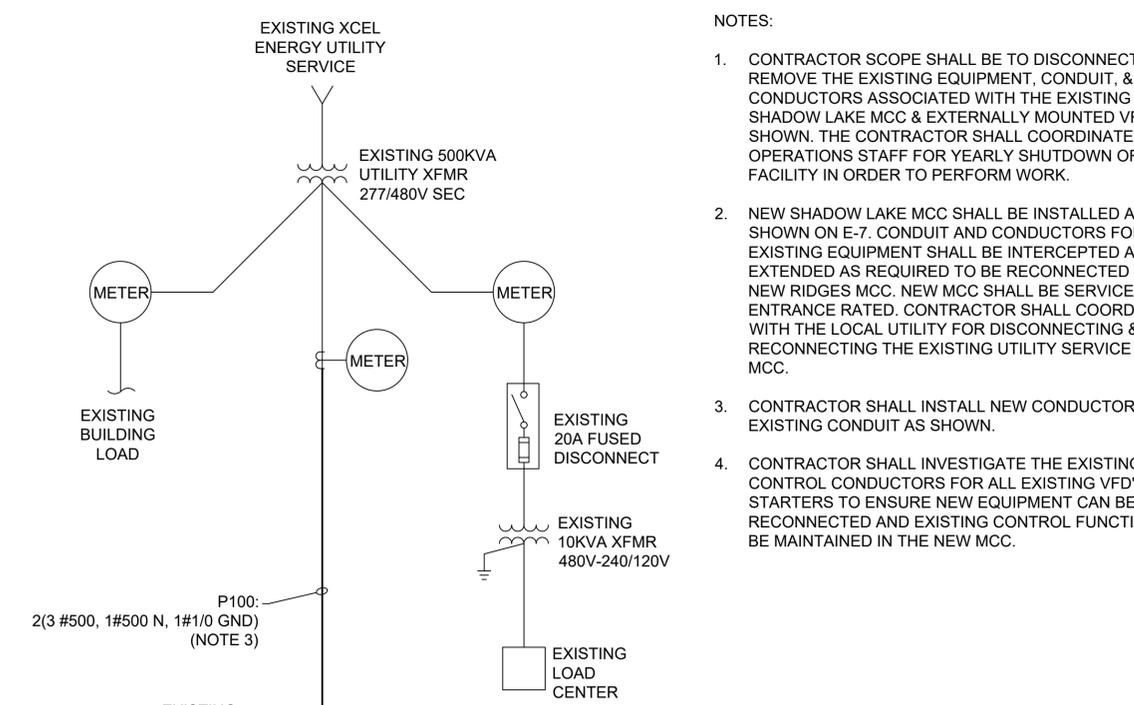
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DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	GENERAL ELECTRICAL SYMBOLS, LEGEND, & ABBREVIATIONS		
PROJECT No.	C5041-1	DRAWING No.	E-1
SHEET NO. OF SHEET REV.	1		A

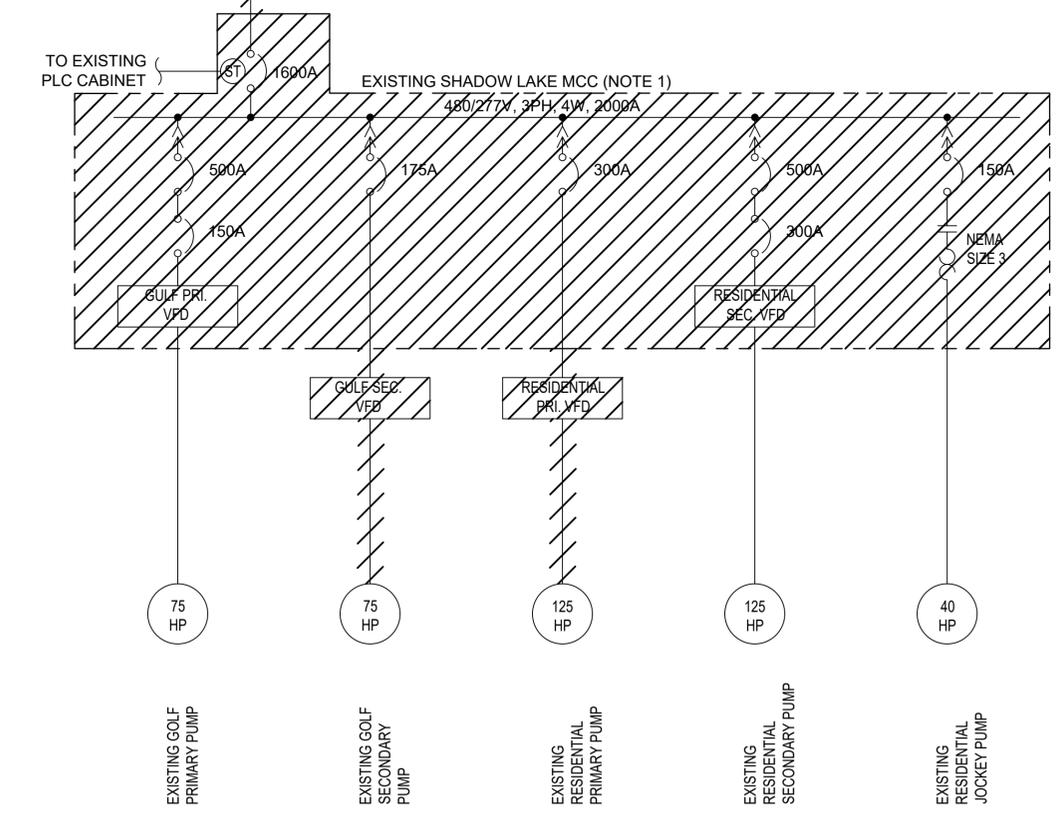


SHADOW LAKE PUMP STATION DEMOLITION DETAIL

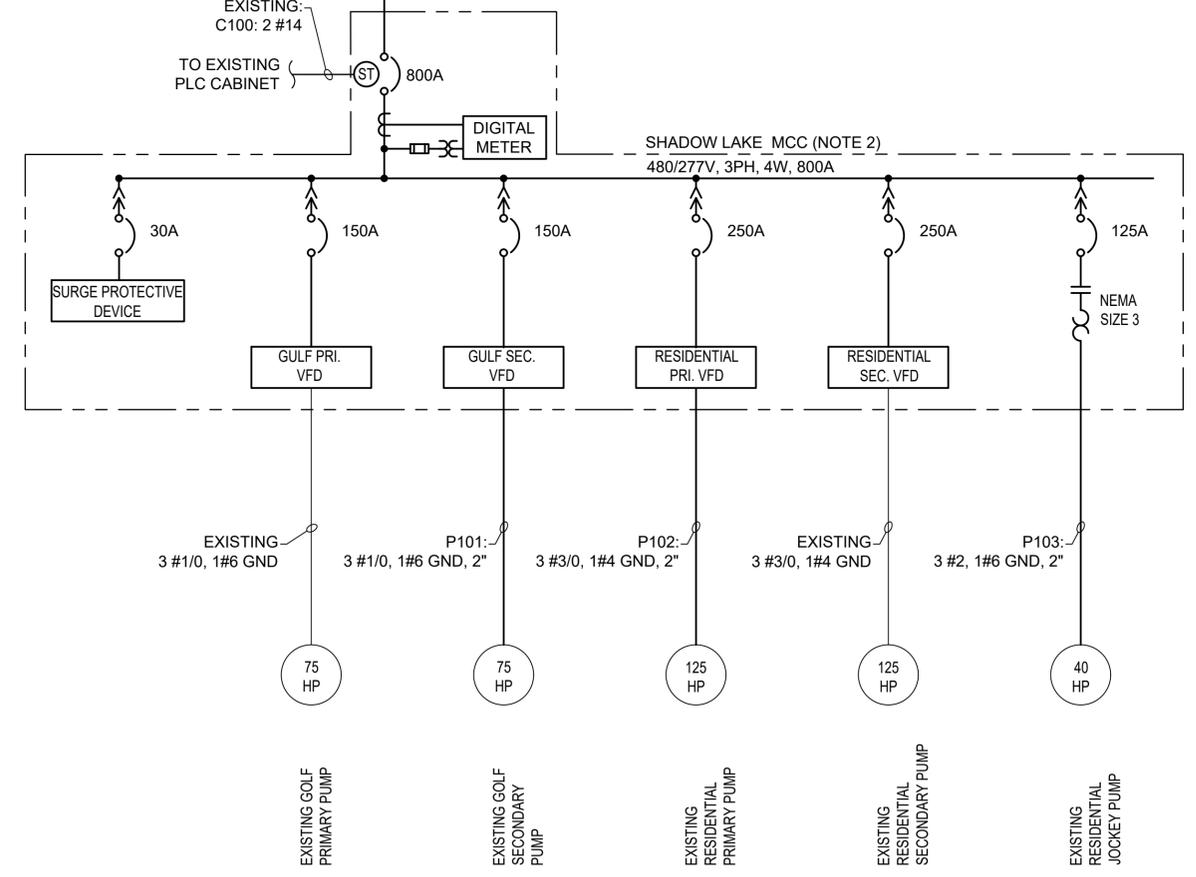
EXISTING LOAD CENTER & 10KVA TRANSFORMER



- NOTES:
1. CONTRACTOR SCOPE SHALL BE TO DISCONNECT & REMOVE THE EXISTING EQUIPMENT, CONDUIT, & CONDUCTORS ASSOCIATED WITH THE EXISTING SHADOW LAKE MCC & EXTERNALLY MOUNTED VFD'S AS SHOWN. THE CONTRACTOR SHALL COORDINATE WITH OPERATIONS STAFF FOR YEARLY SHUTDOWN OF THE FACILITY IN ORDER TO PERFORM WORK.
 2. NEW SHADOW LAKE MCC SHALL BE INSTALLED AS SHOWN ON E-7. CONDUIT AND CONDUCTORS FOR THE EXISTING EQUIPMENT SHALL BE INTERCEPTED AND EXTENDED AS REQUIRED TO BE RECONNECTED TO THE NEW RIDGES MCC. NEW MCC SHALL BE SERVICE ENTRANCE RATED. CONTRACTOR SHALL COORDINATE WITH THE LOCAL UTILITY FOR DISCONNECTING & RECONNECTING THE EXISTING UTILITY SERVICE TO THE MCC.
 3. CONTRACTOR SHALL INSTALL NEW CONDUCTORS IN EXISTING CONDUIT AS SHOWN.
 4. CONTRACTOR SHALL INVESTIGATE THE EXISTING CONTROL CONDUCTORS FOR ALL EXISTING VFD'S & STARTERS TO ENSURE NEW EQUIPMENT CAN BE RECONNECTED AND EXISTING CONTROL FUNCTIONALITY BE MAINTAINED IN THE NEW MCC.

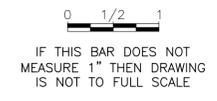


DEMOLITION ONE-LINE DIAGRAM



ONE-LINE DIAGRAM

DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		



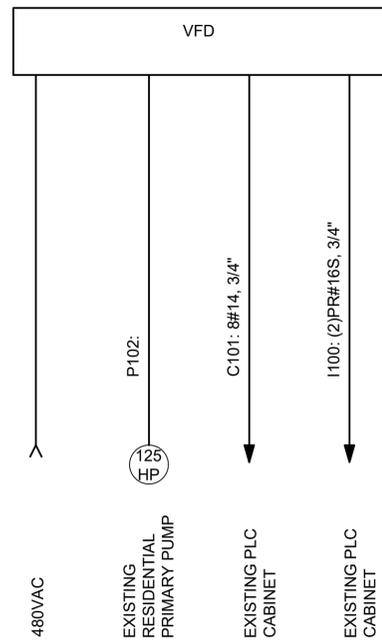
ENGINEERING STAMP:

CLIENT: **CITY OF Grand Junction COLORADO**

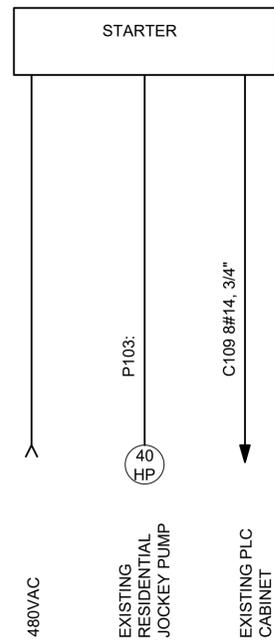
CONSULTANT: **MAGNA ENGINEERING**

SCALE:	NTS
DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

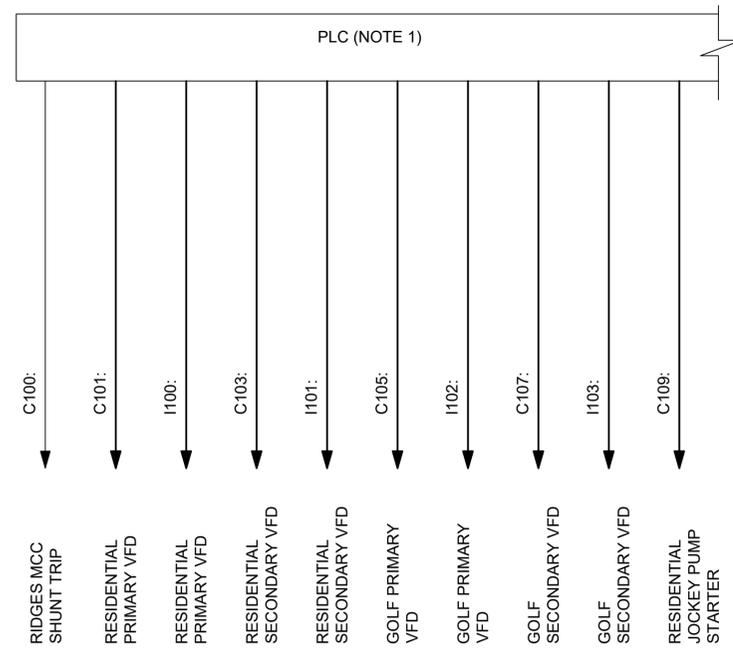
LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	SHADOW LAKE PUMP STATION ONE-LINE DIAGRAMS		
PROJECT No.	C5041-1	DRAWING No.	E-2
SHEET NO. OF SHEET	2	REV.	A



RESIDENTIAL PRIMARY PUMP
 (TYPICAL FOR RESIDENTIAL SECONDARY PUMP, GOLF
 PRIMARY PUMP, & GOLF SECONDARY PUMP)



RESIDENTIAL JOCKEY PUMP

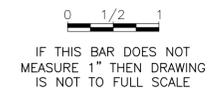


SHADOW LAKE PLC CABINET
 (PARTIAL)

NOTES:

- CONTRACTOR SHALL COORDINATE WITH CITY OF GRAND JUNCTION FOR ADDITIONAL PLC I/O REQUIREMENTS TO ACCOMMODATE SIGNALS AS SHOWN. CITY OF GRAND JUNCTION SHALL BE RESPONSIBLE FOR SPECIFYING, SUPPLYING, AND PROGRAMMING OF PLC.

DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		
		C	ISSUED FOR BID	8/2/2021	RL
		B	ISSUED FOR 100% REVIEW	6/15/2021	RL
		A	ISSUED FOR 60% REVIEW	4/23/2021	RL



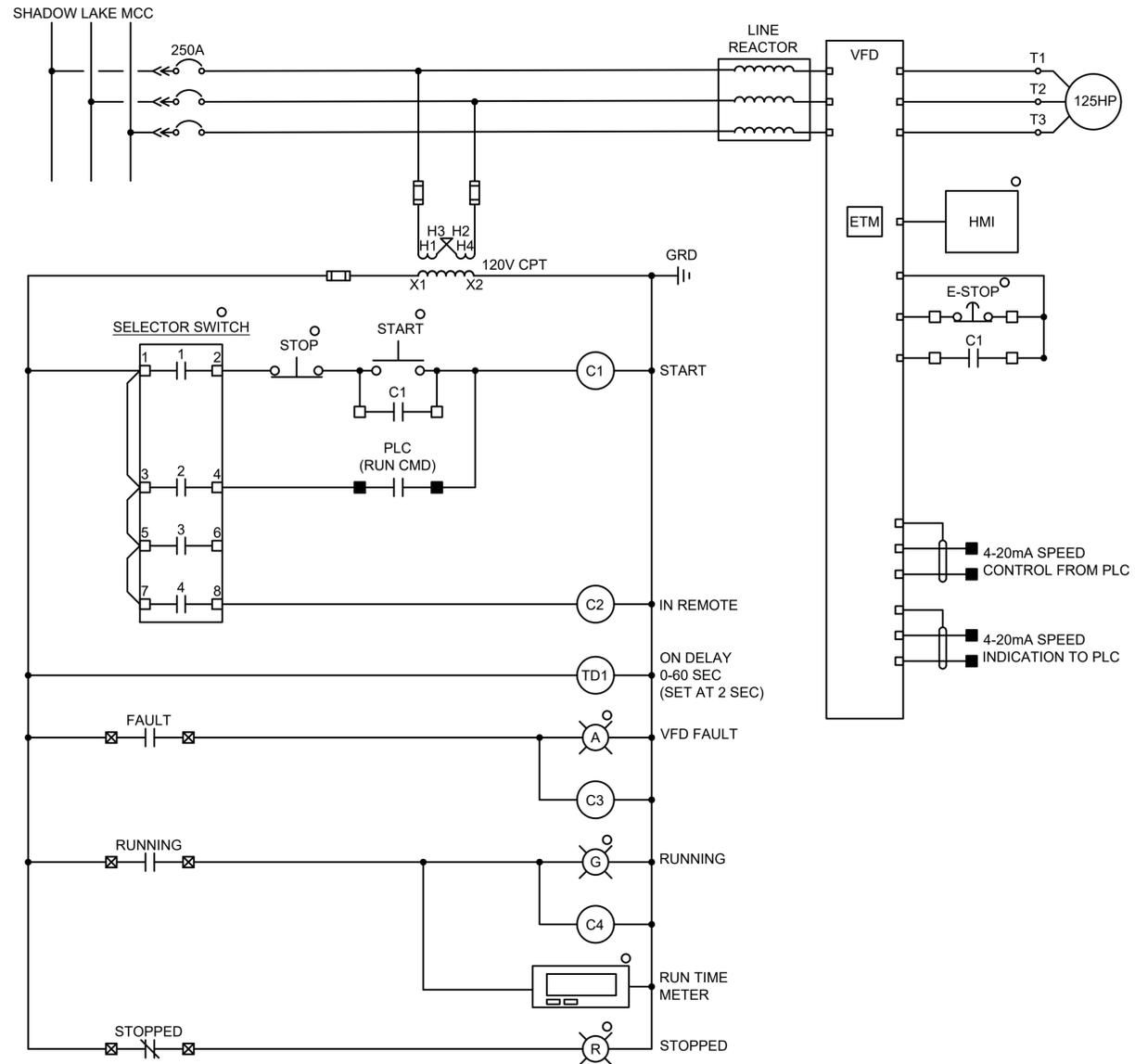
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CLIENT:

CONSULTANT:

SCALE:	NTS
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DESIGNED BY:	RL
APPROVED BY:	JP

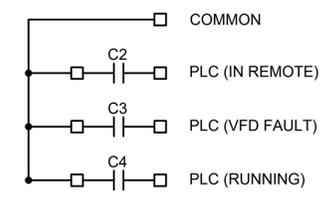
LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	EQUIPMENT ONE-LINE DIAGRAMS		
PROJECT No.	C5041-1	DRAWING No.	E-3
SHEET NO. OF SHEET	3	REV.	A



- NOTES:
- UNLESS OTHERWISE INDICATED, ALL DEVICES ARE LOCATED WITHIN THE SHADOW LAKE MCC. DEVICES LOCATED REMOTE FROM THE SHADOW LAKE MCC ARE INDICATED BY THE LEGEND BELOW. EXISTING WIRING & CONTROLS SHALL BE FIELD INVESTIGATED TO ENSURE EXISTING FUNCTIONALITY & CONTROL WILL BE MAINTAINED ON THE NEW VFD'S. NEW/ADDITIONAL CONTROL SIGNALS SHOWN HERE SHALL BE INCORPORATED.
 - FURNISH INPUT AND OUTPUT CARDS TO CONTROL VFD AS SHOWN. WHEN C2 CONTACT IS CLOSED (IN REMOTE), SPEED CONTROL DETERMINED BY 4-20mA INPUT FROM PLC. WHEN C2 CONTACT IS OPEN (IN HAND), SPEED CONTROL VIA HMI.

- LEGEND
- EXTERNAL CONNECTION
 - INTERNAL CONNECTION
 - ☒ TERMINAL IN VFD OR ELECTRONIC OVERLOAD
 - CONNECTION POINT
 - ▲ LOCATED NEAR MOTOR
 - MOUNTED IN VFD MCC ENCLOSURE DOOR

SELECTOR SWITCH				HAND	OFF	REMOTE
CONTACTS						
1	1	2	3	2	4	1
5	3	6	7	4	8	2



RESIDENTIAL PRIMARY PUMP SCHEMATIC
 (TYPICAL FOR RESIDENTIAL SECONDARY PUMP, GOLF PRIMARY PUMP, & GOLF SECONDARY PUMP)

DRAWING No.		DRAWING TITLE		No.		DESCRIPTION		DATE		BY	
REFERENCE DRAWING		REVISION		C		ISSUED FOR BID		8/2/2021		RL	
				B		ISSUED FOR 100% REVIEW		6/15/2021		RL	
				A		ISSUED FOR 60% REVIEW		4/23/2021		RL	

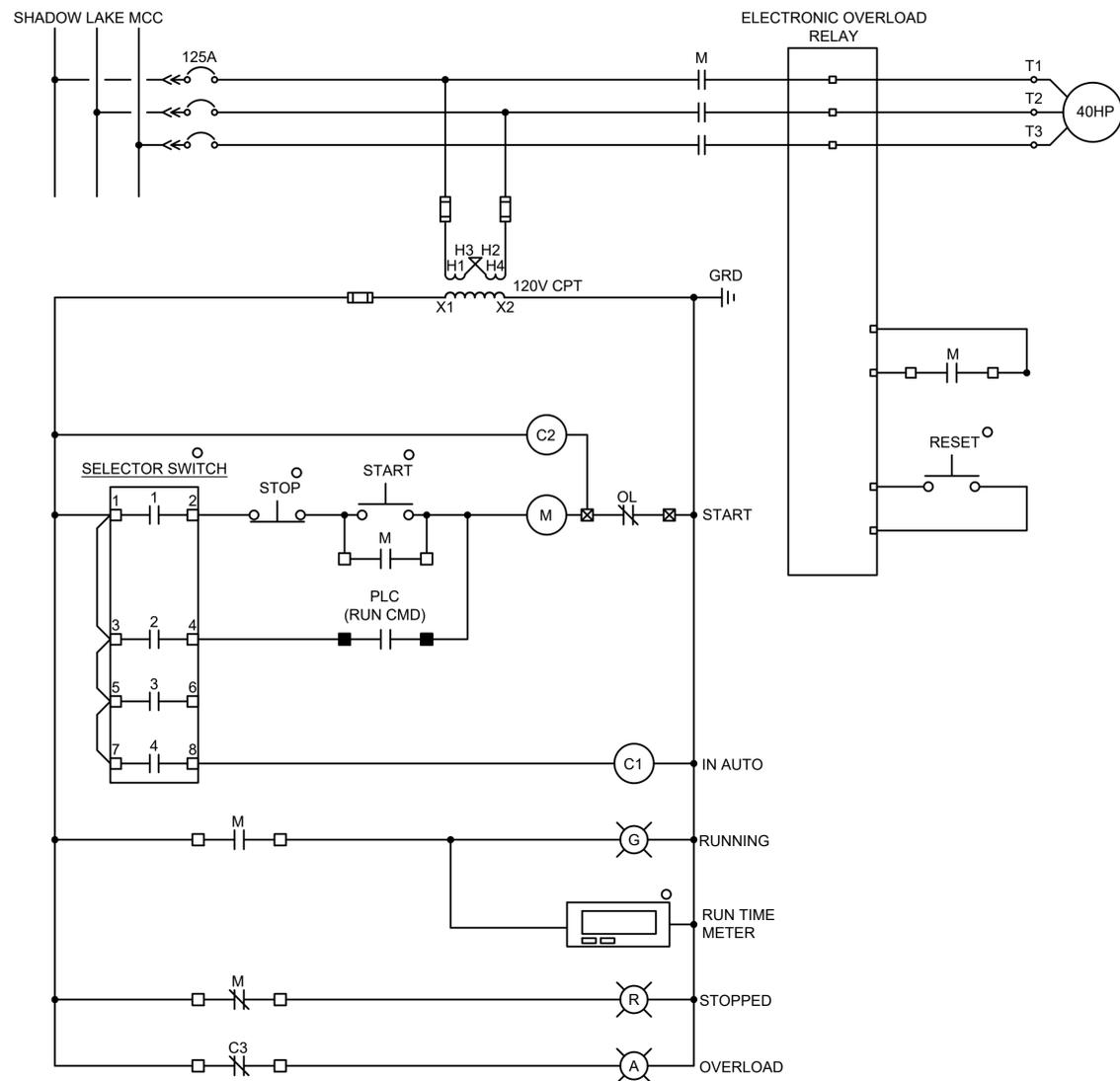
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO FULL SCALE

ENGINEERING STAMP:

CLIENT:

CONSULTANT:

SCALE:	NTS	LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
DRAWN BY:	RL	PROJECT NAME:	MCC REPLACEMENT		
DESIGNED BY:	RL	DRAWING TITLE:	VFD SCHEMATIC		
APPROVED BY:	JP	PROJECT No.	C5041-1	DRAWING No.	E-4
		SHEET NO. OF SHEET	4	REV.	A



NOTES:

- UNLESS OTHERWISE INDICATED, ALL DEVICES ARE LOCATED WITHIN THE STARTER. DEVICES LOCATED REMOTE FROM THE STARTER ARE INDICATED BY THE LEGEND BELOW. EXISTING WIRING & CONTROLS SHALL BE FIELD INVESTIGATED TO ENSURE EXISTING FUNCTIONALITY & CONTROL WILL BE MAINTAINED ON THE NEW STARTER. NEW/ADDITIONAL CONTROL SIGNALS SHOWN HERE SHALL BE INCORPORATED.

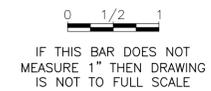
LEGEND

- EXTERNAL CONNECTION
- INTERNAL CONNECTION
- ⊗ TERMINAL IN VFD OR ELECTRONIC OVERLOAD
- CONNECTION POINT
- ▲ LOCATED NEAR MOTOR
- MOUNTED IN MOTOR CONTROL CENTER ENCLOSURE DOOR

SELECTOR SWITCH				HAND	OFF	AUTO
CONTACTS						
1	1	2	3	2	4	
⊗		⊗		⊗		⊗
5	3	6	7	4	8	
⊗		⊗		⊗		⊗

RESIDENTIAL JOCKEY PUMP SCHEMATIC

DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		
		C	ISSUED FOR BID	8/2/2021	RL
		B	ISSUED FOR 100% REVIEW	6/15/2021	RL
		A	ISSUED FOR 60% REVIEW	4/23/2021	RL



ENGINEERING STAMP:

CLIENT: **CITY OF Grand Junction COLORADO**

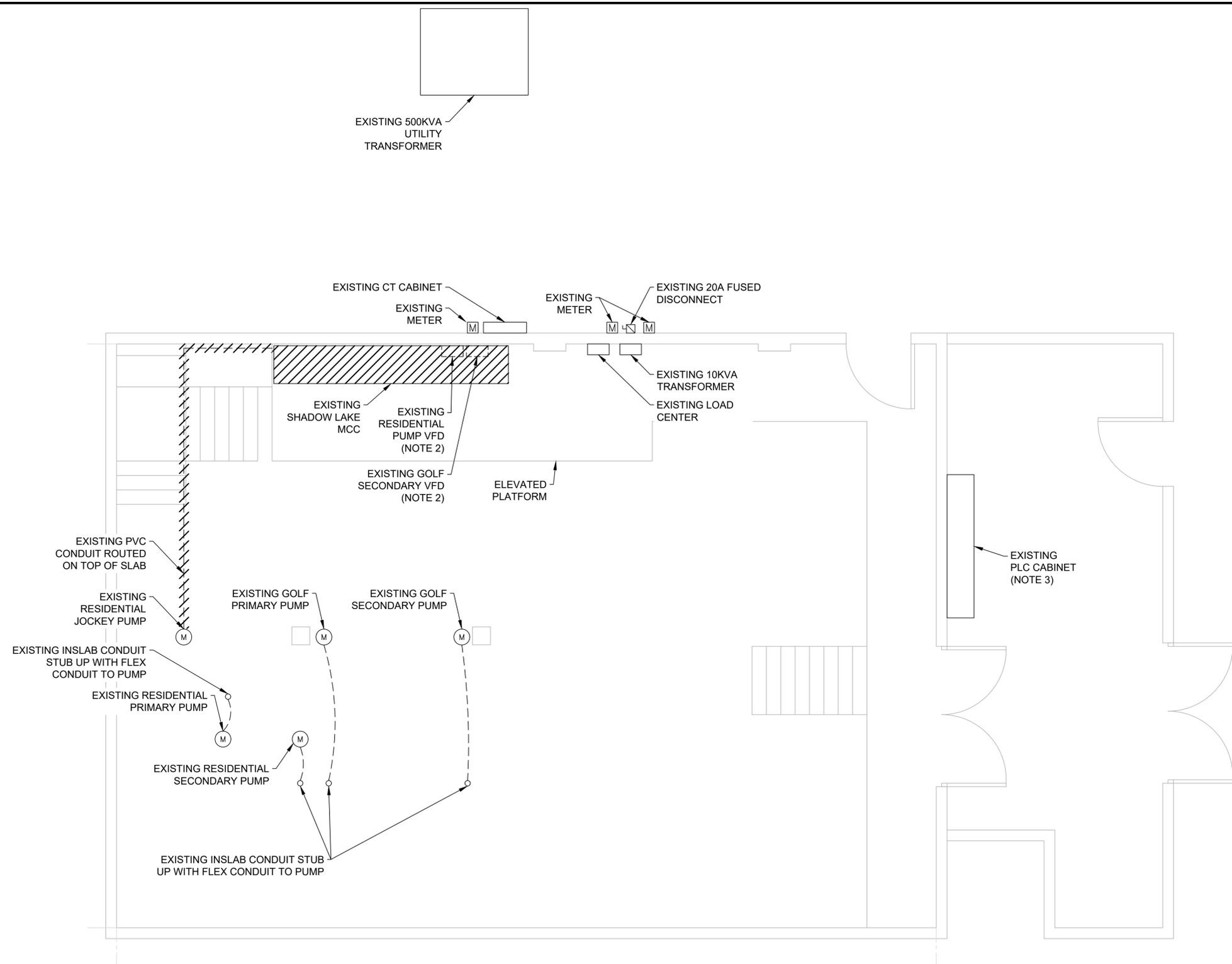
CONSULTANT: **MAGNA ENGINEERING**

SCALE:	NTS
DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	STARTER SCHEMATIC		
PROJECT No.	C5041-1	DRAWING No.	E-5
SHEET NO. OF SHEET	5	REV.	A

NOTES:

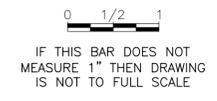
1. CONTRACTOR SHALL DISCONNECT AND REMOVE EXISTING EQUIPMENT AS SHOWN.
2. EXISTING VFD'S ARE WALL MOUNTED BELOW THE ELEVATED PLATFORM
3. CONTRACTOR SHALL FIELD INVESTIGATE EXISTING CONTROLS. ALL I/O ASSOCIATED WITH THE SHADOW LAKE MCC, VFD'S, & STARTER SHALL BE REUSED AND CONFIGURED TO MATCH THE INTENT OF THE NEW DESIGN.



PUMP STATION ELECTRICAL DEMOLITION PLAN
3/8" = 1'-0"



DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		
		C	ISSUED FOR BID	8/2/2021	RL
		B	ISSUED FOR 100% REVIEW	6/15/2021	RL
		A	ISSUED FOR 60% REVIEW	4/23/2021	RL



ENGINEERING STAMP:

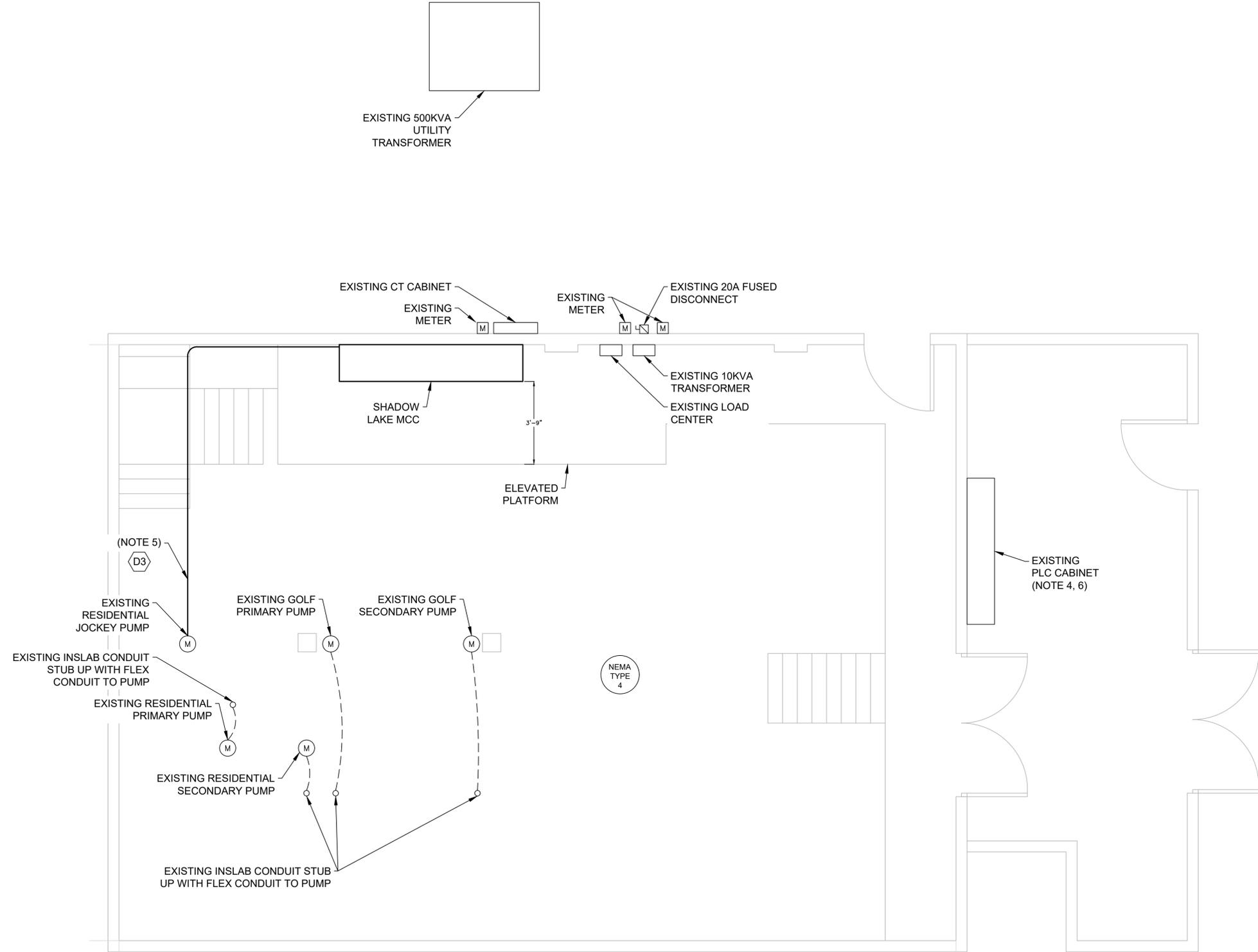
CLIENT: **CITY OF Grand Junction COLORADO**

CONSULTANT: **MAGNA ENGINEERING**

SCALE:	NTS
DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	SHADOW LAKE PUMP STATION DEMOLITION ELECTRICAL PLAN		
PROJECT No.	C5041-1	DRAWING No.	E-6
SHEET NO. OF SHEET	6	REV.	A

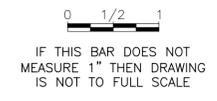
- NOTES:
1. CONTRACTOR SHALL INSTALL EQUIPMENT AS SHOWN.
 2. CONTRACTOR SHALL REUSE EXISTING IN SLAB CONDUITS WHERE POSSIBLE.
 3. CONTRACTOR SHALL ROUTE CONDUITS TO BEST SUIT FIELD CONDITIONS. CONTRACTOR SHALL PROVIDE JUNCTION BOXES AS REQUIRED FOR A COMPLETE INSTALLATION.
 4. EQUIPMENT SHALL BE PROCURED BY THE CITY OF GRAND JUNCTION AND INSTALLED BY CONTRACTOR.
 5. CONTRACTOR SHALL ROUTE RIGID CONDUIT ON TOP OF SLAB.
 6. CONTRACTOR SHALL COORDINATE WITH OPERATIONS STAFF FOR SUPPLYING ADDITIONAL COMPATIBLE PLC I/O MODULES AS REQUIRED TO ACCOMMODATE VFD & STARTER SIGNALS AS SHOWN ON THE SCHEMATIC.



PUMP STATION ELECTRICAL PLAN
3/8" = 1'-0"



DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		
		C	ISSUED FOR BID	8/2/2021	RL
		B	ISSUED FOR 100% REVIEW	6/15/2021	RL
		A	ISSUED FOR 60% REVIEW	4/23/2021	RL



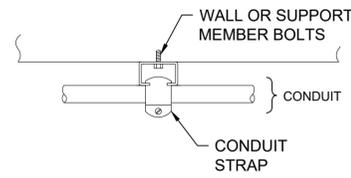
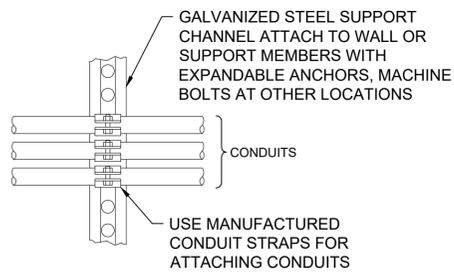
ENGINEERING STAMP:

CLIENT: **CITY OF Grand Junction COLORADO**

CONSULTANT: **MAGNA ENGINEERING**

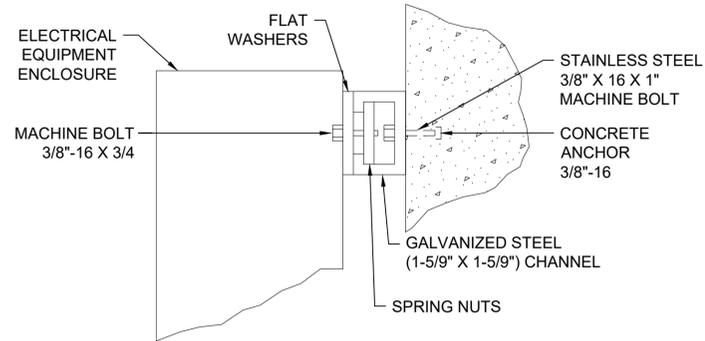
SCALE:	NTS
DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	RIDGES PUMP STATION ELECTRICAL PLAN		
PROJECT No.	C5041-1	DRAWING No.	E-7
SHEET NO. OF SHEET	7	REV.	A

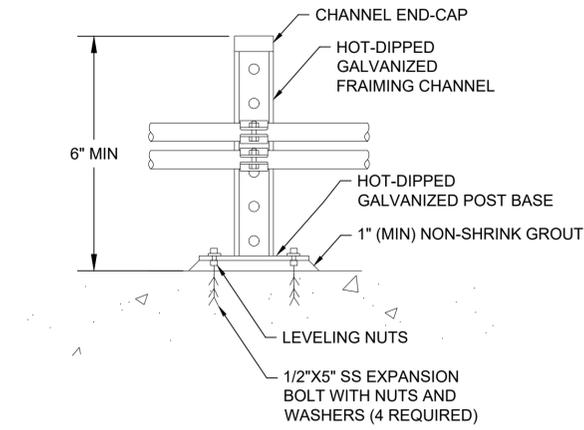


NOTES:
1. CONDUITS SHALL BE MOUNTED TO BEST SUITE FIELD CONDITIONS.

D1 CONDUIT MOUNTING DETAIL
SCALE: NTS

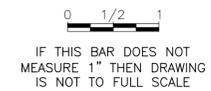


D2 ENCLOSURE MOUNTING DETAIL
SCALE: NTS



D3 CONDUIT FLOOR SUPPORT DETAIL
SCALE: NTS

DRAWING No.	DRAWING TITLE	No.	DESCRIPTION	DATE	BY
	REFERENCE DRAWING		REVISION		
		C	ISSUED FOR BID	8/2/2021	RL
		B	ISSUED FOR 100% REVIEW	6/15/2021	RL
		A	ISSUED FOR 60% REVIEW	4/23/2021	RL



ENGINEERING STAMP:

CLIENT: **CITY OF Grand Junction COLORADO**

CONSULTANT: **MAGNA ENGINEERING**

SCALE:	NTS
DRAWN BY:	RL
DESIGNED BY:	RL
APPROVED BY:	JP

LOCATION:	SHADOW LAKE	SITE:	PUMP STATION
PROJECT NAME:	MCC REPLACEMENT		
DRAWING TITLE:	ELECTRICAL DETAILS		
PROJECT No.	C5041-1	DRAWING No.	ED-1
SHEET NO. OF SHEET	8	REV.	A