

NOTES: Last day for questions is October 14 at 5:00 p.m.

Answers to questions will be provided no later than October 15 at 11:00 a.m. to vendors and posted on the City's website.

YES

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Section 1
Bid Instructions
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BIDDING AND CONTRACT GENERAL CONDITIONS

The following shall be made part of the terms and conditions of the contract (“Contract”) entered into between the City of Rockford (City) and Vendor (also referred to herein as “bidder,” “awarded vendor,” and “contractor”) if awarded the contract. Vendor’s submission of a bid or proposal constitutes acceptance of these Conditions:

1. Pricing. The bidder shall insert price for all bid items and all other information requested in these specifications. The price shall be the *full, delivered cost* to the City of Rockford with no additions.

2. Total versus "Per Item" Awards. The City generally awards contracts on a lump sum basis to the lowest responsible and responsive bidder. However, the City may choose to award on a per item basis. Therefore, each bidder must submit pricing for each item indicated on the bid forms. Bidders must clearly indicate which items are bid and which are not.

3. Delivery of Merchandise. Delivery terms will always be Freight-On-Board (FOB) Destination. The City of Rockford accepts no responsibility for the condition of any merchandise purchased prior to acceptance by City Personnel. Failure to comply with this requirement may constitute rejection of the bid.

4. Acceptance of Merchandise at Delivery. The City of Rockford reserves the right to refuse acceptance of delivered merchandise that differs substantially from the specifications in the invitation to bid or as otherwise permitted by Illinois law.

5. Prompt Payment Act. The City of Rockford intends to comply with the Local Government Prompt Payment Act (50 ILCS 505/1 *et seq.*). The awarded vendor will be paid upon submission of invoices to: City of Rockford Accounts Payable, 425 East State Street, Rockford, IL 61104.

6. W-9 Request for Taxpayer Identification Number. Prior to issuance of a purchase order, the successful bidder will be required to supply the City of Rockford with a federal W-9 Request for Taxpayer Identification Number and Certification. Failure to comply with this requirement will be considered a violation of contract terms, for which the City may bar Vendor from bidding for a period of up to three (3) years.

7. Legal Compliance. Vendor will at all times observe and comply, and will cause its subcontractors to observe and comply, with all applicable federal, state, and local laws, ordinances, rules, regulations, and executive orders, now existing or hereinafter in effect, which may in any manner affect the performance of this contract. Provisions required by law, ordinance, rules, regulations, or executive order to be inserted in this contract will be deemed inserted, whether or not they appear in it. In no event will failure to insert such required provisions prevent the enforcement of applicable law. Lack of knowledge of applicable law on the part of Vendor will in no way be cause for release of this obligation. If the City becomes aware of violation of any

laws, ordinances, rules and regulations on the part of Vendor or subcontractor, it reserves the right to reject any bid, cancel any contract, and pursue any other legal remedies deemed necessary.

Vendor must pay all required taxes and obtain all licenses, certificates, or other authorization required in connection with the performance of its obligation hereunder, and Vendor must require all subcontractors to also do so. Failure to do so may result in rejection of Vendor's bid, cancellation of an award to Vendor, or termination of this contract with Vendor.

By entering into a contract with the City, Vendor certifies that to the best of its knowledge, its principals and any subcontractor used in the performance of this contract meet City requirements and have not violated any City ordinance, code, state, federal, or local rules or regulations, and have not been subject to any debarment, suspension, or other disciplinary action by any government agency. Additionally, if at any time Vendor becomes aware of such information, it must immediately disclose it to the City.

8. Legal Requirements. This contract sets forth the entire final agreement between the City of Rockford and the bidder and shall govern the respective duties and obligations of the parties. The validity of this contract, and any disputes arising from the contract, shall be governed by the laws of the State of Illinois. Any litigation under this agreement shall be resolved in the trial courts of Winnebago County, State of Illinois. Should a provision of this contract be declared invalid by a court of competent jurisdiction, it shall not affect the validity of the remaining provisions of the contract.

9. Safety. Prevention of accidents at any project is the sole responsibility of Vendor and its subcontractors, agents, and employees. Vendor, its subcontractors, agents, and employees shall be fully and solely responsible for the safety of this project. Vendor shall retain exclusive and direct control over the acts or omissions of its subcontractors, agents and employees, and any other persons performing portions of the work and not directly employed by the awarded vendor.

10. Criminal Background Check. When necessary for the protection of citizens and/or City staff, the City may require an awarded vendor to conduct a criminal background check on all of its personnel who will have direct contact with City facilities or residents/businesses served under this contract. Personnel are defined as representatives, agents, employees, subcontractors, or anyone else who will be utilized to fulfill obligations under this contract. Criminal background checks, at a minimum, shall consist of a county level felony and misdemeanor check for each county in which the personnel resided in the last ten (10) years. The awarded vendor shall notify the City of any of its personnel who have been convicted of a felony or misdemeanor prior to commencing any work under this contract. At the City's discretion, personnel with any felony or misdemeanor convictions which raise a concern about the safety of building, property, or City staff/resident's personal security, or is otherwise job related (as determined by the City) shall not perform work under this contract. Once given notice that a background check(s) will be required, it must be completed within fourteen (14) calendar days so as to not delay work to be completed.

11. Control of the Work. With respect to Vendor's own work, the City shall not have contractual, operational, and/or supervisory control over and/or charge of the work and shall not be responsible for construction means, methods, techniques, sequences, procedures, and programs in connection with the awarded vendor's work, since these are solely the vendor's responsibility under the agreement. The City shall not be responsible for the awarded vendor's failure to carry out the work in accordance with the agreement's terms and conditions. The City shall not have control over and/or charge of acts or omissions of the awarded vendor, its subcontractors, and/or their agents or employees, or any other person performing portions of the work not directly employed by the awarded vendor. The awarded vendor shall be considered to be an "independent contractor" pursuant to Illinois law.

12. Bid Bond. When required on the cover sheet, a bid bond for not less than five (5) percent of the bid amount must accompany all bids as a guarantee that if the bid is accepted, the bidder will execute and file the proper contract. A bank cashier's check, bank draft, or certified check equal to the amount specified is acceptable in lieu of a bid bond. Bid bonds of the two lowest firms will be retained until the contract is awarded.

13. Performance and Payment Bond. When required by the specifications herein, the awarded vendor shall furnish a performance and payment bond equal to the amount of the contract, acceptable to the City, within fourteen (14) calendar days after notification of contract award. Failure to furnish the required bond within the time specified may be cause for rejection of the bid and any bid deposit may be retained by the City as liquidated damages and not as a penalty.

14. Taxes. No charge will be allowed for taxes from which the City of Rockford, Illinois is exempt. The City of Rockford, Illinois is not liable for the Illinois Retailers' Occupation Tax, the Service Occupation Tax or the Service Use Tax. The City is exempt from the Federal Excise and Transportation Tax.

15. Withdrawal of Bids. Firms may withdraw or cancel their bids at any time prior to the advertised invitation to bid opening. After the opening time, no bid shall be withdrawn or cancelled. All bids shall be firm and valid for a period of sixty (60) calendar days. If a bidder to whom a contract is awarded refuses to accept the award, the City may, at its discretion, suspend the bidder for a period of time up to three (3) years.

16. Subcontracting. The bidder shall provide information for all subcontractors and leased operators of equipment in the required Subcontractor Utilization Form. Information contained in this form must be complete and accurate, to the best of Vendor's estimating ability at the time of bid, and will be relied upon by the City in projecting Minority and Women Business Enterprise subcontractor utilization for awarded City contracts. Any changes in subcontractor utilization from that which is provided on the Subcontractor Utilization Form must be made immediately in writing by submitting a new form to the City's Equal Opportunity Compliance Officer and the City Project Manager or designee. When subcontractors are used, Vendor must pay subcontractors

for satisfactory performance no later than thirty (30) days after receipt of each payment from the City.

17. Termination of Contract. The City of Rockford reserves the right to terminate the contract in its entirety or in portions, upon written notice to Vendor for convenience, if the Rockford City Council does not appropriate sufficient funds to complete the contract, or in the event of default by Vendor. Default is defined as failure of the awarded vendor to perform any of the provisions of this contract or failure to make sufficient progress so as to endanger performance of this contract in accordance with its terms. The City's written notice of termination shall specify the effective date of termination. Vendor shall discontinue providing goods or services after such effective date, and the City shall not be liable for goods or services provided by Vendor thereafter. In the event of default, the City may purchase the product(s) and/or service(s) from other sources and hold the defaulting company responsible for any excess costs occasioned thereby. The City may require payment of liquidated damages for non-performance. Should default be due to failure to perform or because of a request for a price increase, the City reserves the right to remove the firm from the City's bidder list and place the firm on the City's debarred list for a period of up to three (3) years.

18. Late Bids and Proposals. Regardless of cause, late bids and proposals will not be accepted and will automatically be disqualified from further consideration. It shall be solely Vendor's risk to ensure delivery at the designated office by the designated time. Late bids and proposals will not be opened and may be returned to Vendor at their request and expense.

19. Equal Employment Opportunity. Vendor shall comply with all applicable equal employment opportunity statutes, regulations, and ordinances including but not limited to the City's Equal Opportunity Employment (EOE) Ordinance (City of Rockford Code of Ordinances, Chapter 11, Article IV); the Illinois Human Rights Act (775 ILCS 5/101 *et seq.*), the Illinois Department of Human Rights (IDHR) Rules and Regulations for Government Contracts (44 Ill. Admin. Code, Chapter X, Section 750), the Discrimination in Public Contracts Act (775 ILCS 10/0.01 *et seq.*), Title VII of the Civil Rights Act of 1964, as amended (§ 7, 42 U.S.C. § 2000e *et seq.*); the Age Discrimination in Employment Act of 1967, as amended (29 USC §.621 *et seq.*); Title I of the Americans with Disabilities Act of 1990, as amended (42 USC 12111-12117); the Equal Pay Act of 1963, as amended; and the Uniformed Services Employment and Reemployment Rights Act of 1994, as amended (38 USC §§ 4301-4335).

Pursuant to IDHR's Rules and Regulations and the City's EOE Ordinance, the awarded vendor shall comply with the following terms and conditions during the performance of this contract:

- a) Vendor will not discriminate against any employee, including apprentices, or applicant for employment, including training programs, because of race, color religion, sex, sexual orientation, gender identity, marital status, order of protection status, status as a survivor of domestic violence or human trafficking, national origin or ancestry, citizenship status, age, physical or mental disability unrelated to ability, military status, or unfavorable discharge from military service; and, further, that Vendor will examine all job

classifications to determine if minority persons or women are underutilized and will take appropriate affirmative action to rectify any underutilization.

- b) If Vendor hires additional employees in order to perform this contract or any portion of this contract, Vendor will determine the availability (in accordance with Section 750) of minorities and women in the areas from which Vendor may reasonably recruit and will hire for each job classification for which employees are hired in a way that minorities and women are not underutilized.
- c) In all solicitations and advertisements for employees placed by Vendor on its behalf, Vendor will state that all applicants will be afforded equal opportunity without discrimination because of race, color, religion, sex, sexual orientation, gender identity, marital status, order of protection status, status as a survivor of domestic violence or human trafficking, national origin or ancestry, citizenship status, age, physical or mental disability unrelated to ability, military status, or an unfavorable discharge from military service.
- d) Vendor will send to each labor organization or representative of workers with which it has or is bound by a collective bargaining or other agreement or understanding, a notice advising the labor organization or representative of the Vendor's obligations under the Illinois Human Rights Act and Section 750 of the Illinois Department of Human Rights Rules and Regulations. If any labor organization or representative fails or refuses to cooperate with the Vendor in its efforts to comply with the Act and Part 750, Vendor will promptly notify the Illinois Department of Human Rights and the City of Rockford and will recruit employees from other sources when necessary to fulfill its obligations under the contract.
- e) Vendor will submit reports as required by Part 750, furnish all relevant information that may be requested by the Illinois Department of Human Rights or the City of Rockford, and in all respects comply with the Act, the Department's Rules and Regulations, and the City of Rockford's Equal Opportunity Employment Ordinance. *Vendor's failure to complete the City's required Equal Employment Opportunity Certifications or Vendor and Subcontractor Workforce Data Forms will result in disqualification of Vendor's bid or proposal.*
- f) Vendor will permit access to all relevant books, records, accounts, and work sites by personnel of the City of Rockford and the Illinois Department of Human Rights for purposes of investigation to ascertain compliance with the Act, IDHR's Rules and Regulations, and City of Rockford EOE Ordinance.
- g) Vendor will include verbatim or by reference the Equal Employment Opportunity Clause (44 Ill. Admin. Code, Chapter X, Appendix A) in every subcontract awarded under which any portion of the contract obligations are undertaken or assumed, so that the provisions will be binding upon the subcontractor. In the same manner as with other provisions of this contract, Vendor will be liable for compliance with applicable provisions of this clause by subcontractors. Further, Vendor will promptly notify the City of Rockford and

the Illinois Department of Human Rights if any subcontractor fails or refuses to comply with the provisions of sections (a) through (f) of this paragraph. Vendor shall not utilize any subcontractor declared by the Illinois Human Rights Commission to be ineligible for contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations.

20. Restrictive or Ambiguous Specifications. It is the responsibility of the bidding firm to review the invitation to bid specifications and to notify the Central Services Manager if the specifications are formulated in a manner that would unnecessarily restrict competition. Any such protest or question regarding the specifications or invitation to bid procedures must be received by the Central Services Division not less than seventy-two hours prior to the time set for the opening. In the event a contract term is not defined within the contract document, the term will be given its ordinary dictionary definition.

21. Bid Protest. Firms wishing to protest bids or awards shall notify the Central Services Manager in writing within seven (7) days after the invitation to bid opening. The notification should include the bid number, the name of the firm protesting, and the reason why the firm is protesting the bid. The Central Services Manager will respond to the protest within seven (7) calendar days. A successful protest may result in the reversal of a previously awarded contract.

22. Disputes. In case of disputes as to whether or not an item or service quoted or delivered meets specifications, the decision of the Central Services Manager or authorized representative shall be final and binding to all parties. The Central Services Manager has the right to waive technicalities as they see fit. The Central Services Manager may request a written recommendation from the head of the department using the equipment or service being procured.

23. Exceptions. Any deviations from these specifications shall be noted and submitted with the bid. Failure to address deviations from specifications may result in bid rejection.

24. Acceptance/Rejection of Bids. The City of Rockford reserves the right to accept or reject any or all bids or proposals at any time, for any reason, including but not limited to the Rockford City Council not appropriating sufficient funds to purchase equipment or complete the contract. The City may make awards in any manner deemed in the best interest of the City.

25. Prevailing Wage. When indicated on the cover page of the invitation to bid, this contract calls for the construction of a "public work," within the meaning of the Illinois Prevailing Wage Act, 820 ILCS 130/.01 *et seq.* ("the Act"). The Act requires awarded vendors and subcontractors to pay laborers, workers, and mechanics performing services on public works projects no less than the "prevailing rate of wages" (hourly cash wages plus fringe benefits) in the county where the work is performed. Prevailing wage rates are determined by the Illinois Department of Labor and posted on the Department's website at:

<https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Rates.aspx> .

- (a) The Act *does* apply to owner-operators.
- (b) When applicable, all awarded vendors and subcontractors rendering services under this contract must comply with all requirements of the Act, including but not limited to all wage, notice, recordkeeping, and filing of certified payroll requirements.
- (c) Under the Act, it is mandatory upon Vendor to insert into each subcontract a written stipulation to the effect that not less than the prevailing rate of wages shall be paid to all laborers, workers and mechanics performing work under this contract. It is also the Vendor's responsibility under the Act to verify and pay *current* wage rates, as the Department may change them from time to time.
- (d) It is Vendor's obligation to understand what the Act requires, and to comply accordingly. *Failure on the part of the City to provide proper written notice regarding the applicability of the Prevailing Wage Act does not relieve Vendor or subcontractors of the obligation to comply with the Act when applicable, nor does it relieve them of their obligation to pay back wages when owed.*
- (e) Vendor and all subcontractors shall make all records required under the Prevailing Wage Act available for inspection, copying, or transcription by authorized representatives of the City of Rockford or Department of Labor. Vendor shall further permit such representatives to interview employees during working hours on the job. If Vendor or subcontractor fails to submit the required records or make them available, the City may take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request may be grounds for debarment action.

26. Certified Payroll. The Illinois Prevailing Wage Act requires any contractor and each subcontractor who participates in public works to file with the Illinois Department of Labor (IDOL) certified payroll for those calendar months during which work on a public works project has occurred. The Act requires certified payroll to be filed with IDOL no later than the 15th day of each calendar month for the immediately preceding month through the Illinois Prevailing Wage Portal—an electronic database IDOL has established for collecting and retaining certified payroll. The Portal may be accessed using this link: <https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx>. The City reserves the right to withhold payment due to Vendor until Vendor and its subcontractors display compliance with this provision of the Act.

27. Substance Abuse Prevention. Before Vendor commences work on a public works project, it must have in place a written program which meets or exceeds the program requirements in the Substance Abuse Prevention on Public Works Projects Act (820 ILCS 265/1 et seq.), to be filed with the City and made available to the general public, for prevention of substance abuse among its employees. This program must include pre-hire, random, reasonable suspicion, and post-

accident drug and alcohol testing, as required by the Substance Abuse Prevention on Public Works Projects Act.

28. Apprenticeship Requirement. For construction contracts over \$50,000, Vendor must participate in apprenticeship and training programs approved and registered with the United States Department of Labor's Bureau of Apprenticeship and Training for all Trades that will be in Vendor's (or his subcontractor's) employment, with each worker receiving the required apprenticeship/training appropriate to his trade. Owners or work performed by owners is not exempt from the apprenticeship and training requirement.

29. Indemnification. To the fullest extent permitted by law, Vendor shall indemnify and hold harmless the City, its officers, representatives, elected and appointed officials, agents, and employees from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from Vendor's performance of work under this agreement, and indemnifies and agrees to defend and hold harmless the City against any and all losses, claims, damages, and expenses arising from the work performed hereunder of the erection, construction, placement, or operation of any scaffold, hoist, crane, stay, ladder, support, or other mechanical contrivance in connection with such work including but not limited to losses, claims, damages, and expenses arising pursuant to claims asserted against the City pursuant to theories premised upon sections 343 and 414 of the Restatement (Second) of Torts.

This indemnification agreement shall not be limited in any way by any limitations on the amount or type of damages, compensation, or benefits payable by or for Vendor under the Illinois Workers' Compensation Act (820 ILCS 305/1 *et seq.*), disability benefit acts, or other employee benefit acts, and serves as an express agreement to waive the protection of *Kotecki v. Cyclops Welding Corp.*, 146 Ill.2d 155, 585 N.E.2d 1023 (1991) in Illinois.

Further, Vendor agrees that it is solely responsible for compliance with all safety laws applicable to the work performed hereunder, including but not limited to the Occupational Safety and Health Act (29 USC Ch. 15 §651 *et seq.*) and the Contract Work Hours and Safety Standards Act (40 USC Ch. 37 §3701 *et seq.*) and all standards and regulations which have been or shall be promulgated by the agencies which administer the Acts.

Under no circumstances shall Vendor, its subcontractors, agents, and employees be required to indemnify the City for its own negligence.

30. Insurance Requirements. Upon execution of the contract, and prior to Vendor commencing any work or services with regard to the project, Vendor shall carry commercial general liability insurance, umbrella liability insurance, and automobile liability insurance on ISO form CG 00 01 10 01 (or a substitute form providing equivalent coverage) and Vendor shall provide the City with a Certificate of Insurance and Additional Insured Endorsement on ISO form CG 20 10 11 85 (or substitute form providing equivalent coverage) or on the combination of ISO forms CG 20 IO 10 01 and CG 20 3 7 1001 (or substitute forms providing equivalent coverage) naming the City as

Additional Insured thereunder. Additional insured coverage shall apply as primary insurance and be noncontributory with respect to any other insurance afforded to the City. All coverage shall be placed with an insurance company duly admitted in the State of Illinois and shall be reasonably acceptable to the City. All awarded vendor insurance carriers must maintain an A.M. Best rating of "A-" or better. Coverage shall be afforded to the additional insured whether or not a claim is in litigation.

The insurance coverage required above shall be of sufficient type, scope and duration to ensure coverage for the City for liability related to any manifestation date within the applicable statutes of limitation and/or repose which pertain to any work performed by or on behalf of the City in relation to the contract. The following insurance requirement shall apply to the successful firm for the duration of the contract unless explicitly waived by the Central Services Manager:

- a) Commercial General Liability. The coverage available to the City, as Additional Insured, shall not be less than \$1 million each occurrence, \$2 million general aggregate (subject to a per project general aggregate provision applicable to the project), \$2 million products/completed operations aggregate and \$1 million personal and advertising injury limits. Such insurance shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).
- b) Umbrella Liability. The coverage available to the City, as Additional Insured, shall not be less than \$2 million each occurrence, \$2 million general aggregate. Such insurance shall cover liability arising from premises, operations, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract (including the tort liability of another assumed in a business contract).
- c) Automobile Coverage. The coverage available to the City, as Additional Insured, shall include comprehensive automobile bodily injury and property damage liability coverage for a minimum amount of \$1 million each occurrence, \$2 million general aggregate
- d) Workers Compensation. Vendor shall maintain during the life of this contract statutory workmen's compensation and employer's liability insurance for all his employees engaged in work on the job site.
- e) Insurance Certificates. Each Certificate of insurance shall provide that the insurer must give the City at least thirty (30) days' prior written notice of cancellation and termination of the City's coverage thereunder. Not less than two weeks prior to the expiration, cancellation or termination of any such policy, Vendor shall supply the City with a new and replacement Certificate of Insurance and Additional Insured endorsement as proof of renewal of said original policy. Said new and replacement endorsements shall be similarly endorsed in favor of the City as set forth above. All subcontractors to be utilized by Vendor shall provide Ownership with a Certificate of Insurance naming City of Rockford as additional insured prior to commencement of work by said subcontractor.

31. Conflict of Interest. Each bidder affirms, by submission of a response to this bid or request for proposals, it has no interest and will not acquire any interest in any enterprise, project, or contract that would conflict in any manner of degree with the performance of the work, services, or goods to be provided hereunder. Bidder further affirms that no person having such an interest will be employed to perform any work or services under the contract, and that no employee of the City of Rockford is directly or indirectly interested in the bid or proposal for any reason of personal gain.

32. Non-Waiver. The failure by the City to require performance of any provision shall not affect the City's right to require performance at any time thereafter, nor shall a waiver of any breach or default of this contract constitute a waiver of any subsequent breach or default or a waiver of the provision itself.

33. Professional Services Selection Act. The City of Rockford intends to comply with 50 ILCS 510/0.01 *et seq.* governing the selection of professional services. Any reference in these terms and conditions to supplying pricing or price as a determining factor in selection do not apply for services covered by said act.

34. Compliance with Stormwater Management Ordinance and Environmental Consent Decree. Vendor must comply with the City's Stormwater Management Ordinance. For work performed on the stormwater system, including projects only requiring erosion and sediment control measures, acknowledgement of receipt of the USEPA issued Environmental Consent Decree is required. It is also required that Vendor retain all invoices, work orders and/or other records of work performed in drainage areas for three (3) years beyond the end of the consent decree, estimated to be 12/31/2022. These records are subject to audit and are to be made available immediately upon request by the City or the Federal and State Environmental Protection Agency (EPA). Additionally, there may be other records provided that Vendor will be required to keep on file upon request of the City. Violation of this section and with the City's Stormwater Management Ordinance may result in a fine. Additional information can be found at <https://rockfordil.gov/city-departments/public-works/engineering-division/stormwater-environmental-team/stormwater-consent-decree/>.

35. Acceptance or Rejection of Bids and Proposals. The City of Rockford reserves the right to accept or reject any and all proposals and to waive technicalities in submitted bids.

36. Minority and Women Business Enterprise Policy. It is the policy of the City of Rockford to strongly encourage and promote the award of subcontracts to ready, willing, and able Minority and Women Business Enterprises (MWBEs) certified with the City. The City strongly encourages bidders, when preparing bids or proposals, to contact certified MWBEs regarding potential subcontracting opportunities. The City requires information regarding Vendor's good faith efforts to identify MWBE subcontractors on the Subcontractor Utilization Form required to be completed and submitted with Vendor's bid or proposal. An up-to-date list of the City's certified MWBEs can be found at:

<https://rockfordil.gov/city-departments/finance/central-services/purchasing/>.

37. Veterans Preference. Vendor shall comply with the Veterans Preference Act (330 ILCS 55/1 *et seq.*) in its employment to fill positions for the construction, addition to, or alteration of public works contracted for by the City. This Act requires that preference shall be given to veterans who possess the business capacity necessary for the proper discharge of the duties of employment. Vendor is not required to give preference to veterans who are not residents of the City of Rockford over City residents who are not veterans. A person who has been a member of the Illinois National Guard shall be given priority over a person who has been a member of the National Guard of any other state.

Veterans under the Act are defined as persons who have been members of the armed forces of the United States or who, while citizens of the United States, were members of the armed forces of allies of the United States in time of hostilities with a foreign country, and have served under one or more of the following conditions:

- a) The veteran served a total of at least six (6) months;
- b) The veteran served for the duration of hostilities regardless of the length of engagement;
- c) The veteran served in the theater of operations but was discharged on the basis of a hardship; or
- d) The veteran was released from active duty because of a service connected disability and was honorably discharged.

Vendor shall insure that the preceding provision is inserted in all subcontracts entered into to furnish labor for the construction, addition to, or alteration of public works in connection with this contract.

38. Non-barred Bidder. Vendors affirms, by submission of a response to this bid or request for proposals, that Vendor is not barred from bidding on this contract as a result of a conviction for violation of state law prohibiting bid rigging or rotating.

39. City Debarment. The City of Rockford reserves the right to bar Vendor from future bidding opportunities with the City if false information is submitted as part Vendor's bid response or proposal, Vendor has committed any violation of law, or Vendor fails to comply with the terms and conditions of this contract.

40. Non-Assignment. Neither this Contract nor any of the rights, interests or obligations under the Agreement shall be assigned, in whole or in part, by written agreement, merger, consolidation, operation of law, or otherwise by either party without the prior written consent of the other party.

41. Governing Law. This Contract shall be governed by and construed and enforced in accordance with the laws of the State of Illinois, excluding its choice of law rules and, to the extent

applicable, the copyright laws of the United States of America. In the event of a dispute under this Contract, the parties agree to submit to the exclusive jurisdiction of the state courts of, and federal courts sitting in, the State of Illinois.

42. Severability. In the event that any clause, provision, or portion of these General Conditions or any part thereof shall be declared invalid, void, or unenforceable by any court having jurisdiction, such invalidity shall not affect the validity or enforceability of the remaining portions.

Instruction to Bidders

1. The bidder shall insert the price for all bid items and all other information requested in the Bid Form attached or a computer generated schedule of prices. All computer-generated schedule of prices submitted must be correct and correspond to the latest schedule of prices issued by the City of Rockford or the bid may be rejected. All prices shall be net and shall be the full, delivered cost to the City of Rockford, including all factors whatsoever. Failure to comply with this requirement will constitute rejection of bid.

2. The City requires the improvements specified to be completed under the following guidelines:

3. Bidders bidding on any City of Rockford construction projects for CIP (Capital Improvement Projects) must be pre-qualified with the State of Illinois according to Section 102 of the Standard Specifications for Road and Bridge construction of the Illinois Department of Transportation. An "Affidavit of Availability" issued by the Department of Transportation must accompany each sealed bid.

The bidder, prior to receiving an award, must submit a certified copy of a "Certificate of Eligibility" issued by the Department of Transportation and an "Affidavit of Availability"

4. It shall be mandatory that the awarded vendor and subcontractors comply with the Illinois Preference Act (IL Rev. Stat., Ch. 48, Par. 2201-2207) requires that on Illinois-resident workers be employed on Public Works Projects in times of excessive unemployment.

5. The bidder receiving award of this contract by the Rockford City Council shall submit the following information and be issued a notice to proceed prior to start of work:

a. Construction schedule including starting date, project phasing controlling factors; and, estimated payment schedule (in Microsoft Projects format, one hard copy and one digital copy);

b. Material suppliers including plant locations and State certification.

c. A final, accurate Subcontractor Utilization Form and Subcontractor Workforce Data Forms for each subcontractor to be used. If the subcontractor fails to submit all required EEO compliance forms to Vendor or if the subcontractor is found to be in noncompliance, the City of Rockford may require that the subcontractor in question not be utilized on the project. The City of Rockford also reserves the right to take whatever action necessary to meet all EEO requirements.

6. Bidders are only required to return to the City the forms listed in the Required Forms section of the bid document, along with any special information that may be requested of firms as part of the general or special provisions. Sections 1, 3, and 4 of the bid document need not be returned to the City.

7. Bidder Questions during Bidding.

All questions regarding the bidder's preparation of this bid, pertaining to the drawings and specifications, shall be compiled in writing and e-mailed to Xavier Whitford, (xavier.whitford@rockfordil.gov) City of Rockford, Finance Department, at least 72 hours prior to bid time.

Questions received less than 72 hours before the designated bid time cannot be answered by addendum.

Oral statements will not be binding to City of Rockford or Vendor.

Any questions deemed by City as requiring a response will be answered by addendum issued to all bidders and will become a part of the Contract.

Subcontractors must direct their questions through Vendor only.

The consulting Architect and/or the consulting Engineer shall not be contacted direct without prior authorization from City.

8. These instructions are to be considered an integral part of any proposal.

9. Questions regarding EEOs should be addressed to: City of Rockford Equal Opportunity Compliance (EOC) Officer, at (779) 348-7392.

10. Questions regarding Bid/RFP specs should be addressed to analyst listed in specs section.

FINANCE AND PERSONNEL COMMITTEE
Xavier Whitford
Central Services Manager

Section 2

Required Forms

City of Rockford
EQUAL EMPLOYMENT OPPORTUNITY CERTIFICATION

All bidders seeking to do business with the City of Rockford must complete this certification. **Failure to sign this Certification will result in disqualification of Vendor's bid or proposal.** Questions regarding EEOs should be addressed to: City of Rockford Equal Opportunity Compliance (EOC) Officer, at (779) 348-7392.

1. **Compliance with EEO Law.** Vendor acknowledges and certifies that, if awarded a contract with the City of Rockford, it is subject to and will comply with all applicable equal employment opportunity statutes, regulations, and ordinances including but not limited to: the City's Equal Opportunity Employment (EOE) Ordinance (City of Rockford Code of Ordinances, Chapter 11, Article IV); the Illinois Human Rights Act (775 ILCS 5/101 *et seq.*), the Illinois Department of Human Rights Rules and Regulations for Government Contracts (44 Ill. Admin. Code, Chapter X, Section 750), and the Discrimination in Public Contracts Act (775 ILCS 10/0.01 *et seq.*), Title VII of the Civil Rights Act of 1964, as amended (§ 7, 42 U.S.C. § 2000e *et seq.*); the Age Discrimination in Employment Act of 1967, as amended (29 USC §.621 *et seq.*); Title I of the Americans with Disabilities Act of 1990, as amended (42 USC 12111-12117); the Equal Pay Act of 1963, as amended; the Uniformed Services Employment and Reemployment Rights Act of 1994, as amended (38 USC §§ 4301-4335); and, for federally-funded construction contracts (only), Executive Order 11246, as amended, and relevant U.S. Department of Labor regulations regarding equal employment opportunity for federally assisted construction contracts (see 41 CFR Part 60).
2. **Discrimination Prohibited.** Vendor certifies that it is its policy to provide equal employment opportunity and that it prohibits discrimination against any employee or applicant for employment due to race, color religion, sex, sexual orientation, gender identity, marital status, order of protection status, status as a survivor of domestic violence or human trafficking, national origin or ancestry, citizenship status, age, physical or mental disability unrelated to ability, military status, or unfavorable discharge from military service. Further, Vendor will examine all job classifications to determine if minority persons or women are underutilized and will take appropriate affirmative action to rectify any underutilization, as is required by the Illinois Department of Human Rights Rules and Regulations for Government Contracts.
3. **Non-Segregated Facilities.** Vendor certifies that it provides facilities at its place of business without segregation except where separate facilities for a person of the opposite sex are required. Vendor also certifies that it will, to the greatest extent possible, not assign employees to work at any location where facilities are so segregated and that it will insert into its subcontracts the provisions of this paragraph for work performed under this contract and obtain the same certification from subcontractors.
4. **Government Exclusion, Debarment, or Suspension.** Vendor certifies that it is not subject to any exclusion, debarment, suspension, or other disciplinary action by any government agency including but not limited to the U.S. Government, State of Illinois, Illinois Human Rights Commission, Illinois Department of Labor, or any other federal or state agency or political subdivision. Additionally, if at any time Vendor is subject to such exclusion, suspension, or debarment during the contract period, Vendor certifies that it will immediately disclose this information to the City's EOC Officer.

City of Rockford
EQUAL EMPLOYMENT OPPORTUNITY CERTIFICATION

5. **Subcontracting.** Vendor certifies that, if awarded a public contract with the City of Rockford, it will include verbatim or by reference the provisions of the City’s General Conditions *Equal Employment Opportunity* paragraph 19 in every subcontract awarded under which any portion of the contract obligations are undertaken or assumed. For federally funded construction contracts, the conditions described in paragraph (8) of the “Equal Opportunity Clause for Federally Assisted Construction Contracts” and paragraph (2) of the “Standard Federal Equal Employment Opportunity Construction Contract Specifications” must also be included in every subcontract. Vendor acknowledges that it is responsible for the compliance of all of its subcontractors with this provision. Vendor also certifies it will not utilize any subcontractor excluded, debarred, suspended, or otherwise disciplined by any government agency including but not limited to the U.S. Government, State of Illinois, Illinois Human Rights Commission, Illinois Department of Labor, or any other federal or state agency or political subdivision, and that it will notify the City’s EOC Officer if any subcontractor fails to comply with such provision.
6. **MWBE Procurement Policy.** Vendor understands that it is the policy of the City of Rockford to encourage and promote the award of subcontracts to ready, willing, and able Minority and Women Business Enterprises (MWBEs) certified with the City. The City strongly encourages bidders, when preparing bids or proposals, to contact certified MWBEs regarding potential subcontracting opportunities. Vendor certifies that it has worked in good faith to comply with this policy by contacting MWBE businesses for subcontracting opportunities when possible (list can be found at <https://rockfordil.gov/city-departments/finance/central-services/purchasing/>). For federally funded construction projects (only), Vendor further certifies it has demonstrated good faith efforts to meet the women and minority subcontracting goals set forth in the “Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity.”

Signature of Vendor

Date

**City of Rockford
SUBCONTRACTOR UTILIZATION FORM**

**THIS FORM MUST BE COMPLETED EVEN IF YOU DO NOT PLAN TO USE
SUBCONTRACTORS
(COMPLETE SECTIONS I, II, AND V IF YOU DO NOT PLAN TO USE SUBCONTRACTORS).**

All Vendors seeking to do business with the City of Rockford must provide information about all subcontractors that will be used. **A Subcontractor is any person or business that supplies any of the work, transportation or labor services, supplies, equipment, or materials under a contract with Vendor.** Failure to complete this form will result in disqualification of Vendor's bid or proposal. Questions regarding EEOs should be addressed to City of Rockford Equal Opportunity Compliance (EOC) Officer, at (779) 348-7392.

Section I—Vendor/Prime Contractor Information

Is this an update to a previously submitted Subcontractor Utilization Form? Yes No

| | | | |
|---|------------------------------|---------------------------|------|
| Vendor Name: | | | |
| Project Name: | | Bid or RFP Number: | |
| Total Proposal/Bid Amount (over the full term of the contract): | | | |
| Vendor Contact Name: | | Contact Phone: | |
| | | Contact Email: | |
| Vendor Certification Status: | Minority Business Enterprise | Women Business Enterprise | None |

Section II--Subcontractor Utilization

Will subcontractors be used? Yes (complete rest of form) No (proceed to Section V)

Section III—Subcontractor Selection

Please list information for ALL subcontractors Vendor *believes it will* use. Vendor may make changes or additions to its list of subcontractors by submitting an updated form to the City's EOC Officer after award, if needed.

| Subcontractor Name | MBE or WBE? (Y/N) | Amount | % of Total Proposal/Bid | Scope of Work |
|--------------------|-------------------|--------|-------------------------|---------------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

If more than six subcontractors will be used, please complete the [Subcontractor Utilization Form--Supplement](#).

**City of Rockford
SUBCONTRACTOR UTILIZATION FORM**

If Vendor plans to use subcontractors, but has not yet identified some or all of the subcontractors to be used, please explain why:

Section IV—MWBE Subcontractors Contacted

It is the policy of the City of Rockford to encourage and promote the award of subcontracts to qualified and available Minority and Women Business Enterprises (MWBEs) certified with the City. The City strongly encourages bidders, when preparing bids or proposals, to contact certified MWBEs regarding potential subcontracting opportunities (a list of MWBEs can be found at <https://rockfordil.gov/city-departments/finance/central-services/purchasing/>). Please list the MWBEs Vendor has contacted regarding subcontractor opportunities for this proposal/bid (MWBE subcontractors selected and listed in Section III do not need to be listed again here):

| MWBE Business Name | Method of Contact (e.g. phone, email) | Why not used? |
|--------------------|--|---------------|
| | | |
| | | |
| | | |
| | | |

Section V—Signature

The undersigned certifies that the information provided herein is truthful, accurate, and complete. Further, Vendor acknowledges that if it is awarded the contract, this information must be kept up to date by Vendor. According to the City’s General Conditions Paragraph 16, **any changes in subcontractor utilization must be immediately made in writing** by submitting a new form to the City’s Equal Opportunity Compliance Officer (contact information provided at the top of this form). A complete and accurate list of subcontractors will be required prior to beginning work on the project, if awarded.

Signature **Date**

Name **Title**

City of Rockford
VENDOR WORKFORCE DATA FORM

The City must collect information in an effort to monitor Vendor’s compliance with the Illinois Human Rights Act, Illinois Department of Human Rights Rules and Regulations, and City of Rockford Equal Employment Opportunity Ordinance. **Failure to complete this form will result in disqualification of Vendor’s bid or proposal.** Questions regarding EEOs should be addressed to: City of Rockford Equal Opportunity Compliance (EOC) Officer, at (779) 348-7392

Part I: Vendor Information

| | |
|----------------------------|-----------------------------|
| Vendor Name: | Bid or RFP Number: |
| Project Name: | IDHR Number ¹ : |
| | Expiration: |
| Date: | Estimated Duration of Work: |
| Vendor’s EEO Contact Name: | Contact Email: |
| Title: | Contact Phone: |

Part II: Vendor Workforce Data

Please provide the *number* of individuals employed by Vendor in each category below (report all employees, not just those who will work under the contract). Definitions of the EEO Job Categories are included with this form.

W - White B - Black H – Hispanic/Latino A - Asian AI - American Indian, Alaskan or Hawaiian Native
Tw—Two or more race/ethnicity T – Total

| JOB CATEGORY | MALE | | | | | | | FEMALE | | | | | | | TOTAL |
|--------------------------------|------|---|---|---|----|----|---|--------|---|---|---|----|----|---|-------|
| | W | B | H | A | AI | Tw | T | W | B | H | A | AI | Tw | T | |
| Officials and Managers | | | | | | | | | | | | | | | |
| Professional Workers | | | | | | | | | | | | | | | |
| Technicians | | | | | | | | | | | | | | | |
| Sales Workers | | | | | | | | | | | | | | | |
| Administrative Support Workers | | | | | | | | | | | | | | | |
| Craft Workers | | | | | | | | | | | | | | | |
| Operatives | | | | | | | | | | | | | | | |
| Laborers and Helpers | | | | | | | | | | | | | | | |
| Service Workers | | | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | | | |

¹ Bidders must have an Illinois Department of Human Rights Eligibility Number if 1) bidder employs 15 or more persons, AND 2) if the bid or proposal will total more than \$100,000.

City of Rockford
SUBCONTRACTOR WORKFORCE DATA FORM

This form is *required* if Vendor will be using one or more subcontractors to complete work or perform services for the City. A Workforce Data Form must be completed for *each* subcontractor. Questions regarding EEOs should be addressed to City of Rockford Equal Opportunity Compliance (EOC) Officer, at (779) 348-7392

Part I: Identification

| | |
|-----------------------------------|----------------------------------|
| Subcontractor Name: | Bid Number: |
| Project Name: | IDHR Number: Expiration: |
| Date: | Estimated Duration of Work: |
| Subcontractor's EEO Contact Name: | Contact Email: Contact Phone: |

Part II: Subcontractor Workforce Data

Please provide the *number* of individuals employed by subcontractor in each category below (report all employees, not just those who will work under the contract). Definitions of the EEO Job Categories are included on the next page of this form.

W - White B - Black H – Hispanic/Latino A - Asian AI - American Indian, Alaskan or Hawaiian Native
Tw—Two or more race/ethnicity T – Total

| JOB CATEGORY | MALE | | | | | | | FEMALE | | | | | | | TOTAL |
|--------------------------------|------|---|---|---|----|----|---|--------|---|---|---|----|----|---|-------|
| | W | B | H | A | AI | Tw | T | W | B | H | A | AI | Tw | T | |
| Officials and Managers | | | | | | | | | | | | | | | |
| Professional Workers | | | | | | | | | | | | | | | |
| Technicians | | | | | | | | | | | | | | | |
| Sales Workers | | | | | | | | | | | | | | | |
| Administrative Support Workers | | | | | | | | | | | | | | | |
| Craft Workers | | | | | | | | | | | | | | | |
| Operatives | | | | | | | | | | | | | | | |
| Laborers and Helpers | | | | | | | | | | | | | | | |
| Service Workers | | | | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | | | |

Job Category Descriptions

Officials and Managers: Jobs occupied by administrative and managerial personnel who set broad policies, exercise overall responsibility for execution of these policies, and direct individual departments or special phases of a firm's operations. Includes: officials, executives, middle management, plant managers, department managers, superintendents, salaried supervisors who are members of management, and purchasing agents and buyers.

Professionals: Jobs requiring bachelor or graduate degree and/or professional certification or comparable experience. Includes: accountants and auditors, architects, chemists, computer programmers, designers, editors, engineers, lawyers, scientists, registered professional nurses, personnel and labor relations specialists, physicians, and surveyors.

Technicians: Jobs requiring a combination of basic scientific knowledge and manual skill which is often obtained through 2 years of post-high school education or through equivalent on-the-job training. Includes: drafters, surveying and mapping technicians, engineering aides, junior engineers, mathematical aides, emergency medical technicians, and licensed practical nurses.

Sales Workers: Jobs engaging wholly or primarily in direct selling. Includes: advertising agents and sales workers, insurance agents and brokers, real estate agents and brokers, stock and bond sales workers, securities, commodities, and financial services sales agents, demonstrators, sales workers and sales clerks, grocery clerks, and cashiers/checkers.

Administrative Support Workers: Jobs involving non-managerial tasks providing administrative and support assistance, primarily in office settings. Includes: office support, bookkeepers, accounting and auditing clerks, dispatchers, data entry workers, collectors (bills and accounts), messengers and office helpers, shipping and receiving clerks, typists and secretaries, telephone operators, and legal assistants.

Craft Workers: Jobs requiring higher skill in areas including: construction (building trades craft workers and their formal apprentices); natural resource extraction workers; installation, maintenance and part replacement of equipment, machines and tools; and some production occupations that are distinguished by the high degree of skill and precision. Includes: boilermakers; brick & stone masons; carpenters; electricians; painters; glaziers; plumbers, pipefitters & steam fitters; roofers; elevator installers; earth drillers; oil & gas rotary drill operators; blasters & explosive workers; mechanics; electric & electronic equipment repairers; millwrights; and tool & die makers.

Operatives: Jobs involving operation of machines, factory-related processing equipment, or equipment to facilitate the movement of people or materials. These occupations require intermediate skill level and usually do not require more than several months of training. Includes: machine operators; electrical & electronic equipment assemblers; semiconductor processors; testers; graders & sorters; bridge & lock tenders; truck, bus or taxi drivers; industrial truck & tractor (forklift) operators; conveyor operations; and hand packers & packagers.

Laborers and Helpers: Jobs requiring limited skills and brief training to perform tasks that require little or no independent judgment. Includes: production & construction worker helpers; construction laborers; refuse & recyclable materials collectors; landscapers, grounds maintenance workers, and laborers performing lifting, digging, mixing, loading and pulling operations.

Service Workers: Jobs in food service, personal service, cleaning service, and protective service occupations. Skill may be acquired through formal training, job-related training or direct experience. Includes: food service workers; medical assistants and other healthcare support occupations; transportation attendants; cleaners; janitors; porters; transit and railroad; police and fire fighters; guards; private detectives and investigators.



**Apprenticeship or Training
Program Certification**

Return with Bid

Route _____
County _____
Local Agency _____
Section _____

All contractors are required to complete the following certification:

- For this contract proposal or for all groups in this deliver and install proposal.
- For the following deliver and install groups in this material proposal:

Illinois Department of Transportation policy, adopted in accordance with the provisions of the Illinois Highway Code, requires this contract to be awarded to the lowest responsive and responsible bidder. The award decision is subject to approval by the Department. In addition to all other responsibility factors, this contract or deliver and install proposal requires all bidders and all bidders' subcontractors to disclose participation in apprenticeship or training programs that are (1) approved by and registered with the United States Department of Labor's Bureau of Apprenticeship and Training, and (2) applicable to the work of the above indicated proposals or groups. Therefore, all bidders are required to complete the following certification:

- I. Except as provided in paragraph IV below, the undersigned bidder certifies that it is a participant, either as an individual or as part of a group program, in an approved apprenticeship or training program applicable to each type of work or craft that the bidder will perform with its own employees.
- II. The undersigned bidder further certifies for work to be performed by subcontract that each of its subcontractors submitted for approval either (A) is, at the time of such bid, participating in an approved, applicable apprenticeship or training program; or (B) will, prior to commencement of performance of work pursuant to this contract, establish participation in an approved apprenticeship or training program applicable to the work of the subcontract.
- III. The undersigned bidder, by inclusion in the list in the space below, certifies the official name of each program sponsor holding the Certificate of Registration for all of the types of work or crafts in which the bidder is a participant and that will be performed with the bidder's employees. Types of work or craft that will be subcontracted shall be included and listed as subcontract work. The list shall also indicate any type of work or craft job category for which there is no applicable apprenticeship or training program available.

IV. Except for any work identified above, any bidder or subcontractor that shall perform all or part of the work of the contract or deliver and install proposal solely by individual owners, partners or members and not by employees to whom the payment of prevailing rates of wages would be required, check the following box, and identify the owner/operator workforce and positions of ownership.

The requirements of this certification and disclosure are a material part of the contract, and the contractor shall require this certification provision to be included in all approved subcontracts. The bidder is responsible for making a complete report and shall make certain that each type of work or craft job category that will be utilized on the project is accounted for and listed. The Department at any time before or after award may require the production of a copy of each applicable Certificate of Registration issued by the United States Department of Labor evidencing such participation by the contractor and any or all of its subcontractors. In order to fulfill the participation requirement, it shall not be necessary that any applicable program sponsor be currently taking or that it will take applications for apprenticeship, training or employment during the performance of the work of this contract or deliver and install proposal.

Bidder: _____

By: _____

(Signature)

Address: _____

Title: _____

Route _____
 County _____
 Local Agency _____
 Section _____

RETURN WITH BID

PAPER BID BOND

WE _____ as PRINCIPAL,
 and _____ as SURETY,

are held jointly, severally and firmly bound unto the above Local Agency (hereafter referred to as "LA") in the penal sum of 5% of the total bid price, or for the amount specified in the proposal documents in effect on the date of invitation for bids whichever is the lesser sum. We bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly pay to the LA this sum under the conditions of this instrument.

WHEREAS THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH that, the said PRINCIPAL is submitting a written proposal to the LA acting through its awarding authority for the construction of the work designated as the above section.

THEREFORE if the proposal is accepted and a contract awarded to the PRINCIPAL by the LA for the above designated section and the PRINCIPAL shall within fifteen (15) days after award enter into a formal contract, furnish surety guaranteeing the faithful performance of the work, and furnish evidence of the required insurance coverage, all as provided in the "Standard Specifications for Road and Bridge Construction" and applicable Supplemental Specifications, then this obligation shall become void; otherwise it shall remain in full force and effect.

IN THE EVENT the LA determines the PRINCIPAL has failed to enter into a formal contract in compliance with any requirements set forth in the preceding paragraph, then the LA acting through its awarding authority shall immediately be entitled to recover the full penal sum set out above, together with all court costs, all attorney fees, and any other expense of recovery.

IN TESTIMONY WHEREOF, the said PRINCIPAL and the said SURETY have caused this instrument to be signed by their respective officers this _____ day of _____

Principal

 (Company Name) _____
 (Company Name)
 By: _____ By: _____
 (Signature and Title) (Signature and Title)

(If PRINCIPAL is a joint venture of two or more contractors, the company names, and authorized signatures of each contractor must be affixed.)

Surety

 (Name of Surety) By: _____
 (Signature of Attorney-in-Fact)

STATE OF ILLINOIS,
 COUNTY OF _____

I, _____, a Notary Public in and for said county,
 do hereby certify that _____

(Insert names of individuals signing on behalf of PRINCIPAL & SURETY)

who are each personally known to me to be the same persons whose names are subscribed to the foregoing instrument on behalf of PRINCIPAL and SURETY, appeared before me this day in person and acknowledged respectively, that they signed and delivered said instruments as their free and voluntary act for the uses and purposes therein set forth.

Given under my hand and notarial seal this _____ day of _____

My commission expires _____
 (Notary Public)

ELECTRONIC BID BOND

Electronic bid bond is allowed (box must be checked by LA if electronic bid bond is allowed)

The Principal may submit an electronic bid bond, in lieu of completing the above section of the Proposal Bid Bond Form. By providing an electronic bid bond ID code and signing below, the Principal is ensuring the identified electronic bid bond has been executed and the Principal and Surety are firmly bound unto the LA under the conditions of the bid bond as shown above. (If PRINCIPAL is a joint venture of two or more contractors, an electronic bid bond ID code, company/Bidder name title and date must be affixed for each contractor in the venture.)

Electronic Bid Bond ID Code

 (Company/Bidder Name)

 (Signature and Title)

 Date

City of Rockford
ILLINOIS PREVAILING WAGE ACT NOTICE AND ACKNOWLEDGEMENT

Failure to sign this acknowledgement will result in disqualification of Vendor's bid or proposal.

Prevailing Wage. The work included in this bid/request for proposal calls for the construction of a "public work," within the meaning of the Illinois Prevailing Wage Act, 820 ILCS 130/.01 *et seq.* ("the Act"). The Act requires contractors and subcontractors to pay laborers, workers, and mechanics performing services on public works projects no less than the "prevailing rate of wages" (hourly cash wages plus fringe benefits) in the county where the work is performed. Prevailing wage rates are determined by the Illinois Department of Labor and up-to-date rates are posted on the Department's website at <https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Rates.aspx>. This Act does apply to owner/operators (e.g. a business where the owner is an employee doing work on the job). If awarded this contract, Vendor must comply with all requirements of the Act, including but not limited to all wage, notice, recordkeeping, and filing of certified payroll requirements. *It is your responsibility, as a bidder, to understand the amount this law requires you to pay workers (including yourself as an owner, if applicable) while working on this City of Rockford project— and to bid accordingly.*

Certified Payroll. The Illinois Prevailing Wage Act requires any contractor and each subcontractor who participates in public works to file with the Illinois Department of Labor (IDOL) certified payroll for those calendar months during which work on a public works project has occurred. The Act requires certified payroll to be filed with IDOL no later than the 15th day of each calendar month for the immediately preceding month through the Illinois Prevailing Wage Portal—an electronic database IDOL has established for collecting and retaining certified payroll. The Portal may be accessed using this link: <https://www2.illinois.gov/idol/Laws-Rules/CONMED/Pages/Prevailing-Wage-Portal.aspx>. *The City reserves the right to withhold payment to Vendor until Vendor displays compliance with this provision of the Act.*

By signing below, Vendor acknowledges the applicability of the Prevailing Wage Act to the work that will be performed for the City of Rockford and, if the contract is awarded to Vendor, agrees to comply with the Act.

Vendor Name: _____

Bid/RFP Number: _____

Bid/RFP Title: _____

Name of Authorized Representative: _____

Title of Authorized Representative: _____

Signature of Authorized Representative

Date

City of Rockford
LCPTRACKER VENDOR INFORMATION FORM

The City uses an online system called LCPtracker to collect the certified payrolls Vendor must file with the City in compliance with the Prevailing Wage Act (820 ILCS 130/5 (a)(2)). The City will use the information provided in this form to set up a project in the LCPtracker system, where Vendor will be required to file certified payroll (due the 15th of the month for the preceding month).

- 1. City's Bid Number or PO Number:**
- 2. City's Project Name:** _____
- 3. Company Name (Vendor):**
- 4. Vendor's Address:** _____
- 5. Vendor's City and State:** _____
- 6. Vendor's Zip Code:**
- 7. Vendor's 10 – Digit Phone Number:** _____
- 8. Federal Tax ID Number:**
- 9. Ethnicity of Vendor:** _____
- 10. Principal's Name:**
- 11. Principal's Title:**
- 12. Contact's Nameⁱ:**
- 13. Contact's Email Address:**
- 14. Prime Approver's Nameⁱⁱ:**
- 15. Prime Approver's Email Address:**
- 16. Union Status:** ____ Union ____ Non-Union
- 17. Owner Operator?** ____ Yes ____ No
- 18. City-Certified MBE or WBE?** Yes No
- 19. Start Date of Project:** _____
- 20. Bid or PO Amount:** _____
- 21. If you will employ apprentices for City work, please attach pay scale for them.**

For questions about EEOs, contact Contract and Grant Compliance Officer, by email at (779) 348-7392.

ⁱ The Contact is the person who will manage Vendor's LCPtracker online account and who will use that account to *enter and certify payroll* information in the online system.

ⁱⁱ The Prime Approver is the person who will be responsible for *approving payroll* entered by Vendor and all subcontractors utilizing his or her LCPtracker prime approver online account. The Contact and Prime Approver may be the same person (who will utilize two different accounts to perform each function).

Acknowledgement of Stormwater Management Ordinance and Environmental Consent Decree

By indicating below, we acknowledge receipt of the Stormwater Management Ordinance and Environmental Consent Decree. Both documents can be found on the City of Rockford website at <https://rockfordil.gov/city-departments/public-works/engineering-division/stormwater-environmental-team/stormwater-consent-decree/>

I have been provided access to the City of Rockford Stormwater Management Ordinance and the Environmental Consent Decree and agree to comply with the terms outlined therein.

Person, Firm or Corporation

Authorized Signature

Acknowledgement of Addenda

By indicating below, we acknowledge receipt of the addenda listed.

| | |
|----------------|------------|
| Addendum _____ | Date _____ |

Person, Firm or Corporation

Authorized Signature

**CITY OF ROCKFORD, ILLINOIS
PROPOSAL NO. _____**

BIDDER'S AFFIDAVIT

STATE OF _____

COUNTY OF _____

I, _____ (Name of party signing affidavit)

_____, (Title) being duly sworn
do depose and say:

That material to be furnished for the above designated proposal number shall be supplies from bins, stockpiles or stock materials that conform to the specification set forth herein.

(Signature and title)

Sworn to be before me this _____ day of _____, 2020.

(Notary Public)

My commission expires _____.

(SEAL)



Illinois Department of Transportation

Bureau of Construction
2300 South Dirksen Parkway/Room 322
Springfield, Illinois 62764

Affidavit of Availability For the Letting of _____

Instructions: Complete this form by either typing or using black ink. "Authorization to Bid" will not be issued unless both sides of this form are completed in detail. Use additional forms as needed to list all work.

Part I. Work Under Contract

List below all work you have under contract as either a prime contractor or a subcontractor. It is required to include all pending low bids not yet awarded or rejected. In a joint venture, list only that portion of the work which is the responsibility of your company. The uncompleted dollar value is to be based upon the most recent engineer's or owners estimate, and must include work subcontracted to others. If no work is contracted, show **NONE**.

| | 1 | 2 | 3 | 4 | Awards Pending | |
|--|---|---|---|---|----------------|--------------------|
| Contract Number | | | | | | |
| Contract With | | | | | | |
| Estimated Completion Date | | | | | | |
| Total Contract Price | | | | | | Accumulated Totals |
| Uncompleted Dollar Value if Firm is the Prime Contractor | | | | | | |
| Uncompleted Dollar Value if Firm is the Subcontractor | | | | | | |
| Total Value of All Work | | | | | | |

Part II. Awards Pending and Uncompleted Work to be done with your own forces.

List below the uncompleted dollar value of work for each contract and awards pending to be completed with your own forces. All work subcontracted to others will be listed on the reverse of this form. In a joint venture, list only that portion of the work to be done by your company. If no work is contracted, show **NONE**.

| | | | | | | Accumulated Totals |
|---------------------------------------|--|--|--|--|--|--------------------|
| Earthwork | | | | | | |
| Portland Cement Concrete Paving | | | | | | |
| HMA Plant Mix | | | | | | |
| HMA Paving | | | | | | |
| Clean & Seal Cracks/Joints | | | | | | |
| Aggregate Bases & Surfaces | | | | | | |
| Highway, R.R. and Waterway Structures | | | | | | |
| Drainage | | | | | | |
| Electrical | | | | | | |
| Cover and Seal Coats | | | | | | |
| Concrete Construction | | | | | | |
| Landscaping | | | | | | |
| Fencing | | | | | | |
| Guardrail | | | | | | |
| Painting | | | | | | |
| Signing | | | | | | |
| Cold Milling, Planning & Rotomilling | | | | | | |
| Demolition | | | | | | |
| Pavement Markings (Paint) | | | | | | |
| Other Construction (List) | | | | | | |
| | | | | | | |
| | | | | | | |
| Totals | | | | | | |

Disclosure of this information is **REQUIRED** to accomplish the statutory purpose as outlined in the "Illinois Procurement Code." Failure to comply will result in non-issuance of an "Authorization To Bid." This form has been approved by the State Forms Management Center.

Part III. Work Subcontracted to Others.

For each contract described in Part I, list all the work you have subcontracted to others.

| | 1 | 2 | 3 | 4 | Awards Pending |
|--------------------|---|---|---|---|----------------|
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Subcontractor | | | | | |
| Type of Work | | | | | |
| Subcontract Price | | | | | |
| Amount Uncompleted | | | | | |
| Total Uncompleted | | | | | |

I, being duly sworn, do hereby declare that this affidavit is a true and correct statement relating to ALL uncompleted contracts of the undersigned for Federal, State, County, City and private work, including ALL subcontract work, ALL pending low bids not yet awarded or rejected and ALL estimated completion dates.

Subscribed and sworn to before me
 this _____ day of _____, _____ Type or Print Name _____
 Officer or Director Title

Signed _____

 Notary Public

My commission expires _____

(Notary Seal)

Company _____

Address _____

Request for Taxpayer Identification Number and Certification

**Give Form to the
 requester. Do not
 send to the IRS.**

▶ Go to www.irs.gov/FormW9 for instructions and the latest information.

| | | | | | | |
|--|---|--|--|--------------------------------------|---------------------------------------|--|
| Print or type. See Specific Instructions on page 3. | 1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank. | | | | | |
| | 2 Business name/disregarded entity name, if different from above | | | | | |
| | 3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes. | | 4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): | | | |
| | <input type="checkbox"/> Individual/sole proprietor or single-member LLC | <input type="checkbox"/> C Corporation | <input type="checkbox"/> S Corporation | <input type="checkbox"/> Partnership | <input type="checkbox"/> Trust/estate | Exempt payee code (if any) _____ |
| | <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶ _____ | | | | | Exemption from FATCA reporting code (if any) _____ |
| | Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is not disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner. | | | | | (Applies to accounts maintained outside the U.S.) |
| | <input type="checkbox"/> Other (see instructions) ▶ _____ | | | | | |
| 5 Address (number, street, and apt. or suite no.) See instructions. | | | Requester's name and address (optional) | | | |
| 6 City, state, and ZIP code | | | | | | |
| 7 List account number(s) here (optional) | | | | | | |

Part I Taxpayer Identification Number (TIN)

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

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

| | | | | | | | | | | | |
|---------------------------------------|--|--|--|---|--|--|---|--|--|--|--|
| Social security number | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | - | | | - | | | | |
| or | | | | | | | | | | | |
| Employer identification number | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | - | | | | | | | |

Part II Certification

Under penalties of perjury, I certify that:

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

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

| | | |
|------------------|----------------------------|--------|
| Sign Here | Signature of U.S. person ▶ | Date ▶ |
|------------------|----------------------------|--------|

General Instructions

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

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)

- Form 1099-DIV (dividends, including those from stocks or mutual funds)
 - Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
 - Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
 - Form 1099-S (proceeds from real estate transactions)
 - Form 1099-K (merchant card and third party network transactions)
 - Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
 - Form 1099-C (canceled debt)
 - Form 1099-A (acquisition or abandonment of secured property)
- Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, later.

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting*, later, for further information.

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

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

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

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,
2. You do not certify your TIN when required (see the instructions for Part II for details),
3. The IRS tells the requester that you furnished an incorrect TIN,
4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or
5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code*, later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships*, earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code*, later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. Individual. Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. Sole proprietor or single-member LLC. Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or “doing business as” (DBA) name on line 2.

c. Partnership, LLC that is not a single-member LLC, C corporation, or S corporation. Enter the entity’s name as shown on the entity’s tax return on line 1 and any business, trade, or DBA name on line 2.

d. Other entities. Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. Disregarded entity. For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a “disregarded entity.” See Regulations section 301.7701-2(c)(2)(iii). Enter the owner’s name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner’s name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity’s name on line 2, “Business name/disregarded entity name.” If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

| IF the entity/person on line 1 is a(n) . . . | THEN check the box for . . . |
|--|---|
| • Corporation | Corporation |
| • Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes. | Individual/sole proprietor or single-member LLC |
| • LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes. | Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation) |
| • Partnership | Partnership |
| • Trust/estate | Trust/estate |

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys’ fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

- 1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)
- 2—The United States or any of its agencies or instrumentalities
- 3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities
- 4—A foreign government or any of its political subdivisions, agencies, or instrumentalities
- 5—A corporation
- 6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession
- 7—A futures commission merchant registered with the Commodity Futures Trading Commission
- 8—A real estate investment trust
- 9—An entity registered at all times during the tax year under the Investment Company Act of 1940
- 10—A common trust fund operated by a bank under section 584(a)
- 11—A financial institution
- 12—A middleman known in the investment community as a nominee or custodian
- 13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

| IF the payment is for . . . | THEN the payment is exempt for . . . |
|--|---|
| Interest and dividend payments | All exempt payees except for 7 |
| Broker transactions | Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012. |
| Barter exchange transactions and patronage dividends | Exempt payees 1 through 4 |
| Payments over \$600 required to be reported and direct sales over \$5,000 ¹ | Generally, exempt payees 1 through 5 ² |
| Payments made in settlement of payment card or third party network transactions | Exempt payees 1 through 4 |

¹ See Form 1099-MISC, Miscellaneous Income, and its instructions.

² However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester*, later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at www.SSA.gov. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at www.irs.gov/Businesses and clicking on Employer Identification Number (EIN) under Starting a Business. Go to www.irs.gov/Forms to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to www.irs.gov/OrderForms to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code*, earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983.

You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983.

You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

| For this type of account: | Give name and SSN of: |
|--|---|
| 1. Individual | The individual |
| 2. Two or more individuals (joint account) other than an account maintained by an FFI | The actual owner of the account or, if combined funds, the first individual on the account ¹ |
| 3. Two or more U.S. persons (joint account maintained by an FFI) | Each holder of the account |
| 4. Custodial account of a minor (Uniform Gift to Minors Act) | The minor ² |
| 5. a. The usual revocable savings trust (grantor is also trustee) | The grantor-trustee ¹ |
| b. So-called trust account that is not a legal or valid trust under state law | The actual owner ¹ |
| 6. Sole proprietorship or disregarded entity owned by an individual | The owner ³ |
| 7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A)) | The grantor* |
| For this type of account: | Give name and EIN of: |
| 8. Disregarded entity not owned by an individual | The owner |
| 9. A valid trust, estate, or pension trust | Legal entity ⁴ |
| 10. Corporation or LLC electing corporate status on Form 8832 or Form 2553 | The corporation |
| 11. Association, club, religious, charitable, educational, or other tax-exempt organization | The organization |
| 12. Partnership or multi-member LLC | The partnership |
| 13. A broker or registered nominee | The broker or nominee |

| For this type of account: | Give name and EIN of: |
|---|-----------------------|
| 14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments | The public entity |
| 15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B)) | The trust |

¹ List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

² Circle the minor's name and furnish the minor's SSN.

³ You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

⁴ List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships*, earlier.

*Note: The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes.

Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to phishing@irs.gov. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at spam@uce.gov or report them at www.ftc.gov/complaint. You can contact the FTC at www.ftc.gov/idtheft or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see www.IdentityTheft.gov and Pub. 5027.

Visit www.irs.gov/IdentityTheft to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Section 3
Bid/RFP
Specifications



**Illinois Department
of Transportation**

Special Provisions

The following Special Provisions supplement the “Standard Specifications for Road and Bridge Construction”, Adopted **April 1, 2016**, the latest edition of the “Manual on Uniform Traffic Control Devices for Streets and Highways”, and the “Manual of Test Procedures of Materials” in effect on the date of invitation of bids, and the Supplemental Specifications and Recurring Special Provisions indicated on the Check Sheet included here in which apply to and govern the construction of _____, and in case of conflict with any part, or parts, of said Specifications, the said Special Provisions shall take precedence and shall govern.

SECTION 00 00 02

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 – GENERAL

1.01 DIVISION ONE

- A. The requirements of Division 1 apply to all sections of the Contract(s).

1.02 PROJECT

- A. Project Name: City of Rockford – Well House 13 and Well House 31 HMO Room Build-Outs.
- B. Engineer's Name: Fehr Graham & Associates, LLC
- C. The project consists of installing chemical treatment equipment in well house 13 and well house 31 for the City of Rockford Water Division. The work will include installation of Hydrous Manganese Oxide (HMO) bulk and day tanks, transfer pumps, metering pumps, monitoring equipment, plumbing, electrical panelboards, wiring, and power, and associated fixtures and equipment for assembling a complete and operational HMO injection system for the water treatment works at well house 13 and well house 31. The instruments and equipment for integration into the existing SCADA system will be installed, but the integration work will be done by the City of Rockford.

1.03 PROJECT SCOPE

- A. Contractor shall provide all items, articles, materials, operations or methods mentioned or scheduled on the Drawings or herein specified: including all labor, supervision, equipment, incidentals, taxes and permits necessary to complete the Work as described within the Contract Documents. Contractor shall install all items provided by Owner as mentioned or scheduled on the Drawings or herein specified.

1.04 CONTRACT DOCUMENTS–INTENT AND USE

- A. Intent of Documents:
1. Singular notations and specifications shall be considered plural where application is reasonably inferred.
 2. Mention or indication of extent of work under any division or Specification section is done only for convenience of Contractor and shall not be construed as describing all work required under that division or section.
 3. Some individual sections may contain a list of related sections. The list of related sections in individual sections is provided for the convenience of Contractor and is not necessarily all-inclusive. Contractor may not rely upon this listing for determination of scope of work. Other sections of the Specifications, not referenced in individual sections shall apply as required for proper performance of the Work.
 4. Command type sentences may be used in the Contract Documents. These sentences refer to and are directed to Contractor.

5. Symbols for various elements and systems are shown on the Drawings. Should there be any doubt regarding the meaning or intent of the symbols used, a written interpretation shall be obtained from Engineer.
- B. Use of Documents:
1. Contractor shall examine all Specifications and Drawings for the Work, including those that may pertain to Work Contractor does not normally perform with its own forces.
 2. Contractor shall use all of the Project Drawings and Specifications:
 - a. For a complete understanding of the Project.
 - b. To determine the type of construction and systems required.
 - c. For coordination with other Contractors.
 - d. To determine what other work may be involved in various parts or phases.
 - e. To anticipate and notify others when work by others will be required.
 - f. And all other relevant matters related to the project.
 3. Contractor is also bound by all requirements of the Contract Documents which are applicable to, pertain to, or affect its Work, as may be shown or inferred by the entire set of Project Drawings and Specifications.

1.05 CONSTRUCTION REQUIREMENTS

- A. General Information and Requirements:
1. Operation of the water supply and treatment facilities will be the responsibility of Owner. Contractor shall cooperate with the water utility operation staff at all times, and removal of any operating units from service shall be coordinated by Contractor with Owner and Engineer. Prior to removing or placing any unit process in or out of service, Contractor shall request in writing authorization from Owner with at least two weeks' notice. When notifying Owner and Engineer that a unit process is ready to be placed back into service, Contractor shall attach all necessary passing bacteriological laboratory results.
- B. Construction Sequence:
1. The following construction sequence is provided as a general guideline for the information and for the benefit of Contractor. This construction sequence is not intended to dictate means, method of construction or direct construction activities. This construction sequence is a conceptual general construction sequence with minimum recommended outage, shutdowns, and operating units to be maintained in service. The general construction sequence is projected to allow the Work to be completed without interruption to the existing water treatment process. It is not intended to be all inclusive and does not list all work elements or details that are required to complete the Work, complete treatment processes, or place unit processes in service.
 2. Owner will need access to the facilities, the well and booster pumping facility, and the reservoir, throughout the duration of the project for its required daily rounds. This access is required even when the facility or portions of the facility are out-of-service.

See parking requirements specified within this Section. Contractor shall notify and request approval from Owner and Engineer at least one week prior to limiting access. Requests shall include the date, time, and duration of the requested limited access.

1.06 CONTRACTOR USE OF SITE

A. General:

1. The “area of the site” referred to in these Specifications shall be as shown on the Drawings. If the “area of the site” is not shown, Owner's property lines, the Project right-of-way and/or any easements obtained for the Project shall be considered the “area of the site.”
2. Construction activities shall be confined within the “area of the site” limits.
3. From the start of work to completion Contractor is responsible for the care of the site and the premises which are affected by operations of Work of this Contract.
4. Except for permanent site improvements provided under the Contract, Contractor shall restore property disturbed during the Work, to the conditions which previously existed.
5. Work in occupied spaces shall be restricted to specified Work and essential activities, such as making necessary connections and extending services or constructing temporary access ways. Such work shall be scheduled in advance with Owner.

B. Parking and Deliveries:

1. Contractor is responsible for control of traffic by vehicles and persons within the limits of its operations.
2. Parking for employees, subcontractors, and agents of Contractor shall be in areas subject to approval of Owner.
3. Access to the site for delivery of construction material or equipment shall be subject to approval of Owner.
4. At all times, Contractor shall have an accessible parking space available for Owner’s use.

1.07 EXISTING SERVICES, OVERHEAD UTILITIES, AND UNDERGROUND FACILITIES INCLUDING STRUCTURES

- A. Interruption of existing services and systems including heating, ventilating, air conditioning, water, sanitary, lighting and power, signal and security systems, and similar work shall be kept to an absolute minimum and shall be limited to times approved by Owner.
- B. If deemed necessary by Owner, such work shall be accomplished after Owner's normal office hours.
- C. Work shall not commence until all labor, materials and equipment are available so Work can continue without interruption or delay.
- D. Should uncharted or incorrectly charted services or Underground Facilities be encountered during installation, notify Owner and consult with utility owner immediately.
- E. Cooperate with Owner and utility companies in keeping respective services and Underground Facilities in operation and repair any damage.

- F. Contractor shall not interrupt existing services and Underground Facilities occupied and used by Owner or others, except when permitted in writing by Owner.
- G. Any accidental interruption of services and Underground Facilities shall be repaired immediately, including provision of temporary facilities until permanent repairs can be made.
- H. Locations and elevations of services and Underground Facilities as shown on the Drawings are approximate. It shall be Contractor's responsibility to determine their exact location when in their vicinity. To this end, Contractor shall proceed with caution in the excavation and preparation of the Site so the exact location of services and Underground Facilities can be determined. Contractor shall include in the Contract Price any costs for temporary or permanent relocations of such services and Underground Facilities required to complete the Work unless specifically indicated otherwise in the Specifications.
- I. Contractor shall keep an accurate and complete record of all such services and Underground Facilities encountered and shall provide Owner a copy of this record. The record shall include a description of the item encountered, opinion as to conditions, and adequate measurements and depths so that the item can be located in the future.
- J. Contractor shall inspect all services and Underground Facilities for condition and soundness. Unsound conditions shall be reported to Owner immediately after exposing. Contractor shall not proceed with the Work until the service or facility owner has been notified. Service or facility owner shall then be given time to inspect and correct, if required, the service or Underground Facility. Contractor may make claim under the provisions of Articles 11 and 12 of the General Conditions should Contractor feel a price or time adjustment is justified.
- K. Any additional costs incurred because of failure of Contractor to report the condition of any and all existing services and Underground Facility encountered shall be paid for by Contractor.

1.08 PROTECTION OF WORK AND IMPROVEMENTS

- A. Contractor shall protect the property of Owner, existing improvements, and the Work installed by Contractor and others from abuse, damage, dust, debris, and other objectionable materials resulting from construction activities.
- B. Contractor shall provide suitable covers, partitions, or other dust and fume containment devices to suit construction operations.
- C. Contractor shall keep property, existing improvements and the Work, including structures, mains, fittings and accessories free from dirt and foreign matter at all times.
- D. Contractor shall provide temporary plugging of openings, holes and pipe ends that are existing or that Contractor has installed.
- E. Property, improvements and Work damaged by Contractor shall be repaired or replaced by Contractor to the satisfaction of Owner.

1.09 AVAILABILITY OF LANDS

- A. Easements were not obtained for this Project. Contractor shall confine its operations, equipment and storage areas to the lands and rights-of-way in which the Project is to be located. Contractor may enter into written agreements with property owners for use of other lands during construction. Copies of such agreements shall be provided to Owner.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 01 20 01

CONTRACT CONSIDERATIONS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Cash allowances.
 - 2. Measurement and Payment–Lump Sum.

1.02 CASH ALLOWANCES

- A. See the General Conditions for costs to be included in allowances.
- B. Refer to sections of the specifications identified in the Bid Form for specific information on use of cash allowances.
- C. The Bid shall include the amount equal to the specified quantity times the unit price.

1.03 MEASUREMENT AND PAYMENT–LUMP SUM

- A. Payment for Lump Sum projects will be based on the accepted schedule of values for the project.
- B. An acceptable schedule of values will include the following features:
 - 1. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction. Schedule shall be subdivided as necessary by specification section and work area.
 - 2. Identify each line item with the number and title of the respective Specification Section.
 - 3. For each major line item list sub-values of major products or operations under the item.
 - 4. For the various portions of the work:
 - a. Each item shall include a directly proportional amount of Contractor’s overhead and profit.
 - b. For items on which progress payments will be requested for stored materials, break down the value into:
 - 1) The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by Engineer.
 - 2) The total installed value.
 - 5. The sum of all values listed in the schedule shall equal the total Contract Sum.
 - 6. Schedule shall include a separate listing of general items such as bonds, insurance, mobilization, demobilization, field supervision, and record documents.

- C. Once a schedule of values is accepted, it shall not be revised, except for changes associated with subsequently executed change orders.
- D. No separate measurement for payment will be performed for Lump Sum Work.
- E. Contractor shall estimate percentage of Work completed. Engineer will review Contractor's estimate of quantity of Work completed.
- F. Payment will be made based on the percentage of the Contract completed less retainage and/or liquidated damages.
- G. Unless noted otherwise, all Work described in the Specifications and/or shown on the Drawings shall be included in the Lump Sum Bid.
- H. Some technical specification sections may include payment provisions. These provisions are in addition to the provisions of this section which apply to all of the Work.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.01 SUMMARY

A. Work Included:

1. Whenever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined either by manufacturer's name and catalog number or by reference to recognized industry standards.
2. To facilitate Contractor's understanding of the design intent, procedures have been established for advance submittal of design data and for its review or rejection by Engineer.
3. The type of submittal requirements specified in this section include progress schedule, shop drawings, product data, samples, and other miscellaneous work related submittals.

B. Related work described elsewhere: More detailed requirements for submittals are described in other sections of these specifications for some materials and equipment. They are to be considered additional requirements to supplement the requirements specified in this section. Submittals shall conform to Article 6 of the General Conditions.

C. Definitions: "Electronic Submittal" is defined as any submittal transmitted electronically to Engineer for review.

1.02 IDENTIFICATION OF SUBMITTALS

A. Contractor shall completely identify each submittal and resubmittal by showing at least the following information:

1. Name and address of submitter, plus name and telephone number of the individual who may be contacted for further information.
2. Name and location of project and identification number.
3. Drawing number and specifications section number to which the submittal applies.
4. Include the date of each submittal or resubmittal.

1.03 GROUPING OF SUBMITTALS

A. Unless otherwise specifically permitted by Engineer, Contractor shall make all submittals in groups containing all associated items so that information is available for checking each item when it is received.

B. Partial submittals may be rejected as not complying with the provisions of the Contract Documents.

1.04 TIMING OF SUBMITTALS

A. Contractor shall make all submittals far enough in advance of scheduled dates of installation to provide required time for reviews, for securing necessary approval, for possible revision and resubmittal, and for placing orders and securing delivery.

- B. The review period for submittals that are received after 3 P.M. shall commence on the following business day.

1.05 CONSTRUCTION PROGRESS SCHEDULE

- A. Submit initial schedule in duplicate within 10 days after date of Owner-Contractor Agreement.
- B. Revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, identifying changes since previous version.
- D. Indicate estimated percentage of completion for each item of Work at each submission.
- E. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.06 SHOP DRAWINGS

- A. Shop drawings shall include specially prepared technical data for this project including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements, and similar information not in standard printed form for general application to a range of similar projects. Shop drawings shall be submitted for all manufactured or fabricated items. See individual technical sections for special requirements.
- B. Contractor shall make all shop drawings accurately to scale and sufficiently large to show all pertinent aspects of the item and its method of connection to the work.
- C. Shop drawings shall be checked, approved, and stamped by Contractor in accordance with the General Conditions before transmittal to Engineer for review and approval.
- D. Complete shop drawings and descriptive data shall be submitted on all manufactured or fabricated items prior to 25% completion of the Work. Applications for payment beyond 25% of the Contract amount will not be recommended for payment until all shop drawings are submitted, including the required hard copies, or a revised schedule for any remaining submittals is agreed to by Owner and Engineer.
- E. Contractor shall submit shop drawings following the electronic submittal procedure described below. If electronic submittal is impossible, Contractor may request Engineer to review hard copy submittals on a limited basis. Engineer may request to review hard copy submittals on a limited basis for submittals that are over 100 pages in length. If Engineer agrees to or requests hard copy submittal review, Contractor shall submit six color copies of shop drawings and descriptive data to Engineer for approval. Three copies of these will be returned to Contractor if approved. If shop drawings are not approved or if they are stamped "Approved as Noted-Resubmit," two corrected copies will be returned to Contractor for use in resubmittal. If Contractor desires more than three approved copies, submitted quantity shall be increased accordingly.
- F. Hard copy shop drawings shall be submitted in 3-ring binders or 3-tab report covers.
- G. Shop drawings submitted to Engineer will be reviewed and stamped "Approved," "Approved as Noted," "Approved as Noted-Resubmit," or "Not Approved." Contractor shall resubmit the above number of corrected shop drawings for all shop drawings stamped "Approved as Noted-Resubmit" and "Not Approved" and will continue this process until shop drawings are stamped "Approved" or

“Approved as Noted.” If drawings are stamped “Approved as Noted-Resubmit,” fabrication may proceed in accordance with the marked-up shop drawings. Installation shall not proceed until shop drawings have been resubmitted and stamped “Approved” or “Approved as Noted.”

- H. If shop drawings are stamped “Approved as Noted” or “Approved as Noted-Resubmit” and Contractor does not agree with revisions or cannot conform with revisions, fabrication shall not proceed and shop drawings shall be resubmitted with explanation of Contractor’s position.
- I. All shop drawings used for construction site activities shall bear the “Approved” or “Approved as Noted” stamp of Engineer.
- J. Arrangements may be made between Contractor and Engineer to provide additional copies of “Approved” shop drawings for field activity purposes.
- K. Electronic Submittal Procedures:
 - 1. Summary:
 - a. Shop drawing and product data submittals shall be transmitted to Engineer in electronic (PDF) format using Submittal Exchange, or equal, a website service designed specifically for transmitting submittals between construction team members, or equal.
 - b. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
 - c. The electronic submittal process is not intended for color samples, color charts, or physical material samples.
 - 2. Procedures:
 - a. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer/product, dimensions and coordination of information with other parts of the work.
 - b. Contractor shall transmit each submittal to Engineer using the Submittal Exchange website, www.submittalexchange.com, or equal.
 - c. Engineer review comments will be made available on the Submittal Exchange website for downloading. Contractor will receive email notice of completed review.
 - d. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of Contractor.
 - e. Electronically submitted shop drawings shall follow the following format:
 - 1) Filenames for the shop drawing submittals shall follow a XXXXX.YYY-Z. Description convention where XXXXX is the specification section number, YYY is the submittal number, .Z is the resubmittal number, and description is a short description of what the submittal includes. Submittals shall be consecutively numbered in direct sequence of submittal. Resubmittals shall be consecutively numbered with the first submittal numbered with an -0 and the first resubmittal numbered with a -1.
 - i) Example file name: 03200.016-1. Structure 10 Concrete Reinforcement. This would be the first revision of the sixteenth submittal and contain information on concrete reinforcement.

- 2) All files shall be delivered in PDF format with a minimum resolution of 300 dpi unless otherwise requested by Engineer. Scanned in material shall be scanned in color and any markings by Contractor shall be made in red. Pages shall be rotated to the appropriate position for easy reading on a computer monitor such that the majority of text is vertical.
 - 3) Files shall be delivered without security features activated.
 - 4) Shop Drawings shall be uploaded as individual files. Files combined into a zip drive are not acceptable. All pages of one submittal should be contained in one file.
 - 5) The file shall open to a cover page containing, at a minimum, the following information:
 - i) Contractor's stamp.
 - ii) Name, e-mail, and telephone number of the individual who may be contacted for further information.
 - iii) Project number.
 - iv) Submittal number.
 - v) Submission date, if resubmittal, all previous submission dates.
 - vi) Index detailing contents and the total number of pages in the submittal.
 - f. Once a shop drawing has been "Approved" or "Approved as Noted," Contractor shall provide three hard color copies of the "Approved" or "Approved as Noted," shop drawings to Engineer. Contractor is responsible for the hard copy color replication of Engineer's "Approved" or "Approved as Noted," shop drawings for use by Contractor. Hard copy shop drawings shall be submitted in 3-ring binders or 3-tab report covers.
3. Costs:
- a. Contractor shall include the full cost of Submittal Exchange, or equal, project subscription in their proposal. This cost shall be included in the Contract amount. Contact Submittal Exchange at 1-800-714-0024 to verify cost prior to Bid.
 - b. At Contractor's option, training is available from Submittal Exchange regarding use of website and PDF submittals. Contact Submittal Exchange at 1-800-714-0024.
 - c. Internet Service and Equipment Requirements:
 - 1) Email address and Internet access at Contractor's main office.
 - 2) Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.
- L. Contractor is fully responsible for obtaining any and all copyright permission associated with conversion of shop drawing information to electronic format.
- M. Shop drawings shall include verification that the item meets applicable codes and standards such as NFPA 30, ASTM, OSHA, and others.

1.07 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically described in the Contract Documents, whenever a choice of color or pattern is available in a specified product, Contractor shall submit accurate color charts and pattern charts to Engineer for Owner's review and selection.
- B. Unless all available colors and patterns have identical wearing capabilities and are identically suited for the installation, Contractor shall completely describe the relative capabilities of each.

1.08 SAMPLES AND FIELD MOCKUPS

- A. Contractor shall provide samples and field mockups where noted or specified.
- B. Samples are physical examples which illustrate materials, equipment, or workmanship and establish standards by which the work will be judged.
- C. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product and full range of color, texture, and pattern.
- D. Samples shall have labels firmly attached, bearing the following information:
 - 1. Name of project.
 - 2. Description of product and finish.
 - 3. Name of Contractor.
 - 4. Trade name and number of product.
 - 5. Standards met by the product.
- E. Approval of samples must be obtained prior to proceeding with any work affected by material requiring sample approval.
- F. Samples, unless otherwise noted, become the property of Owner.
- G. In situations specifically approved by Engineer, the retained sample may be used in the construction as one of the installed items.
- H. Field mockups:
 - 1. Contractor shall erect field mockups at the project site in a location acceptable to Engineer and Owner.
 - 2. When accepted by Engineer, the mockup will become the basis for comparison of the actual work.
 - 3. Remove mockup at conclusion of the work if it was not incorporated into the work.

1.09 PRODUCT DATA

- A. Contractor shall provide product data as required to supplement shop drawings.
- B. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate a material, product, or system for some portion of the work.
- C. Contractor shall collect required product data into one submittal for each unit of work or system.
- D. Contractor shall include manufacturer's standard printed recommendations for application and use, compliance with standards, performance characteristics, wiring and piping diagrams and controls,

component parts, finishes, dimensions, required clearances, and other special coordination requirements.

- E. Contractor shall mark each copy of standard printed data to identify pertinent products, models, options, and other data.
- F. Contractor shall supplement manufacturer's standard data to provide information unique to the work.

1.10 RESUBMISSION REQUIREMENTS

- A. Make any corrections or changes in the submittals required by Engineer.
- B. Shop Drawings and Product Data:
 - 1. Revise initial drawings or data and resubmit as specified for initial submittal.
 - 2. Itemize in a cover letter any changes which have been made other than those requested by Engineer.
- C. Electronic shop drawing resubmissions shall follow the nomenclature described in Section 1.06.K.2.e.
- D. See SC-6.17 for additional information regarding resubmittals.

1.11 MANUFACTURER'S DIRECTIONS

- A. Manufactured articles, materials, and equipment shall be stored, commissioned, operated, applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer, unless specified to the contrary.
- B. Wherever specifications call for work to be performed or materials to be installed in accordance with the manufacturer's printed instructions or directions, Contractor shall furnish copies as required for shop drawings of those instructions or directions to Engineer before installing the material or performing the work.
- C. All sheets have reduced dimensions as described for shop drawings, and shall be furnished in 3-ring binders or 3-tab report covers.

1.12 MAINTENANCE MANUAL

- A. Prior to 50% completion of the Contract or at a minimum of 45 days prior to the scheduled start-up date of any individual item of equipment, whichever is earlier, Contractor shall furnish to Engineer three complete copies of a maintenance manual for all equipment furnished and an electronic format compact disk of the maintenance manual in the most recent version of Adobe (.pdf) format identical to the hard copy. Applications for payment beyond 50% of the contract amount will not be recommended for payment until all maintenance manuals are submitted or a revised schedule for remaining maintenance manuals is agreed to by Owner and Engineer. The hard copies shall be in binders that are no larger than 11.5 inches tall, 11 inches long, and 3 inches deep. Provide labeled tabs for each section.
- B. Contractor is responsible for producing an electronic version of the Equipment Operations and Maintenance (O&M) Manuals Manual. The Electronic Equipment O&M Manual shall be delivered in Portable Document Format (PDF). The entire manual may be converted to PDF via scanning or other method of conversion. Drawings or other graphics must be converted to PDF format and made part of the PDF document. The Contractor shall provide all Equipment O&M Manuals in the electronic format as defined below.

- C. The filename for the Equipment O&M Manual submittal will be provided with the request for final Equipment O&M Manuals. Filenames use the "eight dot three" convention (XXXXX_YY.PDF) where XXXXX is the specification section number and YY is an ID number. No one file shall be larger than 10 MB. If technical problems require that the submittal be divided into more than one file, a letter extension shall be added to the end of each filename.
- D. (Example: 19876_01a.pdf). The number of files shall be kept to a minimum. Equipment O&M Manuals that span more than one file shall have the final Bookmark "Return to Table of Contents" which shall take the User to the first file on the Equipment O&M Manual.
- E. All text (word processed), spreadsheets, and electronic graphics shall be delivered in portable document format (*.PDF). The resolution of all scanned images shall be a minimum of 300 dpi unless otherwise requested by Engineer. Scanned images shall be processed with the "original image with hidden text" option (Adobe Acrobat 6 or higher). This results in a clear image and provides for optical character recognition (OCR) and word search functionality. Graphical files shall be fully searchable. All submittals must be indexed with the Adobe Catalog feature. Placement and structure of index files shall be in accordance with Adobe's recommendations to minimize problems when transferring files. Successful searches for words or strings in the PDF document shall demonstrate proof of OCR.
- F. Rotate pages viewed in landscape to the appropriate position for easy reading on a computer monitor.
- G. Bookmarks shall be created in the navigation frame for each entry in the Table of Contents. Three levels deep is usually enough (i.e., "Chapter", "Section", "Subsection"); however, complex submittals like instrumentation and electrical may be required at the discretion of Engineer. When setting bookmarks for Chapter level heading, the page shall be displayed at Full Page. Section and Subsection level heading pages shall be displayed as a magnified view. Bookmarks shall be displayed as subordinate (to other bookmarks in their hierarchy set so that only the Chapter level headings are displayed).
- H. Thumbnails shall be generated and embedded in each PDF file.
- I. Files shall be delivered without Security features activated. Password protected files will be unacceptable.
- J. The opening view for PDF files shall be set as follows:
 - 1. Initial View: Bookmarks and Page
 - 2. Magnification: Fit In Window
 - 3. Page Layout: Single Page
- K. The file shall open to the cover page of the Equipment O&M Manual with bookmarks to the left. The first bookmark shall be the name of Equipment O&M Manual.
- L. The submittal shall be delivered on CD after all Equipment O&M Manuals have been received and reviewed. Each CD shall be labeled, at a minimum, as follows, including:
 - 1. CD-ROM disks,
 - 2. jewel cases, and
 - 3. hard copies.

- M. Manufacturer name, point of contact, telephone number, facsimile number, and e-mail address as appropriate.
- N. Equipment name and/or O&M title spelled out in complete words.
 - 1. Example "Operations and Maintenance Manual" "Horizontal Centrifugal Nonclog Pump"
- O. Specifications section number.
- P. Project name.
- Q. Date and File Name: Example "12-20-07", "19876_01.pdf"
- R. Contractor shall reprocess any portion of the document that does not view or print to Owner's satisfaction.
- S. Contractor is fully responsible for obtaining any and all copyright permissions associated with conversion of this information to electronic format.
- T. The manuals shall include manufacturer's instructions for maintenance and operation for each item of mechanical and electrical equipment. Manuals shall be specific for the equipment as installed; provide project specific inserts as required. Manuals shall contain: operation instructions, lubrication schedules, types and quantities, preventive maintenance program, spare parts list, parts lists, I.D. No. and exploded views, assembly instructions, parts supplier location, trouble shooting and start-up procedures and, where applicable, test data and curves. All sheets shall have reduced dimensions as described for shop Drawings. All sheets shall be furnished in 3-ring binders.
- U. Each maintenance manual shall include a completed equipment maintenance summary form for each type and size of equipment being furnished that requires power, lubrication, or maintenance. Equipment Summary forms are located at the end of this section.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

EQUIPMENT MAINTENANCE SUMMARY FORM

Equipment _____ No.: _____

Specification Section: _____
Equipment Name: _____
Building Name: _____ Room No.: _____
Plant Location: _____
Manufacturer: _____
Address: _____
Address: _____ Phone: _____
Service Representative: _____
Phone: _____ Fax: _____
Make: _____ Model: _____
Serial No.: _____ Type: _____
Size: _____
Equipment Speed: _____
Capacity: _____
Operating Range: _____
Material: _____
Alarms: _____

Drive Ratio: _____ Motor Speed: _____ Service Factor: _____
Volts: _____ Phase: _____ hp: _____ Efficiency: _____
Motor Type: _____
Motor Sensors: _____
Motor Manufacturer: _____
Model: _____ Motor Frame: _____

Insulation Class: _____ FLA: _____ LRA: _____

(1) Complete as applicable; attach supplementary pages as necessary.

Maintenance Requirements

(Use additional sheets if more space is needed.)

LUBRICATION

| <u>Item</u> | <u>Generic Type of Lubricant</u> | <u>Supplier Estimated</u> | <u>Frequency Annual</u> | <u>Quantity</u> |
|-------------|--------------------------------------|-------------------------------|-----------------------------|-----------------|
|-------------|--------------------------------------|-------------------------------|-----------------------------|-----------------|

PREVENTIVE MAINTENANCE

| <u>Item</u> | <u>Action</u> | <u>Frequency</u> | <u>Reference</u> |
|-------------|---------------|------------------|------------------|
|-------------|---------------|------------------|------------------|

SUGGESTED MINIMUM SPARE PARTS LIST

| <u>Manufacturer</u> | <u>Part No.</u> | <u>Quantity Unit</u> | <u>Description</u> |
|---------------------|-----------------|----------------------|--------------------|
|---------------------|-----------------|----------------------|--------------------|

The following information is included in O&M

Manual: Check or mark N/A

1. Recommended installation, adjustment, calibration, and troubleshooting. _____
2. Complete internal and connection wiring diagrams. _____
3. Complete parts lists, by generic title and identification number, with exploded views of each assembly. _____
4. Disassembly, overhaul, and reassembly instructions. _____
5. Recommended prestart checks. _____
6. Recommended start procedure. _____
7. Recommended shutdown procedure for both short and long term. _____
8. Recommended operating precautions that include safety for personnel and equipment. _____
9. Recommended standing maintenance procedure. _____

SECTION 01 40 00

QUALITY CONTROL

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Includes:
 - 1. Quality Assurance–Control of Installation.
 - 2. Tolerances.
 - 3. Manufacturers' Field Services and Reports.

1.02 QUALITY ASSURANCE–CONTROL OF INSTALLATION

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

1.03 TOLERANCES

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

1.04 MANUFACTURERS' FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections or when requested by Engineer, Contractor shall require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, and quality of workmanship.
- B. Contractor shall submit qualifications of observer to Engineer 30 days in advance of required observations.
- C. Contractor shall report observations and site decisions, or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Contractor shall submit report in duplicate within 30 days of observation to Engineer for information.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. OSHA requirements.
 - 2. 35 Ill. Adm. Code 1100.
 - 3. Permits.
 - 4. Substance abuse prevention.
 - 5. Apprenticeship Requirement

1.02 OSHA REQUIREMENTS

- A. All work including site safety, equipment, materials, and fabricated items provided under the Contract shall comply with the provisions of the “Occupational Safety and Health Act.”

1.03 35 ILL. ADM. CODE 1100

- A. Contractor shall comply with 35 Ill. Adm. Code 1100 when disposing of clean construction or demolition debris (CCDD) or uncontaminated soil at a CCDD or uncontaminated soil fill operation.

1.04 PERMITS

- A. The following permits have been obtained by Owner:
 - 1. IEPA Public Water Supply Construction Permit for Well 13
 - 2. IEPA Public Water Supply Construction Permit for Well 31
- B. Contractor shall comply with all provisions of these permits and shall be responsible for notifications as required by these permits. Contractor shall obtain all other permits required for the Work. Where the requirements of any permit is more restrictive than the Drawings or the Specifications, the permit requirements shall govern.
- C. A building permit will be required from Owner. However, Owner will waive fees associated with the permit.

1.05 SUBSTANCE ABUSE PREVENTION

- A. When required by Illinois State Statutes, awarded vendors must have in place and file with the City a written program for prevention of substance abuse among its employees. This program must include pre-hire, random, reasonable suspicion, and post-accident drug and alcohol testing, as required by the Substance Abuse Prevention on Public Works Projects Act.

1.06 APPRENTICESHIP REQUIREMENT

- A. For construction contracts over \$50,000, awarded vendors must participate in apprenticeship and training programs approved and registered with the United States Department of Labor's Bureau of Apprenticeship and Training for all Trades that will be in the awarded vendor's (or his subcontractor's) employment, with each worker receiving the required apprenticeship/training appropriate to his trade. Owners or work performed by owners is not exempt from the apprenticeship and training requirement.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 01 42 19

REFERENCE STANDARDS AND DEFINITIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Work Included:

1. Reference Standards:

- a. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
- b. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is Contractor's responsibility to provide materials and workmanship which meet or exceed that specifically named code or standard.
- c. It is also Contractor's responsibility, when so required by the Contract Documents, to deliver to Engineer all required proof that the material or workmanship, or both, meet or exceed the requirements of the specifically named code or standard.

2. Definitions:

- a. A substantial amount of specification language constitutes definitions for terms found in other Contract Documents, including the Drawings which must be recognized as diagrammatic in nature and not completely descriptive of requirements indicated thereon.
- b. Certain terms used in the Contract Documents are defined generally in this section to supplement definitions of the Agreement, General Conditions, Supplementary Conditions, and other general contract documents.
- c. Definitions and explanations of this section are not necessarily either complete or exclusive, but are general for the Work.

- B. Related Work Described Elsewhere: The specific naming of codes or standards occurs on the Drawings and in other sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards:

1. It is Contractor's responsibility to verify the requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.
2. When required by individual sections of these specifications, Contractor shall obtain a copy of each pertinent code or standard and maintain the copies at the job site during submittals, planning, and progress of the Work until Substantial Completion of the Work is attained.

- B. Overlapping or Conflicting Requirements:
 1. Where compliance with two or more industry standards or sets of requirements are specified, and the overlapping of those standards or requirements establishes different or conflicting minimums or levels of quality, the most stringent requirement (which is generally recognized to be also most costly) is intended and will be enforced, unless more detailed language written directly into Contract Documents clearly indicates that a less stringent requirement is acceptable.
 2. Refer all uncertainties to Engineer for decision before proceeding.

1.03 REFERENCE STANDARDS

- A. Applicable standards of the construction industry are made a part of the Contract Documents by reference as if copied directly into the Contract Documents, or as if published copies were bound herewith. See Article 3.02 of the General Conditions for additional provisions regarding references.
- B. Standards referenced directly in the Contract Documents or by governing regulation, have precedence over nonreferenced standards which are recognized in industry for applicability to the Work.
- C. Nonreference standards are hereby defined to have no particular applicability to the work except as a general measurement of whether the Work complies with standards recognized in the construction industry.
- D. Reference standards and codes listed in these specifications may include, but are not necessarily limited to, standards or codes published by the following agencies and organizations:
 1. AA Aluminum Association
1525 Wilson Boulevard, Arlington, VA 22209
 2. AAMA American Architectural Manufacturer's Association
1827 Walden Office Square Suite 550, Schaumburg, IL 60173-4268
 3. AASHTO American Association of State Highway & Transportation Officials
444 North Capitol Street NW Suite 249, Washington, DC 20001
 4. ACI American Concrete Institute
38800 Country Club Drive, Farmington Hills, MI 48331-3439
 5. AI Asphalt Institute
2696 Research Park Drive, Lexington, KY 40511-8480
 6. AISC American Institute of Steel Construction
One East Wacker Drive Suite 700, Chicago, IL 60601-1802
 7. AISI American Iron and Steel Institute
25 Massachusetts Avenue NW Suite 800, Washington, DC 20001
 8. ANSI American National Standards Institute
25 West 43rd Street, New York, NY 10036

9. APA American Plywood Association
7011 South 19th, Tacoma, WA 98466-5333
10. API American Petroleum Institute
1220 L Street NW, Washington, DC 20005-4070
11. ARI Air-Conditioning & Refrigeration Institute
4100 North Fairfax Drive Suite 200, Arlington, VA 22203
12. ASHRAE American Society of Heating, Refrigerating, and
Air Conditioning Engineers
1791 Tullie Circle NE, Atlanta, GA 30329
13. ASME American Society of Mechanical Engineers
Two Park Avenue, New York, NY 10016-5990
14. ASSE American Society of Sanitary Engineering
901 Canterbury Suite A, Westlake, OH 44145
15. ASTM ASTM International
100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
16. AWI Architectural Woodwork Institute
46179 Westlake Drive Suite 120, Potomac Falls, VA 20165-5874
17. AWPA American Wood Protection Association
P.O. Box 361784, Birmingham, AL 35236-1784
18. AWS American Welding Society
8669 Doral Boulevard Suite 130, Doral, FL 33166
19. AWWA American Water Works Association
6666 West Quincy Avenue, Denver, CO 80235
20. BHMA Builder's Hardware Manufacturers Association
355 Lexington Avenue 15th floor, New York, NY 10017
21. BIA Brick Industry Association
1850 Centennial Park Drive Suite 301, Reston, VA 20191
22. CRSI Concrete Reinforcing Steel Institute
9333 North Plum Grove Road, Schaumburg, IL 60173
23. EJMA Expansion Joint Manufacturers Association
25 North Broadway, Tarrytown, NY 10591
24. FM FM Global
FM Global Corporate Offices, 270 Central Avenue, Johnston, RI 02919
25. FTI Facing Tile Institute

- Box 8880, Canton, OH 44711
26. GA Gypsum Association
6525 Belcrest Road Suite 480, Hyattsville, MD 20782
 27. GANA Glass Association of North America
800 SW Jackson Street Suite 1500, Topeka, KS 66612-1200
 28. ICC International Code Council
500 New Jersey Avenue NW 6th Floor, Washington, DC 20001
 29. IES Illuminating Engineering Society
120 Wall Street, Floor 17, New York, NY 10005-4001
 30. MIL Military Specifications
Naval Publications and Forms Center
5801 Tabor Avenue, Philadelphia, PA 19120
 31. NAAMM National Association of Architectural Metal Manufacturers
800 Roosevelt Road Building C Suite 312, Glen Ellyn, IL 60137
 32. NCMA National Concrete Masonry Association
13750 Sunrise Valley Drive, Herndon, VA 20171-4662
 33. NECA National Electrical Contractors Association
3 Bethesda Metro Center Suite 1100, Bethesda, MD 20814
 34. NEMA National Electrical Manufacturers Association
1300 North 17th Street Suite 1752, Rosslyn, VA 22209
 35. NFPA National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169-7471
 36. NIST National Institute of Standards and Technology
(U.S. Department of Commerce),
100 Bureau Drive, Stop 1070 Gaithersburg, MD 20899-1070
 37. NRCA National Roofing Contractors Association
10255 West Higgins Road Suite 600, Rosemont, IL 60018-5607
 38. NSF National Sanitation Foundation International
P.O. Box 130140, 789 North Dixboro Road, Ann Arbor, MI 48113-0140
 39. OSHA Occupational Safety & Health Administration
200 Constitution Avenue NW, Washington, DC 20210
 40. PCA Portland Cement Association
5420 Old Orchard Road, Skokie, IL 60077
 41. PCI Prestressed Concrete Institute

- 200 West Adams Street Suite 2100, Chicago, IL 60606
42. SAE Society of Automotive Engineers
SAE World Headquarters
Commonwealth Drive, Warrendale, PA 15096-0001
43. SDI Steel Deck Institute
P.O. Box 25, Fox River Grove, IL 60021
44. SDI Steel Door Institute
30200 Detroit Road, Westlake, OH 44145-1987
45. SIGMA Sealed Insulating Glass Manufacturers Assoc.
North Michigan Avenue Suite 2400, Chicago, IL 60611
46. SJI Steel Joist Institute
234 Cheves Street, Florence, SC 29501
47. SMACNA Sheet Metal and Air Conditioning
Contractor's National Association
4201 Lafayette Center Drive, Chantilly, VA 20151-1219
48. SSPC Society for Protective Coatings
40 24th Street 6th Floor, Pittsburgh, PA 15222-4656
49. TCA Tile Council of America
100 Clemson Research Boulevard, Anderson, SC 29625
50. UL Underwriters Laboratories
333 Pfingston Road; Northbrook, IL 60062

1.04 SUBMITTALS

- A. For Owner's records, Contractor shall submit copies of permits, licenses, certifications, inspection reports, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1.05 DEFINITIONS

- A. Indicated:
1. The term "indicated" is a cross-reference to details, notes, or schedules on the drawings, to other paragraphs or schedules in the specifications and to similar means of recording requirements in the Contract Documents.
 2. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated", it is for the purpose of helping the reader locate cross-reference, and no limitation is intended except as specifically noted.
- B. Approve (or Words of Similar Nature):

1. Where used in conjunction with Engineer's response to submittals, requests, applications, inquiries, reports, and claims by Contractor, the meaning of the term "approve" will be held to the limitation of Engineer's responsibilities and duties as specified in Paragraph 1.02.B.1. of the General Conditions.
 2. In no case will "approval" by Engineer be interpreted as a release of Contractor from responsibility to fulfill requirements of the Contract Documents.
- C. Minimum Requirements:
1. Indicated requirements are for a specific minimum acceptable level of quality or quantity, as recognized in the industry.
 2. Actual work must comply with (or within specified tolerances) or exceed minimums.
 3. Contractor shall refer uncertainties to Engineer before proceeding.
- D. Abbreviations: Abbreviations, where not defined in the Contract Documents, will be interpreted to mean the normal construction industry terminology.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 01 66 01

MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: Contractor shall be responsible for the delivery, handling, storage and protection of all material and equipment required to complete the Work as specified herein.
- B. Related Sections and Divisions: Specific requirements for the handling and storage of material and equipment are described in other sections of these Specifications.

1.02 PRODUCTS

- A. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.
- B. Contractor shall not use materials and equipment removed from existing construction, except as specifically required, or allowed, by the Contract Documents.
- C. When any construction deviations from the Drawings and/or Specifications necessary to accommodate equipment supplied by Contractor, result in additional costs to Contractor or other contractors, such additional costs shall be borne by Contractor. Contractor shall also pay any additional costs necessary for revisions of Drawings and/or Specifications by Engineer.
- D. Each major component of equipment shall bear a nameplate giving the name and address of the manufacturer and the catalogue number or designation.

1.03 TRANSPORTATION AND HANDLING

- A. Materials, products and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.
- B. Contractor shall not overload any portion of the structure in the transporting or storage of materials.
- C. Contractor shall not damage other construction by careless transportation, handling, spillage, staining or impact of materials.
- D. Contractor shall provide equipment and personnel to handle products, including those provided by Owner, by methods to prevent soiling and damage.
- E. Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.
- F. Contractor shall handle product by methods to avoid bending or overstressing. Lift large and heavy components only at designated lift points.

1.04 DELIVERY AND RECEIVING

- A. Contractor shall arrange deliveries of products in accordance with the Progress Schedule, allowing time for observation prior to installation.

- B. Contractor shall coordinate deliveries to avoid conflict with the Work and conditions at the Site; limitations on storage space; availability of personnel and handling equipment and Owner's use of premises.
- C. Contractor shall deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.
- D. Contractor shall clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.
- E. Immediately on delivery, Contractor shall inspect shipment to assure:
 - 1. Product complies with requirements of Contract Documents and reviewed submittals.
 - 2. Quantities are correct.
 - 3. Accessories and installation hardware are correct.
 - 4. Containers and packages are intact and labels legible.
 - 5. Products are protected and undamaged.

1.05 STORAGE AND PROTECTION

A. General:

- 1. Contractor shall store products, immediately on delivery, in accordance with manufacturer's instructions, with all seals and labels intact and legible.
- 2. Available storage space at the Site is limited. Any additional off-site space required shall be arranged by Contractor.
- 3. Contractor shall allocate the available storage areas and coordinate their use by the trades on the job.
- 4. Contractor shall arrange storage in a manner to provide access for maintenance of stored items and for observation.

B. In enclosed storage, Contractor shall:

- 1. Provide suitable temporary weather tight storage facilities as may be required for materials that will be damaged by storage in the open.
- 2. Maintain temperature and humidity within ranges stated in manufacturer's instructions.
- 3. Provide ventilation for sensitive products as required by manufacturer's instructions.
- 4. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- 5. Store solid materials such as insulation, tile, mechanical and electrical equipment, fittings, and fixtures under shelter, in original packages, away from dampness and other hazards.
- 6. Store liquid materials away from fire or intense heat and protect from freezing.

C. At exterior storage, Contractor shall:

- 1. Store unit materials such as concrete block, brick, steel, pipe, conduit, door frames, and lumber off ground, out of reach of dirt, water, mud and splashing.
- 2. Store tools or equipment that carry dirt outside.

3. Store large equipment so as not to damage the Work or present a fire hazard.
4. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet material and provide ventilation to avoid condensation.
5. Completely cover and protect any equipment or material which is prime coated or finish painted with secured plastic or cloth tarps. Store out of reach of dirt, water, mud and splashing.
6. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.
7. Provide surface drainage to prevent erosion and ponding of water.
8. Prevent mixing of refuse or chemically injurious materials or liquids.
9. Cover aggregates such as sand and gravel in cold wet weather.
10. Remove all traces of piled bulk materials at completion of work and return site to original or indicated condition.

1.06 MAINTENANCE OF STORAGE

- A. Contractor shall periodically inspect stored products on a scheduled basis.
- B. Contractor shall verify that storage facilities comply with manufacturer's product storage requirements and verify that manufacturer required environmental conditions are maintained continually.
- C. Contractor shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.
- D. Contractor shall perform scheduled maintenance of equipment in storage as recommended by the manufacturer. A record of the maintenance shall be kept and turned over to Engineer when the equipment is installed.

1.07 INSTALLATION REQUIREMENTS

- A. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified.
- B. After installation, Contractor shall protect all materials and equipment against weather, dust, moisture, and mechanical damage.
- C. Contractor shall be responsible for all damages that occur in connection with the care and protection of all materials and equipment until completion and final acceptance of the Work by Owner. Damaged material and equipment shall be immediately removed from the Site.

1.08 EQUIPMENT WARRANTIES

- A. Warranties shall be nonprorated, include all parts and labor, and be in written form. Warranties shall specifically exclude buyer's indemnification language. Warranty language shall not eliminate manufacturer's responsibility for sizing of the equipment. During warranty period, manufacturer shall be responsible for any travel expenses, outside contractor fees, and rental equipment fees associated with providing warranty service.

Warranties shall not exclude normal wear items. Manufacturer shall pay expenses incurred for repairs and parts replacement not made by manufacturer if manufacturer's response is not within 72 hours of notification by Owner. Warranty language shall be provided with the shop drawings.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

TS No. _____

EQUIPMENT START-UP AND O&M TRAINING SCHEDULING FORM

FEHR GRAHAM

PROJECT _____ CLIENT _____

CONTRACT _____

CONTRACTOR _____ Date: _____

The following equipment is scheduled for start-up on _____

EQUIPMENT NAME: _____ SPECIFICATION SECTION: _____

MANUFACTURER: _____ MINIMUM HOURS OF TRAINING: _____

DATE O&M MANUALS SUBMITTED: _____

Specification Section 01 75 01 requires that start-up and operation and training be conducted by a qualified manufacturer's representative prior to placing equipment in operation. Review Specification Sections 01 33 23 and 01 40 00 and the individual equipment sections for start-up and training requirements. Owner may find it necessary to propose alternate dates for training based on conflicts with other training and staff availability. The Operation and Maintenance Manuals must be submitted prior to training.

After the equipment or system has been properly installed and is functioning correctly, submit a written report in accordance with Specification Section 01 40 00.

Submit the completed form to Engineer and Owner at least 7 days prior to start-up and training. Proposed Training Date: _____ Time of Training: _____

Factory-trained representative giving training:

Name(s): _____

Company: _____

Address: _____

Phone: _____

Fax: _____

E-mail: _____

CERTIFICATE OF PROPER INSTALLATION

Project _____
Equipment _____
Specification Section _____
Contract _____

I hereby certify the equipment supplier/manufacturer has inspected this equipment and that it has been properly installed, adjusted, and calibrated. I further certify this equipment may now be operated for test purposes and/or normal use.

MANUFACTURER’S REPRESENTATIVE

Signature _____ Date _____
Name (print) _____
Title _____
Representing _____

CONTRACTOR

Signature _____ Date _____
Name (print) _____
Title _____

This form shall be completed and submitted to Engineer prior to Owner training.

SECTION 01 75 01

STARTING OF SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. General.
 - 2. Equipment and system installation.
 - 3. Starting equipment and systems.
 - 4. Demonstration, instructions, and operator training.
 - 5. Start-up and testing.
 - 6. Equipment systems requiring certification of proper installation.
- B. Contractor shall perform the Work described in the following subsections.

1.02 GENERAL

- A. The number of days for manufacturer's services stated in the Specifications shall be considered as the minimum number of days. Should additional time be required for services because of equipment malfunction or other problem, such time shall be at the expense of Contractor, with no change in Contract Price.
- B. "Days" specified shall consist of 8-hour days on-site, excluding travel time.
- C. Contractor shall designate and provide one person to be responsible for scheduling, coordinating, and expediting the specified services. Scheduling the services shall be done in cooperation with, and with the prior approval of Engineer and Owner. Such schedule shall be arranged with the appropriate subcontractors, manufacturers, and suppliers with sufficient time to allow their compliance with the service requirements.
- D. Contractor shall manage equipment checkout such that checkout has been completed and deficiencies addressed prior to demonstration and training. Scheduling training prior to checkout may result in cancellation when checkout cannot be completed prior to training.
- E. The City of Rockford will complete integration of equipment, but physical startup of the equipment will be the responsibility of the Contractor. Contractor shall be available by phone within 2 hours of a call from the City until integration effort by the City is complete. The Contractor/Subcontractor shall be available within 24 hours to meet on-site if any problems or questions arise related to the Contractor's scope of work until integration effort by the City is complete. Coordination will be required between the City and the Contractor during startup.

1.03 EQUIPMENT AND SYSTEM INSTALLATION

- A. Competent and experienced technical personnel shall represent the manufacturers of all equipment and systems for as many days as may be necessary to provide proper installation and to resolve assembly or installation problems at the site that are attributable to, or associated with, the equipment furnished. This requirement applies to manufacturers for all equipment furnished, whether or not specifically set forth in the Specifications.
- B. Where a manufacturer's certificate is called for in this Specification Section, the manufacturer's representative shall provide the attached certificate stating that the equipment or system has been installed in accordance with the manufacturer's instructions and has been inspected by a manufacturer's authorized representative, that it has been serviced with the proper initial lubricants, that applicable safety equipment has been properly installed, that the proper electrical and mechanical connections have been made, and that any other manufacturer requirements have been met. This certification shall be provided to Engineer and Owner prior to the start-up. This certificate is in addition to the manufacturer's standard startup reports, checklists, and other pertinent information.
- C. Functional (or run) testing is required for all equipment and systems. The manufacturer's representative shall supervise the functional test, which shall include checking for proper rotation, alignment, speed, excessive vibration, and noisy operation. The Manufacturer's Certificate of Proper Installation shall state that proper adjustments have been made and that the equipment or system is ready for start-up.
- D. Manufacturer shall demonstrate, using laser alignment equipment, if appropriate, that the installed equipment has been aligned properly. Final acceptance of equipment will not be granted until manufacturer has demonstrated to Engineer that acceptable alignment to tolerances have been achieved. For pumps with motors 7.5 hp and larger, the acceptable shaft alignment tolerances shall be as recommended in the pump manufacturer's written instructions and shall include parallel offset and angular gap measurements.

1.04 STARTING EQUIPMENT AND SYSTEMS

- A. Where field testing and start-up services are called for in the Specifications, or when technical assistance is necessary as a result of any malfunction of the equipment or system furnished, the manufacturer's representative shall provide such services.
- B. Manufacturer's representative shall also conduct and/or assist with performance testing, as required by the Specifications. These services shall continue until such times as the applicable equipment or system has been successfully tested for performance and has been accepted by Owner for full-time operation.
- C. Coordinate schedule for start-up of various equipment and systems. Coordination includes, but is not limited to, communication with subcontractors, suppliers, Owner, and Engineer. Contractor shall confirm that all necessary work is complete and that the equipment and systems can be operated in conjunction with all associated processes.
- D. Notify Engineer and Owner a minimum of 7 days prior to start-up of each item using the attached Equipment Startup and O&M Training Scheduling form. Contractor shall submit form to Engineer.
- E. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions that may cause damage.

- F. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- G. Verify wiring and support components for equipment are complete and tested.
- H. Execute start-up under supervision of applicable manufacturer's representative and Contractor's personnel in accordance with manufacturers' instructions.
- I. Require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up and to supervise placing equipment or system in operation.
- J. Equipment manufacturer shall provide a written report covering checkout, testing, inspections, and start-up and shall identify any deficiencies noted. Report shall be submitted to Engineer. Contractor shall be responsible for correcting all deficiencies noted in report. In addition, Contractor shall submit a fully executed Certificate of Proper Installation form if required in Paragraph 3.01 of this section.

1.05 DEMONSTRATION, INSTRUCTIONS, AND OPERATOR TRAINING

- A. For all mechanical equipment and systems and where called for in the Specifications, provide a qualified technical representative to provide detailed instructions to Owner's personnel for operation and maintenance of equipment and associated instrumentation. Training services shall include pre-start-up classroom instruction and start-up on-site instruction, as stated in the Specifications.
- B. Refer to the Specifications for additional training requirements.
- C. Contractor shall coordinate the pre-start-up training periods with Owner's operating personnel and manufacturers' representatives.
 - 1. Schedule training dates and times with Owner, that are acceptable to the Owner, using equipment, startup, and O&M training form. Normal hours available for training are between 7:30 A.M. to 3 P.M., Monday through Friday, except for holidays.
 - 2. Submit outline and presentation to Engineer at least 7 days in advance of training.
 - 3. Provide name, contact information, and brief synopsis of qualifications of the trainer.
 - 4. If materials above are not provided at least 7 days in advance, training may be canceled.
 - 5. Failure of supplier's or manufacturer's representative to appear for scheduled training, failure to notify Owner 24 hours in advance of need to cancel scheduled training or failure to arrive within 30 minutes of start of scheduled training shall result in reimbursement to Owner for time lost by Owner's personnel in waiting for arrival of manufacturer's representative. Except in case of failure to arrive on time, time will not exceed 1 hour for each employee scheduled to receive training. Failure to arrive on time will be reimbursed by actual time late, up to 1 hour, after 1 hour, training will be rescheduled. Contractor shall reimburse Owner via a change order.
 - 6. During the training, instructor will dedicate its time solely to training and not start-up services.
 - 7. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

8. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment.
 9. Prepare and insert additional data in operation and maintenance manuals when need for additional data becomes apparent during instruction.
 10. Owner may videotape the training for future internal use. Provide to Owner paper and electronic copies of any media used as part of training.
 11. Provide training handouts for each of Owner's personnel present.
- D. Contractor shall provide attached Certificate of Operator Training cosigned by Owner and supplier's representative verifying training was accomplished to satisfaction of all parties.
 - E. Operation and maintenance manual submitted in accordance with Section 01300–Submittals shall be provided prior to operator training.
 - F. For equipment or systems requiring seasonal operation, perform demonstration for dormant season at start of dormant season.
 - G. Final payment for various items of equipment will not be made by Owner until the equipment is operating to Owner's satisfaction.
 - H. Where items of equipment are placed into service at different times or sequence, manufacturer's services for start-up, field testing, and supervision shall be provided for each time or sequence. Training shall be provided prior to or at the time the first similar item of equipment is placed in service.

1.06 START-UP AND TESTING

- A. Prior to acceptance of any portion of the Work, start-up and testing of all equipment and testing of all materials furnished on the Project by Contractor shall have been conducted in the presence of representatives of Contractor, Owner, and Engineer and also manufacturer if requested by Owner or Engineer.
- B. Contractor shall provide whatever temporary installations and conditions are necessary in order to perform start-up and testing operations on all equipment and materials furnished under the Contract. Temporary connections and equipment necessary during start-up and testing operations shall include, but not be limited to, temporary piping and electrical power and control equipment and devices, temporary connection from various parts of the systems and any other labor, materials, fuel, devices, or items that may be required for start-up and testing operations. Temporary conditions shall include filling with water, if necessary, to check equipment and materials.
- C. All temporary installations and conditions shall be removed by Contractor upon completion of start-up and testing.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 EQUIPMENT SYSTEMS REQUIRING CERTIFICATION OF PROPER INSTALLATION.

- A. All equipment specified in the plans and these specifications.

END SECTION.

SECTION 01 77 00

CONTRACT CLOSEOUT

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.
 - 4. Project record documents.
 - 5. Warranties.
 - 6. Spare parts and maintenance materials.

1.02 CLOSEOUT PROCEDURES

- A. Contractor shall provide submittals to Engineer that are required by governing or other authorities.
- B. Contractor shall comply with General Conditions and Supplementary Conditions and complete the following before requesting Engineer's observation of the Work, or designated portion thereof, for substantial completion.
 - 1. Submit executed warranties, workmanship bonds, maintenance agreements, inspection certificates, and similar required documentation for specific units of Work, enabling Owner's unrestricted occupancy and use.
 - 2. Submit record documentation, maintenance manuals, tools, spare parts, keys, and similar operational items.
 - 3. Submit consent of surety (if surety required in Contract).
 - 4. Complete final cleaning, touch-up work of marred surfaces, and remove temporary facilities and tools.

1.03 FINAL CLEANING

- A. It is Contractor's responsibility to completely clean up the inside and outside of all buildings and the construction site at the completion of the Work.
- B. Contractor shall clean areas of the building in which painting and finishing work is to be performed just prior to the start of this work and maintain these areas in satisfactory condition for painting and finishing. This cleaning includes:
 - 1. Removal of trash and rubbish from these areas.
 - 2. Broom cleaning of floors.
 - 3. Removal of any plaster, mortar, dust, and other extraneous materials from finish surfaces, including but not limited to exposed structural steel, miscellaneous metal, masonry, concrete, mechanical equipment, piping, and electrical equipment.

- C. In addition to the cleaning specified above and the more specific cleaning that may be required in various technical sections of the Specifications, Contractor shall prepare the Project for occupancy by a thorough cleaning throughout, which shall include the following:
 - 1. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
 - 2. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
 - 3. Replace filters of operating equipment.
 - 4. Clean debris from roofs, gutters, downspouts, and drainage systems.
 - 5. Clean site; sweep paved areas, rake clean landscaped surfaces.
 - 6. Remove waste and surplus materials, rubbish, and construction facilities from the Site.

1.04 ADJUSTING

- A. Contractor shall adjust operating products and equipment to ensure smooth and unhindered operation.

1.05 PROJECT RECORD DOCUMENTS

- A. Contractor shall maintain on Site, one set of the following record documents to record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Contractor shall ensure entries are complete and accurate, enabling future reference by Owner.
- C. Contractor shall store record documents separate from documents used for construction.
- D. Contractor shall record information concurrent with construction progress.
- E. Specifications: Contractor shall legibly mark and record at each Product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by addenda and modifications.
- F. Record Drawings: Contractor shall legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

1.06 WARRANTIES

- A. Contractor shall provide warranties beyond project one year warranty as required by technical sections and as follows.
- B. Submit warranty information as follows:
 1. Provide notarized copies.
 2. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers, and provide Table of Contents and assemble in three ring binder with durable cover.
 3. Submit with request for certificate of Substantial Completion.
 4. For items of work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

Contractor shall provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END SECTION.

SECTION 04 22 00

CONCRETE UNIT MASONRY ASSEMBLIES

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Includes:
 - 1. General Contractor Provide:
 - a. Concrete masonry units.
 - b. Ties and anchors.
 - c. Masonry cleaners.
- B. Work is related to the installation of containment walls and as necessary to facilitate the installation of equipment.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Section 09 91 00 – Painting and Finishing
- B. Products installed, but not furnished, under this Section include the following:
 - 1. Concrete unit masonry containment walls

1.03 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - 2. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through once source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar Ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.06 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

PART 2 – PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners, unless indicated as bullnose.
- B. Concrete Masonry Units: ASTM C 90, Grade N and as follows:
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
 - 2. Weight Classification: Normal Weight.
 - 3. Provide Type I, moisture-controlled units.
 - 4. Size (Width): Manufactured to the following dimensions:
 - a. 6 inches nominal; 5-5/8 inches actual.
 - b. 8 inches nominal; 7-5/8 inches actual.
 - c. 10 inches nominal; 9-5/8 inches actual.
 - d. 12 inches nominal; 11-5/8 inches actual

5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to receive a direct application of plaster, provide texture-face units made with gap-graded aggregates.
 - b. Where units are to be left exposed, provide color and texture matching the range represented by approved sample.

2.02 TIES AND ANCHORS

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

2.03 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 1. Non-headed bolts, bent in manner indicated.
- B. Post installed Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 1. Type: Chemical anchors.
 2. Type: Expansion anchors.
 3. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/An 5 for Class Sc 1 service condition (mild).
 4. For Post-Installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
 5. For Post-Installed Anchors in Grouted Masonry Units: Capability to Sustain, without failure, a load equal to six times the loads imposed.

2.04 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of ½ cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gal. of water.

2.05 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
- B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
 1. Limit cementitious materials in mortar to Portland cement, mortar cement, and lime.
 2. For all masonry, use type S mortar.

- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or course) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.02 INSTALLATION

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 - 1. Mix units from several pallets or cubes as they are placed.
- E. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- F. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.03 CONSTRUCTION TOLERANCES

- A. Comply with tolerances specified in ACI 530.1/ASCE 6/TMS 602, and the following:

1. For conspicuous vertical lines, such as external corners, door jambs, reveals and expansion and control joints, do not vary from plumb by more than 1/4-inch in 20-feet, nor 1/2-inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than ¼-inch in 10-feet, nor 1/2-inch maximum.
3. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half size units, particularly at corners, jambs, and where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. One-half running bond with vertical joint in each course centered on units in courses above and below.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- F. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- G. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.
- H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- I. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- J. Build non-load-bearing interior partitions full height of story to underside of solid floor of roof structure above, unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.

2. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above.

3.05 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 1. With full mortar coverage on horizontal and vertical face shells.
 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
- B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
 1. At cavity walls, bevel beds away from cavity, to minimize mortar protrusions into cavity. As work progresses, trowel mortar fins protruding into cavity flat against the cavity face of the brick.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct applied finishes (other than paint), unless otherwise indicate.

3.06 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but no more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.07 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACE 530.1/ASCE 6/TMS 602.

- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
 - 1. Comply with requirements of ACE 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.08 FIELD QUALITY CONTROL

- A. The Contractor shall engage a qualified independent testing agency to perform field quality-control testing indicated below.
- B. Retesting of materials failing to meet specified requirements shall be performed at Contractor's expense.
- C. Testing Frequency: Tests and Evaluations listed in this Article shall be performed during construction for each 5,000 sq. ft. of wall area or portion thereof.
- D. Mortar properties shall be tested per ASTM C 780.
- E. Grout shall be samples and tested for compressive strength per ASTM C 1019.
- F. Brick Tests: For each type and grade of brick indicated, units shall be tested according to ASTM C67.
- G. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units shall be tested according to ASTM C 140.

3.09 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
 - 4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

END SECTION.

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section covers the work necessary for miscellaneous metal work including, but not limited to, the following:
 - 1. Anchor Bolts and Fastenings
 - 2. Miscellaneous Metal Supports
- B. The Contractor shall perform all work as indicated below unless otherwise noted, and any additional work to produce a complete, finished job.

1.02 RELATED SECTIONS

- A. References to any of the following Sections are only for clarity of reading and reference, and shall not be taken as a complete description of the work. Related work as specified elsewhere is as follows:
 - 1. Section 09 91 00 – Painting and Finishing

1.03 SUBMITTALS

- A. Submittals shall be as specified in the General Conditions.
- B. Submit the following:
 - 1. Certified copies of test reports of factory tests required by the applicable standards.
 - 2. Shop drawings and performance data and physical characteristics for miscellaneous metals fabrication.
 - a. Include details of dimensions, cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
 - b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
 - 3. Welding certification as specified in this Section.

1.04 MATERIALS AND WORKMANSHIP

- A. Metal work shall be finished straight, smooth, and even and free from defects and to the sizes specified and required.
- B. The Contractor shall frame all work. Materials shall be manufactured and delivered in ample time for the installation of work built into structures.

- C. The Contractor shall provide all necessary angles, brackets, metal inserts, anchor bolts, frames, adjusting screws, and bolt gaskets to properly secure metal work to the masonry, structural steel framing, or other parts of the structure; and all other items necessary for the complete installation of the work intended, whether or not specified herein or shown on the Drawings. Use of rivets are not allowed.
- D. Welding for steel, and in particular anodized aluminum and stainless steel, shall be neat, symmetrical, clean, and unobtrusive in appearance.

1.05 QUALITY ASSURANCE

- A. The Contractor shall design and construct all work in accordance with the Illinois Building Code, latest edition. Design briefs shall be submitted, if required.
- B. The recognized authority is by application of the following publications:

- 1. U.B.C.
- 2. ASTM
- 3. OSHA

- C. Codes and Standards

Comply with the provisions of the followings, except as otherwise indicated:

- 1. AISC "Code of Standard Practice for Steel Buildings and Bridges". Paragraph 4.2.1 of this code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings."
- 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
- 3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts", approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
- 4. American Welding Society (AWS) D1.1 "Structural Welding Code-Steel".
- 5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
- 6. Structural aluminum construction shall conform to the Aluminum Association's Aluminum Design manual "Specifications for Aluminum Structures – Allowable Stress Design".

- D. Qualifications for Welding Work

- 1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
- 2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting will be the Contractor's responsibility.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. All metal fabrications shall be prominently marked for identification in assembly either by painting or attached tag.
- B. Metals shall be handled and stored in such a manner as to prevent damage, corrosion, or deterioration of paint finishes.
- C. Piling sections shall be marked for length and sorted and stacked at the job site to prevent distortion and to facilitate proper sequence of setting and driving.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Unless specified otherwise, materials shall meet the following requirements:
 - 1. Structural steel and mild steel: ASTM A36
 - 2. Steel pipe: ASTM A-53
 - 3. Steel tubing: ASTM A501
 - 4. Galvanizing 1.25 ounces per square foot of surface area: ASTM A-123
 - 5. Aluminum: Alloy designation of the Aluminum Association

| | Description | Alloy Type |
|----|--|------------|
| a. | Extruded, Structural and rolled Shapes | 6061-T6 |
| | Structural Welded Rod | 5554 |
| | (Anodized-AA C22 A31) | (5356) |
| b. | Smooth Plates | 5053-T6 |
| | Welded Rod | 5356 |
| c. | Tread Plate | 6061-T6 |
| | Welding Rod | 4043 |
| | (Anodized-AA C22 A31) | (5356) |

2.02 STAINLESS STEEL SHAPES, PLATES, AND ANCHOR BOLTS

- A. Stainless steel shapes, plates, and anchor bolts shall conform to the requirements of ASTM A167.
 - 1. Exterior and Submerged Use – A167, Type 316
 - 2. Industrial Uses – A167, Type 316
 - 3. Interior and Architectural Use – A167, Type 302/304
 - 4. Anchor Bolts – A167, Type 316

2.03 ANCHOR BOLTS AND FASTENINGS

- A. Unless specified otherwise; nuts and bolts, washers, rivets, and screws shall be stainless steel.
- B. Fastening for stainless steel and aluminum work shall be stainless steel.
- C. Stainless steel shall be ASTM A-276, Type 304 standards.
- D. Structural high strength bolts shall be ASTM A-325 standards.
- E. Anchors or fastenings required to fix equipment after concrete has been placed shall be the epoxy adhesive type, or alternative anchorage according to the equipment manufacturer's instructions.
- F. Epoxy Adhesive Anchors Standard:
 - 1. Hilti: HIT-RE 500 V3 with Stainless Steel Rod
 - 2. Simpson Strong Tie: ET-Epoxy Tie Adhesive with Stainless Steel Rod

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Erect miscellaneous structural steel items in accordance with AISC Code.
- B. Erect structural aluminum items in accordance with the Aluminum Association Specifications.
- C. All field welding shall be in accordance with AWS D1.1.
- D. Where dissimilar metals are in contact, or when aluminum is in contact with concrete, mortar, masonry, or pressure-treated wood; protect dissimilar surfaces as specified in Section 09 91 00.
- E. Field assembly shall meet the following requirements:
 - 1. Frames shall be accurately assembled to the lines and elevations indicated.
 - 2. The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.
- F. Unless otherwise indicated on the Drawings, provide stainless steel hardware in submerged conditions, including expansion bolts, equipment anchors, nuts, bolts, and washers used for mounting piping, equipment, and other submerged items.

3.02 PAINTING

- A. All items not fabricated from aluminum, stainless steel, or galvanized steel shall be thoroughly cleaned and prepared and given one shop coat of an approved primer in accordance with Section 09 91 00, before shipment. Do not shop coat portions of steel work to be built into concrete except for one inch adjacent to the exposed portions. The Contractor shall paint or touch up abrasion marks where shop paint has been removed or chipped during erection or transportation, using the same paint as specified for shop painting.

- B. The Contractor shall paint all aluminum in contact with concrete or steel with two coats of approved bitumen prior to fixing.

3.03 MISCELLANEOUS SUPPORTS

- A. Miscellaneous supports shall be provided to the sizes, details, and locations as shown on the Drawings.

3.04 FASTENERS

- A. The Contractor shall install stainless steel bolts and washers for all aluminum connections.

END SECTION.

SECTION 09 91 00

PAINTING AND FINISHING

PART 1 – GENERAL

1.01 SUMMARY

- A. Furnish and apply coatings and do related work necessary to complete the work shown or specified.
- B. Painting will be required on the proposed containment wall and touched up as needed based on the impacts of construction.

1.02 CODES, SPECIFICATIONS AND STANDARDS

- A. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.

1.03 DEFINITIONS

A. Abbreviations

- 1. ASTM – American Standard Testing Materials
- 2. OSHA – Occupational Safety and Health Administration
- 3. SSPC – Steel Structures Painting Council
- 4. TNE – Tnemec Company, Inc.
- 5. SW – The Sherwin Williams Paint Co.
- 6. DFT – Dry film thickness
- 7. DMT – Dry mil thickness
- 8. NFPA – National Fire Protection Association
- 9. NACE – National Association of Corrosion Engineers

B. Coating

- 1. The term coating includes emulsions, enamels, paints, stains, varnishes, sealers, emulsion filler, and other coating materials whether used as prime, intermediate, or finish coats.

C. Spatter

- 1. Drops and droplets of coating and spilled or splashed coatings on surfaces not specified to be coated or surfaces previously finish coated.

1.04 QUALITY ASSURANCE

- A. All coating and surface preparation shall be completed by a qualified painting contractor who shall have experience in applying protective coatings to industrial and municipal water and wastewater treatment facilities.

- B. All coating shall be done strictly in accordance with the most recent manufacturer's printed instructions and shall be performed in a manner satisfactory to the Owner.
- C. Minimum requirements for materials are included in this Section. These requirements are intended to establish standards of quality. Products of manufactures which meet all minimum requirements as herein established shall be acceptable. Written acceptance of the materials to be used shall be obtained prior to surface preparation or application.
- D. No request for substitution will be considered which decreases the film thickness designated, or which offers a change from the generic type of coating specified. Requests for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, and nonvolatile content by volume.
- E. All materials shall be brought to the job site in the original sealed and labeled containers of the manufacturer and shall be subject to inspection by the Engineer's representative.
- F. All materials shall be the product of, or recommended by, the coating manufacturer.
- G. All materials shall be compatible with the service intended. No products shall be used that may have ingredients which might react detrimentally with the adjacent fluids or gases.

1.05 SUBMITTALS

- A. Submittals shall be as specified in Section 01 33 23.
- B. Submit the following:
 - 1. Technical product data sheets for all products used.
 - 2. Color charts
 - 3. Samples of slip-resistant adhesive tape, if used.
 - 4. List of surfaces indicating coating system and colors.
 - 5. Manufacturer's application instructions.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for the delivery, storage, and handling of the products.
- B. Promptly remove damaged or deteriorated products from the job site, including products which have exceeded their shelf life. Replace damaged products with undamaged and undeteriorated products.
- C. All painting materials stored on the job site shall be stored in a location consistent to the manufacturer's storage requirements. The Contractor shall take all safety precautions in accordance with NFPA Bulletin No. 101.

1.07 JOB CONDITIONS

- A. Environmental Requirements
 - 1. Perform coating work in strict conformance with the manufacturer's printed recommendations as to environmental conditions under which the coating and coating systems can be applied.
 - 2. Do not apply the finish in areas where dust is being generated.

3. During the course of the coating work, adequately ventilate the coated spaces to ensure there will be no concentration of noxious odors, hazardous fumes, or flammable vapors.
 4. Unless otherwise noted, do not apply coating in damp weather or when the temperature is below 50°F or above 95°F.
 5. Provide heating and enclosures when necessary to maintain the specified temperature during the application and curing of the coatings.
 6. Provide forced air circulation in enclosed areas during the application and curing periods.
 7. All costs associated with providing and/or maintaining the required environmental conditions shall be borne by the coating sub-contractor.
- B. Protection
1. Protect all finish work of other trades and surfaces not being coated. Furnish suitable coverings as required. Remove coating spatter from all finished surfaces, and restore finishes of affected items to their original conditions at no additional cost to the Owner.
 2. Post "Wet Paint" notices, as required, to protect newly coated surfaces.
 3. Keep oily rags and waste in Underwriters' Laboratories labeled metal containers. Do not allow oily rags and waste to accumulate in buildings.
 4. Protection of Adjacent Surfaces
 - a. Cover or otherwise protect all finished work or other trades and surfaces not being painted. Remove finish hardware, accessories, light fixtures and cover plates, factory finished work, and similar items. Replace upon completion of painting.
- C. Job Site Conference
1. The Contractor shall arrange and conduct a job site conference between the coating manufacturer's representative, the Owner's representative, and the personnel assigned this work prior to any field surface preparation or coating application.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Except as otherwise specified, materials shall be the products of the following manufacturers, or approved equal:
1. Tnemec Company, Inc. (TNE)
 2. The Sherwin Williams Company (SW)
- B. Equivalent materials of other manufacturers may be substituted on written approval of the Engineer. Requests for substitution shall include the manufacturer's literature for each product giving the name, generic type, and descriptive information. Submittals shall include the following performance data as certified by a qualified testing laboratory:
1. ASTM D 4541: Adhesion
 2. ASTM B 117: Salt Spray

3. ASTM D 1653: Permeability
 4. ASTM D 4060: Abrasion
 5. ASTM D 4585: Humidity
 6. Galvanic Protection: Conductivity
- C. Materials selected for coating systems for each type of surface shall be the product of a single manufacturer, unless otherwise acceptable to the Engineer.

2.02 MATERIALS

- A. All field applied primers and undercoats shall be provided to ensure compatibility of the total coating systems and of the same manufacturer as the finish coats for each system as specified hereafter. Provide barrier coats over incompatible primers or remove and re-prime as required. No thinner or solvents other than those approved by the Coating Manufacturer shall be used.
- B. All materials shall herein be assigned a designation number for ease of reference. The minimum material requirements shall be as listed.

2.03 COATING SYSTEMS

- A. All surfaces to be coated shall be cleaned of all dirt, oil, grease, salts, mill scale, and other foreign matter prior to the surface preparation and coating applications described below.
- B. Non-Submerged Interior or Exterior Metals, Machinery, and Piping
 1. Surface Preparation
 2. Commercial blast, per SSPC-SP6; Achieve 1.0 to 2.0 mil profile
 3. Prime Coat (shop coated or field coated)
 - a. Organic Zinc-Rich Urethane; One coat; 2.5 to 3.5 mils DFT
 - 1) TNE: Tneme-Zinc, Series 90-97
 - 2) SW: Corothane I Galvapa 1K Zinc Primer; B65G11
 4. Finish Coat
 - a. Aliphatic Acrylic Polyurethane; Two coats, 2.0 to 5.0 mils DFT per coat
 - 1) TNE: Endura-Shield, Series 73U
 - 2) SW: Acrolon 218 HS, B65 W600 Series
 5. Minimum of three coats and a minimum total finished DMT of 6.5.
- C. Interior or Exterior Fiberglass (FRP) and PVC Piping and Surfaces
 1. Surface Preparation
 2. Cleaner/Detergent per SSPC-SP1, Lightly abrade with sandpaper; Surface to resemble medium-grit sandpaper
 3. Prime Coat
 - a. Epoxy; One coat; 2.5 to 4.0 mils DFT

- 1) TNE: Hi-Build Epoxoline, Series 66 or 69
 - 2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series
4. Finish Coat (Interior)
 - a. Polyamide Epoxy; One coat, 2.5 to 4.0 mils DFT
 - 1) TNE: Hi-Build Epoxoline, Series 66 or 69
 - 2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series
 5. Finish Coat (Exterior)
 - a. Aliphatic Acrylic Polyurethane; One coat, 2.5 to 4.0 mils DFT
 - 1) TNE: Endura-Shield, Series 73
 - 2) SW: Acrolon 218 HS, B65 W600 Series
 6. Minimum of two coats and a minimum total finished DMT of 5.0.
- D. Interior Concrete Walls and Ceilings
1. Surface Preparation
 - a. Abrade per ASTM D4259; achieve a profile of 80 grit sandpaper. Fill in voids, holes, pits, and cracks per the manufacturer's instructions. Scrub existing walls with ADD H2O.
 2. Prime Coat and Finish Coat
 - a. Epoxy
 - 1) TNE: Tneme-Glaze, Series 280, 2 coats, 8.0 to 10.0 mils DFT per coat
 - 2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series, 2 coats, 8.0 to 10.0 mils DFT per coat
 3. Minimum of two coats and a minimum total finished DMT of 16.0.
- E. Concrete Floors
1. Surface Preparation
 - a. Prepare per ASTM D4259; achieve a profile of 80 grit sandpaper, or per manufacturer's instructions.
 2. Clear or Colored Sealer; Gloss Finish
 - a. Prime Coat: Epoxy, One coat
 - 1) TNE: Series 201 Epoxyprime, 10.0 to 12.0 mils DFT
 - 2) SW: ArmorSeal 1000 HS, B67-2000 Series, 10.0 to 12.0 mils DFT
 3. Minimum of two coats and a minimum total finished DMT of 8.0.
- F. General Requirements
1. The total finish dry mil thickness shall be in accordance with the manufacturer's coating system's requirements.

2. The term submerged applies to water and wastewater. Special consideration shall be given to applications where acids or other highly corrosive materials will be present.
3. The minimum total dry film thickness excludes the primer.

2.04 COLORS

- A. Comply with OSHA requirements concerning color coding and safety marking.
- B. Color code exposed piping. Color code equipment associated with piping, unless otherwise shown or specified. Whenever banding is listed for color coding, bands shall be six inches wide spaced along the pipe at five foot intervals.
- C. Color coding shall be generally as follows. Specific colors for each type of service will be selected by the Owner after the submittal of the color charts.

| Application | Color |
|---|---------------------------------|
| Dangerous Machine Parts and Energized Equipment | Safety Orange |
| Traffic Operations and Housekeeping marking | White |
| Fire Protection Equipment and Flammable Materials | Safety Red |
| Radiation Hazards | Safety Yellow with Black Legend |
| Water Lines, Finished or Potable | Light Blue |
| Wastewater Lines | Light Gray |

| Application | Color |
|-----------------------------|-------------------------------|
| Raw Water Lines | Green |
| Backwash Lines | Dark Brown |
| Sewer (Sanitary or Other) | Light Gray |
| Chemical Lines | To Be Determined in the Field |
| Non-Potable Water Lines | Violet or Purple |
| Walls, Ceilings, and Floors | To Be Determined in the Field |
| Compressed Air | Safety Green |
| Natural Gas | Safety Yellow |
| Other Items | To Be Determined in the Field |

2.05 MIXING AND TINTING

- A. Coatings, except to part epoxies, shall be delivered to the job site premixed.

- B. Job tinting will not be acceptable, except as approved by the Owner.
- C. All mixing shall be done in mixing pails placed in suitably sized non-ferrous or oxide resistant metal pans.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Inspect all surfaces on which paint is to be applied, and notify the Engineer of any defects considered detrimental to the application of the materials specified.
- B. If any dirty, rusty, scaly, greasy, damp, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film are painted over, both the removal of the paint and repainting the affected area shall be done by the Contractor without additional cost to the Owner.
- C. Provide all scaffolding, staging, and other temporary facilities required for the proper execution of the work. Scaffolding shall be placed so as not to interfere with the work of others. Should it be necessary for the progress of the work on the building in general, the Contractor shall, if so directed and without extra cost to the Owner, move, relocate, or arrange his scaffolds, ladders, or coverings to permit the Owner or other crafts to proceed with their work without delay.
- D. The Contractor shall furnish a low voltage wet sponge instrument for checking film continuity. The Contractor shall also furnish a dry mil thickness gauge for checking film thicknesses.

3.02 SURFACE PREPARATION

A. General

1. All surfaces to be coated shall be prepared in a workman-like manner with the objective of obtaining a clean and dry surface. No coating shall be applied before the prepared surfaces are approved by the Engineer.
2. All preparation and cleaning procedures shall be in strict accordance with the coating manufacturer's printed instructions and as specified in this Section for each particular substrate condition.
3. Remove or otherwise protect hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted prior to surface preparation and painting operations. Remove items, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space, reinstall the removed items. Such removal and reinstalling shall be done by workmen skilled in the trades involved.
4. Clean surfaces to be coated before applying coating or surface treatment. Remove oil and grease with clean cloths and cleaning solvents in accordance with SSPC SP-1 prior to mechanical cleaning. Clean surfaces of galvanized metals, fiberglass and PVC with water soluble detergents prior to etching. Cleaning solvents shall be low toxicity and shall have a flash point in excess of 115°F. Program cleaning and painting so dust and other contaminants from the cleaning process do not fall in wet, newly coated surfaces.

B. Metals

1. All ferrous metal to be primed in the shop shall have all rust, dust, and scale, as well as all other foreign substances, removed by sandblasting in accordance with SSPC SP-6 or SP-10 and achieve a profile ranging from 1.0 to 3.0 mils DFT as recommended by the manufacturer. Immersion (submerged metals) exposure shall receive surface preparation in accordance with SSPC SP-10 near-white blast. Non-immersion (non-submerged metals) exposure shall receive surface preparation in accordance with SSPC SP-6 commercial blast. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Abraded or corroded spots on shop coated surfaces shall be wire brushed and touched up with primer specified in this Section. Remove all surface imperfections that will induce premature coating system failure. Chip or scrape off weld splatter and weld slag. Grind down sharp and rough edges of weld seams to create a smooth transition. Surface cleanliness shall be verified in accordance with SSPC-VIS1.
2. Store shop coated ferrous surfaces out of contact with the ground in such a manner and location as will minimize the formation of water-holding pockets, soiling, contamination, and deterioration of the coating film.
3. All ferrous metals not primed in the shop shall be sand-blasted in the field prior to application of the primer pretreatment in accordance with the criteria specified above.
4. All non-ferrous metals and galvanized surfaces, whether to be shop or field primed, shall be solvent cleaned per SSPC SP-1 prior to the application of a vinyl-phosphoric wash and/or primer.
5. Any piping scheduled for a coating which is supplied with a bituminous coating shall receive two coats of titanium pigmented alcohol-soluble resin before applying primer and colored finished coat.
6. All exterior and interior electrical conduits shall be coated per this Section.
7. All existing coated metals and previously shop coated metals shall be free of all foreign substances and cleaned according to the manufacturer's recommendations prior to application of primer and finish coats.
8. All non-submerged existing pipe, pipe supports, metal structural members, and miscellaneous metal items to remain which are to be recoated shall have all loose and poorly adhered existing coating removed with hand tool cleaning to provide a surface preparation of SSPC SP-2 (hand tool cleaning) or SP-3 (power tool cleaning). All submerged existing metal items to remain and to be recoated shall have SSPC SP-10 (near white blast cleaning) or SP-11 (near white power tool cleaning) surface preparation to remove existing coating to bare metal. All rust, dust scale, and other foreign substances shall be removed. Bare metal exposed after cleaning shall be immediately primed to prevent new rusting. Prior to applying new coating, clean existing metals and piping with water-soluble degreasers or solvents per SSPC SP-1.

C. Concrete

1. All concrete surfaces shall be allowed to cure a minimum of 28 days before coatings may be applied.

2. Concrete surfaces to be coated shall receive a brush-off blast per ASTM D4259 to achieve a profile equal to 80-grit sandpaper as recommended by the manufacturer to remove laitance, efflorescence, chalk, dust, dirt, grease, oil, asphalt, tar, excessive mortar, and mortar droppings. Surface deposits of free iron shall be removed prior to painting. At no time shall the underlying aggregate be exposed. Fill holes and imperfections in finish surfaces with surface/fill as recommended by the manufacturer. Do not coat over surfaces where the moisture content exceeds that permitted in the coating manufacturer's written instructions.

3.03 APPLICATION

A. Coating Thickness

1. Each coat of material shall be applied at a rate specified by the manufacturer to achieve the minimum dry mil thickness required. Dry film thickness shall be verified in accordance with SSPC-PA2. If the material has thickened, or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of unthinned material as original furnished by the manufacturer must not cover a greater square foot area when applied by spray gun than when applied unthinned by brush. Coatings in submersible applications shall be pinhole free.
2. Deficiencies or excesses in film thickness shall be corrected by the application or removal of an additional coat(s) of material.

B. Application to Concrete Floors

1. After the floor is clear and dry, prepare the surface in accordance with ASTM D4259 brush-off blast or etch with a 5% solution (by weight) of muriatic acid to achieve a profile equal to 80-grit sandpaper. Remove all dust and apply one coat of sealer using a lamb's wool applicator. Let the coat dry overnight, then burnish the first coat and sweep the surface thoroughly before applying the second coat. Apply the second coat and let dry overnight before opening to traffic.

C. Application to Concrete Stairs and Skid-Resistant Areas

1. Follow the same procedures as concrete floors, with one of the following additions:
 - a. Apply a third coat containing an adequate amount of silica sand or the manufacturer's standard skid-resistant coating on the top surface of all steps and landings, or in areas specified to be skid resistant to provide a skid-resistant surface, or
 - b. For stairs only, provide skid resistant adhesive tape on the surface of all steps and edges of landings in sufficient amount to cover the outer six inches of each step or landing.
 - c. Other areas to receive skid-resistant coatings will be specifically noted in this Section or on the Drawings.

D. Drying Time

1. Drying time shall be construed to mean “under normal conditions.” Where conditions are other than normal because of the weather or because the coating must be done in confined spaces, longer drying times will be necessary. Additional coats of material shall not be applied, nor shall units be returned to service until the coatings are thoroughly dry.

3.04 PROTECTIVE COATING OF NON-FERROUS AND GALVANIZED METALS

- A. Where non-ferrous metals such as aluminum, copper, and galvanized metal comes in contact with concrete or dissimilar metals, a protective coating must be applied. In the case of galvanized materials, obtain a recommendation from the coating supplier.
- B. A vinyl gasket may be used in lieu of the protective coating.
- C. The bottom of the aluminum railing posts and aluminum clip angles shall be coated with an aluminum impregnated caulking compound (Aluminastic, or equal) prior to erection.
- D. After erection and alignment, the opening between non-ferrous metal surfaces and the concrete shall be sealed in a watertight manner with the proper caulking compound, relative to, and in accordance with, the opening width demand.

3.05 CLEANING

- A. Touch-up coatings and restore finish where damaged or defaced by construction activities.
- B. Remove coating spatter from all finished surfaces and restore affected finishes.
- C. Remove excess materials, scaffolding, staging, drop cloths, equipment, and rubbish from the job site.

3.06 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 09 96 35

CHEMICAL-RESISTANT COATING

PART 1 – GENERAL

1.01 SUMMARY

- A. Work includes high-performance chemical-resistant epoxy coating system.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.
- C. Work is related to installation of chemical resistant coating in the HMO tank area.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with provisions of Section 01 33 23 - Shop Drawings, Samples, and Product Data.
- B. Submit copy of manufacturer's Material Safety Data Sheets (MSDS) for each product.

1.03 QUALITY ASSURANCE

- A. Applicator shall have minimum 5-years of satisfactory documented experience on projects of similar size and scope.
- B. Furnish primers, pretreatments, thinners, and finish coats by the same manufacturer.

1.04 ENVIRONMENTAL CONDITIONS

- A. Storage and application temperatures shall be in strict accordance with manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers include the following, or equal: Tnemec Company, Inc.; Sherwin Williams.

2.02 MATERIALS

- A. Primer shall be compatible with coating; Series 201 Epoxoprime, Corobond Epoxy Primer, or equal.
- B. Coating for floor in chemical containment areas shall be chemical-resistant, Novolac epoxy coatings, Tnemec Series 239 Chemtread, Cor-cote HCR Novolac intermediate coatings, followed by Series 282, Core-Cote HCR FF Novolac top coat or equal.
- C. Coating for walls up to 2 feet 8 inches from floor in chemical containment area shall be Novolac epoxy coating, Tnemec Series 282, or equal.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Concrete surfaces shall be abrasive cleaned in accordance with SPCC-SP13/NACE No. 6 and provide a surface profile in accordance with ICRI NO. 03732 at CSP-3 to CSP-5.

- B. A representative of the manufacturer shall observe and approve the surface preparation prior to application of coating.

3.02 APPLICATION

- A. Mix components in strict accordance with manufacturer's instructions.
- B. Surface and material temperature shall be between 70°F and 90°F during application.
- C. Coating for Floors and Bases:
 - 1. Primer shall be applied at the rate of 160 square feet per gallon.
 - 2. Intermediate coat shall be applied within 4 to 6 hours of prime coat. Intermediate coat shall be applied to 1/4-inch thickness (100 s.f./large kit) and in accordance with manufacturer's instructions.
 - 3. Top coat shall be applied at 250-square feet per gallon.
- D. Coating for walls shall be applied as follows:
 - 1. One primer coat (160-square feet per gallon).
 - 2. One top coat (180-square feet per gallon).
 - 3. One top coat (250-square feet per gallon).
- E. Exposed perimeter edges of topcoat, including doorways, drains, traffic aisle sides, etc., shall be "keyed" into substrate to allow full 1/4-inch thickness at these points. Sawcut substrate using power saw with carbide or diamond tip blades.
- F. Where the concrete floor meets the wall, provide a 45-degree angle cove with a height of 1 to 2 inches.
- G. Do not install coating over expansion joints.

END SECTION.

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Equipment supports.

1.02 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.03 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.04 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.

3. B-Line Systems, Inc.; a division of Cooper Industries.
 4. Carpenter & Paterson, Inc.
 5. Empire Industries, Inc.
 6. ERICO/Michigan Hanger Co.
 7. Globe Pipe Hanger Products, Inc.
 8. Grinnell Corp.
 9. GS Metals Corp.
 10. National Pipe Hanger Corporation.
 11. PHD Manufacturing, Inc.
 12. PHS Industries, Inc.
 13. Piping Technology & Products, Inc.
 14. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.
- 2.03 TRAPEZE PIPE HANGERS
- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
- 2.04 METAL FRAMING SYSTEMS
- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.
 5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- 2.05 FASTENER SYSTEMS
- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

PART 3 – EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.04 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.07 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: Perform all work required to furnish and install equipment, valve, pipe, and wire identification with supplementary items necessary for proper installation as specified herein, or shown on the drawings. Contractor shall identify including, but not limited to, all equipment, valves, piping, ductwork, dampers, pumps, and wires.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23.
- B. Schedule: Provide schedule for nameplates and labeling tags for shop drawings. Reference drawings for type used.

1.03 REFERENCES

- A. All material, installation, and workmanship shall comply with the applicable requirement and standards addressed within the following references:
 - 1. ASME A13.1–Scheme for the Identification of Piping Systems
 - 2. NFPA 13–Installation of Sprinkler Systems
 - 3. NFPA 14–Installation of Standpipe and Hose Systems.
 - 4. NEPA 45–Fire Protection for Laboratories Using Chemicals.
 - 5. Illinois Plumbing Code.

PART 2 – PRODUCTS

2.01 NAMEPLATES

- A. Type “A” Nameplates Use:
 - 1. Fans, Unit heaters, etc.
 - 2. Size: 4-inch by 4-inch.
 - 3. Material: 3-layer laminated Micarta. Background Color: Black.
 - 4. Character Color: White. Character Size: 1 1/4 inches. Engraving: Equipment label.
 - 5. Mounting Location: Equipment–Top wireway.
- B. Type “B” Nameplates Use:
 - 1. Identify control stations, thermostats, sampling locations, etc.
 - 2. Size: 3/8-inch by 2-inch.
 - 3. Material: 3-layer laminated Micarta.

4. Background Color: Black.
5. Character Color: White. Character Size: 1/8 inch.
6. Engraving: Control station number or equipment controlled.
7. Mounting Location: Device front at top.

2.02 LABELING TAGS

- A. Labeling Tags Use:
1. Field-mounted devices (Limit switches, etc.).
 2. Size: 1-inch by 3-inch.
 3. Material: 1/32-inch-thick stainless steel.
 4. Character Size: 1/4 inch.
 5. Engraving: As requested by Engineer.

2.03 WIRE MARKERS

- A. Wire markers shall be permanently attached wraparound adhesive, sleeve- or heat-shrink-type labels. Wire numbering preprinted on the conductor, flag-type labels, and individual wraparound numbers (such as Brady preprinted markers) are not acceptable.
- B. Wire markers shall be specifically printed for this project using a wire marker printer. Handwritten markers are not acceptable.

2.04 PIPE MARKERS

- A. Manufacturers: Marking Systems, Inc., Seton Name Plate Company, W.H. Brady Company, or equal.
- B. Pipe markers shall conform to ANSI A13.1. Arrow markers must have same ANSI background colors as their companion pipe markers or be incorporated into the pipe identification marker.
- C. Plastic Pipe Markers: Factory-fabricated, flexible, semirigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Pipe markers and arrow markers also shall be provided for all piping systems.
- E. Use Seton Setmark type SNA or Brady Snap-on type identification for all piping systems, up through 6 inches. For piping systems larger than 6 inches, use Seton or Brady strap-on markers, or similar, by Marking Services, Inc. Self-adhesive labels are not acceptable. Provide lettering in accordance with following table.

PIPE MARK SIZE CHART

| Outside Pipe Diameter (Including Covering) | Minimum Length of Label Field Color (Inch) | Minimum Height of Letters (Inch) |
|---|---|-------------------------------------|
| 3/4 inch to 1 1/4 inch | 8 | 1/2 |
| 1 1/2 inch to 2 inch | 8 | 3/4 |
| 2 1/2 inch to 6 inch | 12 | 1 1/4 |
| 8 inch to 10 inch | 24 | 2 1/2 |
| Over 10 inch | 32 | 3 1/2 |

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state, and local requirements and referenced standards and conform to code and ordinances of authorities having jurisdiction.
- B. Degrease and clean surfaces to receive nameplates.
- C. Install nameplates parallel to equipment lines.
- D. Affix nameplates with stainless steel screws or sticky-back adhesive.
- E. Affix labeling tags with permanent bonding cement or locking wire ties. Provide 3/8-inch hole to accommodate wire tie.
- F. Prepare and install neatly typed directions in all panels, including existing panels, where work is done under this Contract.
- G. Four-inch-round, 4-inch-square, and 4 11/16-inch junction boxes concealed above ceilings may be identified with neat lettering on the cover with a permanent-type black marking pen.

3.02 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, control panels, thermostats, junction boxes, and at load connection. Identify with branch circuit or feeder number for power circuits and with control wire number as indicated on schematic and interconnection diagrams for control wiring. Wire markers shall be permanently attached wraparound adhesive or heat-shrink-type markers. Wire numbering preprinted on the conductor, individual wraparound numbers, and flag-type labels are not acceptable.
- B. Conductors in pull boxes, motor control centers, control panels, cabinets, and panelboards shall be grouped as to circuits and arranged in a neat manner. All conductors of a feeder or branch circuit shall be grouped, bound together with nylon ties, and identified. Phase identification shall be consistent throughout the system.

3.03 PIPE MARKERS

- A. Install pipe markers in accordance with manufacturer's instructions.
- B. Install in clear view and align with axis of piping.
- C. All pipes shall be labeled with a minimum of two labels in each room, crawl space, or compartment. Locate identification at maximum 20-foot centers on straight runs, including risers and drops adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Labels shall be abbreviated as noted under fluid abbreviations on drawings.
- D. All piping containing or transporting hazardous or corrosive chemicals shall be identified with labels every 10 feet and with at least two labels in each room, closet, or pipe chase.
- E. Labels shall identify fluid being conveyed and include flow direction arrow. Provide a double-ended arrow marker when flow can be in either or both directions.
- F. Indicate delivered water temperature on domestic hot water supply and return lines.

- G. Contractor shall include a schedule in its submittal identifying the various pipe designations, abbreviations, and labeling scheme. Colors, text, and piping abbreviations are to be selected by Owner, with the following piping marker scheme used where applicable.

| Pipe Contents | Label Colors (Background/Text) |
|---------------------------|--------------------------------|
| Water Lines | |
| Nonpotable water | Green/White |
| Potable water | Green/White |
| Raw Water | Green/White |
| Finished Water | Green/White |
| Chemical Lines | |
| Hydrous manganese oxide | Orange/Black |
| Other Lines | |
| Plumbing drains and vents | Green/White |

END SECTION.

SECTION 22 11 00

PLUMBING PIPING

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Aboveground and exposed piping and valves of every description.
 - 2. Wall pipes and fittings.
 - 3. Concrete foundations and anchor bolts for all equipment furnished under this section.
 - 4. Piping connections to all aboveground or exposed equipment whether furnished under this section or not.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 REFERENCES

- A. ASTM D1784–Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- B. ASTM D1785–Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120.
- C. ASTM D2672–Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
- D. ASTM D2467–Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- E. ASTM D2464–Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- F. ASTM F656–Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

1.03 SUBMITTALS

- A. Shop Drawings: General arrangement drawings of all interior cast or ductile iron or steel piping with all equipment attached shall be submitted to Engineer for approval prior to installation. Additional shop drawing requirements are found in the General Conditions and Division 1. Drawings shall include proposed length, location and elevation of pipe, fittings, valves, and other appurtenances.

PART 2 – PRODUCTS

2.01 MATERIALS–GENERAL

- A. All materials used in the manufacture, assembly, and painting of piping and valves in contact with water shall be compatible with potable water supplies and in contact with chemical feed systems shall be compatible with the chemicals being used. All glues, solvents, solders, etc., shall likewise be compatible. For instance, no lead-base solders shall be used. All materials shall be National Sanitation Foundation (NSF) approved.

- B. Size, Type, and Joining:
 - 1. All materials shall conform to the size and type shown on the drawings or called for in the specifications.
 - 2. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event fittings are not available, the method of joining shall be selected by Contractor and submitted to Engineer for review.
- C. Piping appurtenances shall be made of the materials specified. All appurtenances not designated as to type shall be subject to approval of Engineer.

2.02 PIPE MATERIALS

- A. PVC Piping:
 - 1. All chemical feed lines except chlorine and water supply lines located within chemical rooms shall be constructed of PVC.
 - 2. PVC shall conform to ASTM D1784, Class 12454-B.
 - 3. PVC piping and fittings shall be PVC 1120, Schedule 80 high-impact conforming to ASTM D1785 with bells conforming to ASTM D2672. Solvent-weld fittings shall conform to ASTM D2467 and for threaded ASTM D2464.
 - 4. All piping shall be approved for use by the National Sanitation Foundation.
 - 5. All pipe delivered to the jobsite shall be properly marked for type, grade, and design stress rating. Expansion joints shall be provided where needed. In general, water supply joints shall be solvent-weld and chemical feed joints shall be threaded, except where flanges are shown on the drawings, or where transition to another pipe material is required. Pipe shall be installed in compliance with ASTM D2321, except as otherwise specified herein.
 - 6. Provide threaded couplings near all fittings on threaded pipe. All unions and wall penetrations shall be threaded.
 - 7. Schedule 40 PVC pipe may be used for plumbing vents where allowed by code.
- B. Polyethylene Tubing:
 - 1. Except as otherwise specified, chemical tubing shall be HDPE or PE tubing, unless otherwise shown or specified. If required, all tubing bends, tees, adapters, and unions shall be clear polypropylene or 304 stainless-steel and compatible with tubing and solution, or equal.
 - 2. Pneumatic tubing, from solenoid cabinet to all solenoid controlled valves, shall be HDPE or PE tubing, unless otherwise shown or specified.
 - 3. Tubing shall be connected to all sample taps and shall be HDPE or PE tubing, and routed to the sink located in the filter room. If required, all tubing bends, tees, adapters, and unions shall be clear polypropylene or 304 stainless-steel and compatible with tubing and housing, or equal.
 - 4. All HDPE and PE tubing and fittings shall be rated for 150 psi, minimum. Tubing inserts shall be used at all fittings.

5. Tubing runs in excess of 10 feet shall be run in adequately supported minimum 2-inch inner diameter schedule 40 PVC conduits. Conduit runs shall be broken at all fittings and bends to allow easy access to interior tubing. Conduit shall be supported as specified for PVC piping.

2.03 FINISHES

- A. It is the intent of this specification that all equipment, supports, and appurtenances shall be furnished factory shop-primed, clean, and ready to accept finish painting by Contractor, with a minimal amount of surface preparation. Preparation and painting shall conform to all requirements and provisions specified in Division 9. Unless otherwise specified, mechanical equipment and accessories shall be furnished with all surfaces (except galvanized, stainless-steel, rubber, copper, PVC) prepared in accordance with near white grade SSPC Specification No. 10, removing all dirt, rust scale, and foreign materials. Surface preparation shall be done at such time during the assembly process as to preclude damage to the equipment once assembled. Cleaned surfaces shall then be factory shop-primed. Factory shop-priming shall be with one coat of Tnemec N69-1255 Hi-Build Epoxoline primer, or equal, applied to a minimum of 5.0 mils dry thickness. (For equipment surfaces in contact with potable water, primer shall be 140-1255 Beige Pota-Pox Primer and shall be NSF-approved.) Primer used shall be compatible with proposed finish coats; Contractor to verify.
- B. Factory standard prime finish for valves and meters is acceptable if material is compatible with epoxy finish coat specified in Division 9. Primer used shall be compatible with proposed finish coats; Contractor to verify.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Size, Type, and Joining: All materials shall conform to the size and type shown on the drawings or called for in the specifications. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event fittings are not available, the method of joining shall be selected by Contractor and submitted to Engineer for review.
- B. Unless shown otherwise, underfloor piping shall clear floor slabs and footings by a minimum of 6 inches.
- C. Support:
 1. All interior or exposed pipelines, except in chemical feed rooms, shall be securely supported by adjustable metal saddles, brackets, or adjustable hangers supported directly by concrete, masonry work, or tile.
 2. Exposed piping in chemical feed rooms shall be supported with a plastic support system, Aickinstrut Series V, or equal.
 3. Strap hangers, tin clips, or U-hooks will not be acceptable.
 4. Piping shall be supported, even though not shown on the drawings, with base fittings and concrete pads when bottom of pipe is less than 6 inches above the floor, with Anvil 264, B-line, or equal, adjustable pipe saddle stand with floor flange to 6 feet above the floor, and with Grinnell, or equal, adjustable iron or heavy steel pipe hangers with supporting clamps or inserts more than 6 feet above the floor.

5. In general, the maximum spacing of supports shall not exceed 10 feet on centers.
6. Plumbing system shall be installed with hangers and supports in accordance with the Plumbing Code.
7. Stainless steel supports shall be used in submerged locations.
8. Insulation saddles shall be used at supports of insulated piping. Contractor shall furnish and place hangers, supports, wall pipes, sleeves, and floor boxes in the forms before concrete is poured wherever needed or shown on the drawings.
9. All piping shall be adequately supported and braced to resist thrust at bends and joints. Use base elbows, poured concrete, or rod ties.
10. The weight of the piping shall be supported independently of connected equipment.
11. All supports and parts shall conform to the latest requirements of ASME B31 and shall have a structural safety factor of 5. Accurate weight balance calculation shall be made by Contractor to determine the required supporting force at each hanger location and the pipe weight load at each equipment connection. Contractor shall be responsible for the installation and application of the supports. Pipe hangers shall be capable of supporting the pipe weight load in all conditions of operation. The hangers shall allow free expansion and contraction of the piping to prevent excessive stress in the piping. Where vertical movement up to 1/8 inch is anticipated, a precompressed variable spring support shall be used. Rigid hangers shall be provided with a means of vertical adjustment after erection. Where horizontal piping movements are greater than 1/2 inch, or where the hanger rod angularity from vertical is greater than 4 degrees from hot to cold position of the pipe, the hanger pipe and structural attachments shall be offset in a manner that the rod is vertical in the hot position. Hangers and supports shall be spaced in accordance with ASME B31 and as indicated in this specification. Pipe supports shall be placed before and after a valve, expansion joint, or equipment so stress will not be transferred to them.
12. Contractor shall provide calculations of pipe supports if requested by Engineer.
13. All carbon steel parts shall be furnished with all surfaces (except galvanized or stainless-steel), prepared in accordance with near white grade SSPC Specification No. 10, removing all dirt, rust scale, and foreign materials. Surface preparation of all carbon steel parts shall be performed at such time during the assembly process as to preclude damage to the equipment once installed and assembled. Cleaned surfaces shall then be shop-primed. Shop-priming shall be with one coat of Tnemec N69-1255 Hi-Build Epoxoline primer, or equal, applied to a minimum of 5.0 mils dry thickness. Primer used shall be compatible with proposed finish coats; Contractor shall verify. It is the intent of this specification that all equipment, supports, and appurtenances shall be furnished shop-primed, clean, and ready to accept finish painting by Contractor, with a minimal amount of surface preparation. Preparation and painting shall conform to all requirements and provisions specified in Division 9.
14. The following maximum spacings shall be provided for supports:

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING

| Nominal Pipe or Tube Size | Copper Tubing | | Ductile Iron (See Note 1) ft | PVC Pipe (See Note 2) ft |
|---------------------------------|------------------------|----------------------------|---------------------------------|-----------------------------|
| | Water Service ft | Vapor or Air Service ft | | |
| 1/4 | 5 | 5 | | |
| 3/8 | 5 | 6 | | Continuous |
| 1/2 | 5 | 6 | | Continuous |
| 3/4 | 5 | 7 | | Continuous |
| 1 | 6 | 8 | | 4 |
| 1 1/4 | 7 | 9 | | 4 |
| 1 1/2 | 8 | 10 | | 4 |
| 2 | 8 | 10 | | 4 |
| 2 1/2 | 9 | 10 | | 4 |
| 3 | 10 | 10 | | 4 |
| 4 | 10 | 10 | 10 | 4 |
| 5 | 10 | 10 | 10 | 4 |
| 6 | 10 | 10 | 10 | 9 |
| 8 | 10 | 10 | 10 | 9 |
| 10 | 10 | 10 | 10 | 10 |
| 12 | 10 | 10 | 10 | 10 |
| 14 | | | 10 | 10 |
| 16 | | | 10 | 10 |

Note 1: Provide at least one hanger per pipe length located as close to the flange or joint on barrel as possible.

Note 2: Spacing is based on Schedule 80 at 100°F. For Schedule 40 or higher temperatures, provide shorter span. Consult manufacturer's recommendations.

15. The length of hanger span and support spacing in the above table refers to straight lengths of pipe. When there are changes of direction in pipe, two supports shall be placed less than three-fourths the full span in the table. When practical, a hanger shall be located immediately adjacent to a change in direction of piping. Where there are concentrated loads between supports such as valves, spacing shall be based on load calculations rather than this table.
16. Provide saddles or shields under piping hanger and supports for all insulated piping to prevent crushing of insulation. Provide stainless-steel pipe shields under stainless-steel piping to prevent indentation of piping from the support or clamp.

D. Penetrations:

1. Where pipes pass through concrete members without wall fittings shown, Contractor shall provide sleeves in the forms for the piping.
2. The sleeve diameter shall not exceed the pipe o.d. (or flange o.d. where applicable) plus 2 inches, unless otherwise shown on drawings.
3. If the concrete members are to be watertight, the annular space around the pipe shall be caulked with lead wool or sealed with an approved mechanical seal.

4. For copper pipe provide an elastomeric sleeve on pipe where it passes through walls or slabs.
5. Where pipes pass through a roof, they shall be run through an approved roof penetration with flashing and counter-flashing.
6. Where pipes pass through nonwatertight walls, the annular space shall be grouted full.
7. Where pipes pass through nonwatertight floors, the sleeve shall extend 1 inch above the finished floor elevation, and the annular space shall remain open.
8. Where new pipes go through existing watertight concrete members, Contractor shall core a hole through the wall and provide a wall sleeve or wall pipe.
9. Space between wall sleeve or wall pipe and concrete shall be filled with nonshrinking mortar.
10. The annular space between the wall sleeve and pipe shall be sealed with an approved mechanical seal.
11. Where new pipes go through existing nonwatertight concrete or masonry members, holes shall be cored and grouted full (walls), remain open (floors).
12. Plug abandoned pipes and wall pipes, after pipe and fitting removal, flush to the concrete surface with nonshrinking mortar, to achieve a watertight seal.
13. No chases or recesses shall be made in poured concrete for pipe installation, and no pipe shall run in poured concrete unless called for in the drawings or specifications or permitted by Engineer. The cutting or core drilling of concrete for pipe shall be avoided wherever possible, and in no case, where such cutting or core drilling is necessary, shall reinforcing rods be cut or disturbed without prior consultation with Engineer.
14. All openings for pipe work shall be neatly patched in a workmanlike manner.

E. Layout:

1. Exposed piping shall run straight, in neat parallel lines, and shall be located far enough from walls, ceilings and floors, to permit access for covering of pipe and painting work.
2. Care shall be taken in laying out piping that there is no interference with the proper location of piping for other purposes or other equipment, and shall be run with regard to the requirements of each service.
3. Piping shall not interfere with headroom or clear floor space.
4. Unless otherwise shown, small water piping shall be concealed in (except reinforced concrete walls) walls placed in piping pits, above suspended ceilings, or under floors where possible, or as shown on the drawings.
5. Pipes under floors shall have a minimum of 6 inches of sand cover.
6. Plates shall be provided on all uncovered pipes passing through floors, walls, and ceilings, constructed of materials other than poured concrete. Plates shall be on exposed sides and shall be chrome-plated, spring and snap type.
7. An ample number of unions shall be provided in all threaded, soldered, and glued pipelines and at all equipment to facilitate removal and replacement. Install a shutoff valve at each appliance.

8. Contractor shall provide 3/8-inch tapped and plugged connections in suction and discharge of all pumps for testing.
9. The appropriate number, size, and lengths of spool pieces and flange fillers needed for plumbing and leveling any existing piping shall be included in the price bid.
10. Valves shall be located on all branches of water supply lines where shown on the drawings. Position valves to facilitate access and operation.

3.02 FIELD QUALITY CONTROL

A. Site Tests:

1. Contractor shall include the cost of all testing, cleaning, and disinfection in the price bid.
2. All piping, interior or exposed, shall be subject to test before being covered with insulation or paint. All piping and appurtenances shall be watertight or airtight and free from visible leaks.
3. All piping shall be flushed or blown out after installation prior to testing.
4. Contractor shall provide all necessary piping connections, water, air, test pumping equipment, water meter, bulkheads, valves, pressure gauge, and other equipment, materials and facilities necessary to complete the specified tests. Contractor shall provide all temporary sectionalizing devices and vents as required for testing.
5. Pressure Tests: The test pressure in all lines shall be held for 1 hour during which time the leakage allowance shall not exceed that specified. In case repairs are required, the pressure test shall be repeated until the pipeline installation conforms to the specified requirements. Pumps, air compressors, instrumentation, and similar equipment shall not be subjected to the pressure tests.

6. Test Requirements:

| Fluid Abbreviation or Name | Minimum Test Pressure in psi | Test Medium | Leakage Allowance Designation |
|----------------------------|------------------------------|-------------|-------------------------------|
| Potable Water | 150 | Water | "A" |

7. Leakage allowance Designation "A" shall mean zero leakage for unburied pipe and shall be not more than 0.002 gallons per hour per inch diameter per 100 feet of buried pipe for compression or solder joint pipe.
8. Tests for all gravity sewers shall be as follows: Pipe will be plugged at its downstream end and water will be placed inside the pipe to a minimum head of 10 feet. Water shall be held for 15 minutes without dropping. No leakage is allowed.

3.03 CLEANING AND DISINFECTION

- A. All equipment and materials shall be clean before installation. Contractor shall disinfect and flush the system before it is put on line.
- B. Contractor shall assist Owner with obtaining water samples and arrange for analysis of water in potable systems for bacteria at City of Rockford Lab as part of the Lump Sum Bid. Samples shall be paid for by Contractor as part of its Bid. Copies of test results shall be submitted to Owner and Engineer.

- C. Potable water piping shall be disinfected according to the standard specifications for water and sewer main construction in Illinois, which shall include initial flush and disinfection to 50 ppm with gaseous chlorine or other acceptable methods. Acceptable concentration after 24 hours shall be 25 ppm.
- D. Broken concrete, rubble fill, and other excess material shall be removed from the site and wasted.
- E. All surplus material, tools, and equipment shall be removed and the premises shall be left free of everything of the kind.

END SECTION.

SECTION 23 05 00

BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. The Conditions of the Contract and General Requirements of this Project Manual apply to the General Contractor, Subcontractor, material suppliers and all other persons furnishing labor and materials under this Section.
- B. Base Bid:
 - 1. Mechanical Contractor Provide:
 - a. Work as outlined on drawings and specified herein.
 - b. Install and provide all low voltage cabling required for HVAC systems.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Section 23 05 13 – HVAC Fans.
 - 2. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.

1.03 QUALITY ASSURANCE

- A. All Mechanical work shall comply with the International Energy Conservation Code (IECC 2015).
- B. All materials and equipment furnished shall be new and to the extent possible, standard products of the various manufacturers except where special construction or performance features are called for. Where more than one of any specific item is required, all shall be of the same type and manufacturer.
- C. The product of specified acceptable manufacturers shall be acceptable only when that product complies with or is modified as necessary to comply with all specified and indicated requirements (listed herein or on the Drawings).
- D. Materials and equipment not herein specified or indicated as to manufacturer but necessary for complete functioning systems, shall be provided from sources conforming to the quality levels and functional requirements for corresponding materials and equipment set forth herein.

1.04 INTENT

- A. It is the intent of the Mechanical Division of these Specifications that all mechanical work specified herein be coordinated as required with the work of all other Divisions of the Specifications and the Drawings so that all installations shall operate as designed. All systems shall be completely assembled, tested, adjusted, and demonstrated to be ready for operation to the satisfaction of the Architect/Engineer before acceptance by the Owner. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the Work, the same as if herein specified or shown.

1.05 REGULATORY AGENCIES, CODES, AND STANDARDS

- A. Governing state, local governmental laws, ordinances, referenced codes and standards constitute minimum requirements and strict compliance shall be part of the Contract Documents.
- B. The Contractor shall include in the Work, without extra cost to the Owner, any labor, materials, services, apparatus, drawings, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the drawings and/or specified.
- C. Portions or all of certain recognized industry or association standards referred to herein as being a requirement of these Specifications shall be considered as binding as though reproduced in full herein. Unless otherwise stated the referenced standard shall be the standard which is current as of the date of issuance of these Specifications. Reference may be made to standards either by full name or for the sake of brevity by letter designation as follows:
 - 1. AABC Associated Air Balance Council
 - 2. AGA American Gas Association
 - 3. AMCA Air Moving and Conditioning Association
 - 4. ANSI American National Standards Institute
 - 5. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
 - 6. IPC Illinois Plumbing Code
 - 7. NEC National Electric Code
 - 8. NEMA National Electric Manufacturers Association
 - 9. NFPA National Fire Protection Association
 - 10. OSHA Occupational Safety and Health Administration
 - 11. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
 - 12. UL Underwriters' Laboratories, Inc.
 - 13. IMC International Mechanical Code
 - 14. IECC International Energy Conservation Code 2015

1.06 DRAWINGS

- A. The layout shown on the Drawings is necessarily diagrammatic but shall be followed as closely as actual construction and as other work will permit. Changes from these Drawings required to make this Work conform to the building construction or other Work of other trades shall be made by the Contractor without additional cost to the Owner, but only with the prior approval of the Architect/Engineer. All major changes shall be shown on Shop Drawings and noted as such to be submitted before the changes are made.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials and equipment shall not be delivered to the work site until their installation, according to the work schedule, is imminent. These materials and equipment shall be stored only in areas designated as Contractors storage areas.

- B. Materials and equipment subject to deterioration shall be stored and protected accordingly.
- C. Contractor shall be responsible for all damage to materials stored on site.

1.08 PROJECT CONDITIONS

- A. When existing conditions prohibit the proper installation as shown on the Drawings or as specified herein, the Contractor shall notify the Architect/Engineer, in writing, requesting a solution.
- B. Contractor is responsible for the verification of new and existing conditions on the site before that particular phase of installation begins.
- C. Installation of systems specified shall be coordinated with all other work specified in the Contract Documents.
- D. All expenses incurred by Architect/Engineer in troubleshooting systems and problems caused by inadequate workmanship or unauthorized or authorized deviations from the Contract Documents including materials or equipment substitutions on the part of a Contractor shall be borne by that Contractor.

1.09 WARRANTY AND INSPECTIONS

- A. The Contractor shall submit in writing a guarantee warranting all items of material, equipment and labor furnished to be free of defects for a minimum period of one (1) year from the date of final acceptance of the work by the Owner, and further agrees that if defects appear within stipulated guarantee period, same shall be replaced or made good without charge. See Division 1 and other Sections in Division 23 for additional requirements.
- B. Where inspections of the work are required by State or Local authorities, obtain certificates of inspection of the work by such authorities, and these certificates (in triplicate) shall be submitted to the Architect/Engineer.

1.10 CUTTING AND PATCHING

- A. All cutting and patching of masonry, carpentry, steel, ironwork, concrete structural work, and finished surfaces belonging to the building shall be done in order that this work may be properly installed. All disturbed constructions or finishes shall be replaced or repaired to their original condition and under no condition shall structural work be cut except upon approval of the Architect/Engineer.
- B. Cutting through ceilings, floors, walls and partitions shall be done in a careful manner and the openings filled around the pipes, conduits, and sleeves.

1.11 LOCATION OF EQUIPMENT

- A. The approximate location of all equipment is shown on the Drawings.
- B. The Architect/Engineer reserves the right to change the location of any equipment five (5) feet in any direction without these changes being made the subject of an extra charge provided such changes are made before final installation.

1.12 LINES AND LEVELS

- A. Determine all grades, maintain necessary lines and levels throughout the progress of the work, and assume full responsibility for their correctness. Where levels are indicated on the Drawings, work shall be installed at those levels unless prior written approval to change is obtained from the Architect/Engineer.

1.13 GUARANTEE

- A. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
- B. Contractor further guarantees that the material will be of the best procurable and that none but experienced workman familiar with each particular class of work will be employed.
- C. Contractor further guarantees, upon receipt of written notification from the Owner, to replace and make good at his own expense any defects, which may develop within the warranty period due to faulty workmanship or material, after final payment and acceptance by the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Each item of equipment furnished under these specifications is to be essentially the standard product of the manufacturer, however, component parts of equipment need not be products of one manufacturer.
- B. All material and equipment shall be of the best quality normally used in good commercial practice, being products of reputable manufacturers. Each major component shall bear a nameplate stating name and address of the manufacturer and catalog number or designation. All materials shall be of the manufacturer's latest design standard, and bear Underwriter's Laboratories, Inc. label and the manufacturer's trademark.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Listed or Labeled Equipment
 - 1. Listed or labeled equipment shall be installed in accordance with instructions included in the listing or labeling.
 - 2. Every precaution has been taken to ensure Drawings and Specifications do comply with these instructions, if the Contractor feels some item or items may not comply with these instructions, notify the Architect/Engineer for a solution, prior to installation.
- B. Anchors: All equipment shall be firmly attached to the structure using anchors, screws, hangers, etc. listed for the use intended.

3.02 MOVING OF MATERIAL

- A. If necessary, the Contractor shall be responsible for moving temporarily located materials in order to complete final installation.

3.03 PROTECTION OF WORK

- A. The Contractor shall protect his work from damage by keeping all equipment and materials protected.

3.04 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 23 05 13

HVAC FANS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Centrifugal inline fans.

1.02 REFERENCES

- A. AMCA 99–Standards Handbook.
- B. AMCA 210–Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- C. AMCA 300–Reverberant Room Method for Sound Testing of Fans.
- D. AMCA 301–Method for Calculating Fan Sound Ratings from Laboratory Test Data.
- E. ASTM B117–Standard Practice for Operating Salt Spray (Fog) Apparatus.
- F. NFPA 70–National Electrical Code.
- G. NEMA MG 1–Motors and Generators.

1.03 SUBMITTALS

- A. Submittal shall include fan-specific performance curves showing airflow, head, and motor horsepower.

1.04 QUALITY ASSURANCE

- A. Fans shall bear AMCA-certified rating seals.

1.05 DELIVERY, STORAGE AND HANDLING

- A. All fans shall be stored and handled in accordance with manufacturer’s instructions.
- B. Motors, shafts, and bearings shall be protected from weather and dust.

1.06 WARRANTY

- A. Standard One-Year Warranty: Unless otherwise stated below, manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of one year from the earlier of either the date established for partial utilization in accordance with GC14.04 and 14.05, as modified in the Supplementary Conditions, or Substantial Completion of the project.

PART 2 – PRODUCTS

2.01 CENTRIFUGAL INLINE FANS

- A. Acceptable manufacturers are Plastec or approved equal.
- B. Centrifugal inline fans shall be of drive type indicated on drawing schedules. Fan performance shall be as indicated on equipment schedules. Fans shall be UL listed.

- C. The fan wheel shall be centrifugal with backward-inclined blades. The fan wheel shall be statically and dynamically balanced.
- D. The fan shall be quiet-operating and vibration-free. Fan performance shall include AMCA-certified air and sound ratings and AMCA seal. Furnish and install spring-type vibration isolators provided by fan manufacturer.
- E. The fan shaft shall be mounted in prelubricated ball bearing pillow blocks. Bearings shall be sealed and have a minimum L10 life of 100,000 hours.
- F. The fan housing shall be all aluminum construction with square inlet and discharge collars. Provide access panels for servicing drives and motors. All fasteners shall be either stainless-steel or aluminum.
- G. Fans shall be mounted on vibration isolators furnished by fan manufacturer.
- H. Belt drives shall have a sliding or pivoting motor plate for belt tensioning. The belt and motor shall be totally enclosed by a guard with tachometer holes. The motor shall be mounted out of the airstream. The fan motor shall be totally enclosed, fan-cooled, and NEMA-approved ball-bearing type. Starters and disconnects shall be provided as a part of Division 16. Motors shall be provided with a 1.15 service factor. Thermostats shall be applied to motor windings, capable of shutdown and manual reset (by Division 16).
- I. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and drawings.
- B. Contractor shall provide all mounting hardware and accessories necessary to complete installation.
- C. Provide flexible duct connections on inlet and outlet of all fans.
- D. Drawings and specifications are based on the scheduled manufacturer and model number. Contractor shall be responsible for the cost of any changes because of substitutions or alternates of other manufacturers or model numbers. Contractor shall pay all costs for revisions of drawings by Engineer. Any changes shall be coordinated and provided at no additional cost to Owner.
- E. Installation of all equipment furnished under this Contract shall be supervised by a qualified representative of the equipment manufacturer. All equipment shall be placed in operation, and plant operators shall be trained to the satisfaction of Owner by a qualified representative of the equipment manufacturer. Owner may videotape training presentations given by manufacturer's representatives. Final payment for various items of equipment will not be made by Owner until the equipment is operating to their satisfaction.

END SECTION.

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Equipment supports.

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 – PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for All Water Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.03 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.04 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 – EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
- 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use thermal-hanger shield inserts for insulated piping and tubing.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.07 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 05 00

BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 WORK INCLUDES

A. Base Bid:

1. Electrical Contractor Provide:
 - a. Conduit complete with supports, fittings, boxes and accessories for the following systems:
 - 1) All lighting and power wiring 120V and above.
 - 2) All control wiring 120V and below.
2. Other systems as noted on the drawings.
 - a. Conduits for the following systems:
 - 1) Empty raceways for use by others.
 - 2) Other systems as noted on the drawings.

1.02 RELATED WORK

A. Specified elsewhere:

1. Any bidding requirements, bid and contract forms, supplemental general conditions, general and special conditions, and general requirements which may be included in other portions of this specification shall apply to this portion of the work.
 - a. Section 26 05 53 – Electrical Identification.

1.03 DEFINITIONS

- ###### A. The term “Provide” shall include such labor, material, methods, equipment and transportation or other facilities required to complete the Contract, and the performance of all duties thereby related to the complete installation of the described topic.

1.04 CODE COMPLIANCE

- ###### A. Comply with the listed applicable codes including but not limited to the following:
1. IBC International Building Code (2012)
 2. NFPA 70 / 70E; National Electrical Code, NEC (2011)
 3. Illinois Accessibility Code; IAC (Latest Edition)
 4. NFPA 101, Life Safety Code (2010)
 5. IECC –International Energy Conservation Code (2015)

1.05 QUALITY ASSURANCE

- ###### A. Only new, clean and unused perfect equipment, apparatus, materials and supplies shall be utilized during the course of the project.

- B. All materials shall be new, without blemish, and shall bear a nationally recognized testing laboratory (NRTL) label. All approved material shall be installed according to manufacturer's specifications or as directed by the project Architect / Engineer. All material installation shall fully comply with recognized standards of NFPA, NEMA, ASTM, IEEE, ANSI and ASHRAE.

1.06 CUTTING, PATCHING AND REPAIRING

- A. The Electrical Contractor shall be fully responsible for all cutting, patching and repairing of areas required or disturbed by said contractor's installation. The Electrical Contractor shall patch, repair, or replace any surfaces, materials, or equipment / devices damaged or defaced by his/her work. Contractor shall provide cutting, patching and repair / replacement work required to bring the disturbed area back to original pre-construction conditions.
- B. The Electrical Contractor shall obtain approval from the Engineer prior to the placement of any penetrations or sleeves through any main support beams, firewalls, foundations, exterior walls, or existing finished areas.
- C. The Electrical Contractor shall provide touch-up painting to area affected by cutting, patching and demolition.
 - 1. Thoroughly clean damaged areas and provide primer, intermediate and finish coats to suit the degree of damage created at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing application of successive coats.

1.07 FIRE STOPPING / SEALING

- A. Seal penetrations of fire-rated walls, floors or ceilings by raceways for compliance with NEC Article 300.21. Fill void around raceway. Sleeves shall be heavy wall steel pipe, anchored to building construction and finished plug with wall or ceiling. Fire stop material must be NRTL listed.
 - 1. Manufacturers:
 - a. Dow Corning Silicon RTV Foam
 - b. Chase Technology Corp. Fire Resistant Foam Sealant
 - c. 3M Fire Barrier
 - d. T & B Fire Barrier
 - e. Nelson Flameseal

1.08 FIELD CORRECTIONS AND/OR CHANGES

- A. Contractor shall accurately record all as-built and field directed changes on a field set of construction set drawings. Any deviations in locations of conduits, wiring / cabling, devices or equipment shall be recorded and safe kept for turn over to the Engineer at completion of project.
- B. Contractor shall be fully responsible for all accurate field constructed final conditions being reflected on "As-built" field prints. Contractor shall be held responsible and retainage withheld until all final field conditions are recorded to the satisfaction of the Engineer and using agency.

1. Provide (One) original "As-built" set and (One) copy of the "As-built" prints for Engineers use at completion of the project.

PART 2 – PRODUCTS

2.01 RIGID METAL CONDUIT AND FITTINGS

- A. Rigid Steel Conduit: ANSI C80.1 and UL6. Heavy wall seamless tubing with hot-dipped galvanized coating.
- B. Conduit bodies for rigid steel conduit shall be as manufactured by Appleton, Form 35, or equal, and be constructed of stamped steel for sizes 2 inches and under, and cast malleable iron for sizes over 2 inches. Conduit bodies shall have built-in pulling rollers, domed gasketed covers, and stainless-steel screws. Covers for conduit bodies must have bolts that thread into the conduit body. Snaptight and wedgenut covers are not allowed. Contractor shall select body style and size according to application.
- C. PVC-coated conduit and fittings shall be internally and externally hot dipped galvanized rigid metal conduit with hot dipped galvanized threads and PVC coating. PVC coating shall be UL listed with rigid metal conduit as the primary means of corrosion protection for the conduit, and PVC coating shall have an external 40 mil thickness with an internal 2 mil urethane coating. Acceptable manufacturers shall be Plasti-bond RedH2OT by Robroy Industries, Ocal-Blue by Thomas & Betts, or equal. PVC-coated conduit and fittings shall meet the following listings and manufacturing standards, without exception. All installers shall be field-certified from the factory for installation and shall provide proof of certification:
 1. ANSI C80.1.
 2. UL6.
 3. NEMA RN1.
- D. Conduit bodies for PVC-coated rigid conduit shall be as manufactured by Plasti-bond RedH2OT by Robroy Industries, Ocal-Blue by Thomas & Betts, or equal, and have a 40 mil PVC exterior coating and 2 mil red urethane interior coating. Conduit bodies shall be Form 8 style or pulling elbow and include pulling rollers, domed, gasketed covers and stainless-steel screws. Covers for conduit bodies must have bolts that thread into the conduit body. Snaptight and wedgenut covers are not allowed. Contractor shall select body style and size according to application.
- E. Fittings and Conduit Bodies: ANSI/NEMA FB 1 and UL 514B; threaded-type material to match conduit. For hazardous locations, fittings and conduit bodies shall meet the requirements of UL 886. Split couplings are not allowed.
- F. Supports: One-hole or two-hole pipe straps may be used for surface-mounted conduit. Where one-hole straps are used, provide conduit clamp and back spacer. Where standoffs are required, provide pipe straps and supporting devices as specified in Section 26 05 29 – Hangers and Supports for Electrical Systems. Support material shall match that of the conduit type provided.

2.02 POLYVINYL CHLORIDE CONDUIT (PVC) AND FITTINGS

- A. Conduit: Heavy wall rigid, Schedule 40, Schedule 80 where noted, UL listed for underground, encased, and aboveground applications. PVC conduit installed in exterior locations shall be UV resistant.
- B. Conduit bodies for PVC conduit shall be as manufactured by Carlon, or equal, and be suitable for use with Schedule 40 or Schedule 80 PVC conduit. Conduit bodies shall have smooth hubs, textured lids, and foam-in-place gaskets. Contractor shall select body style and size per application.
- C. Supports: Two-hole nonmetallic clamps or conduit support straps may be used for surface-mounted conduit. Where standoffs are required, provide pipe straps and supporting devices as specified in Section 26 05 29 – Hangers and Supports for Electrical Systems. Support material shall match that of the conduit type being provided.

2.03 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

- A. Liquidtight Flexible Metal Conduit:
 - 1. Conduit: Spiral-wound, electrogalvanized, single-strip steel with integral grounding conductor continuously enclosed within the entire length of the convolutions. The flexible PVC jacket shall be sunlight-resistant, flame-retardant, and resistant to damage from mild acids. Conduit shall be UL Listed and be rated for installation in Class I, Division 2, Groups C and D locations. Conduit shall be Liqueflex Type LA, or equal.
 - 2. Fittings: UL listed with thermoplastic elastomer sealing gasket.
 - a. Provide stainless-steel fittings outdoors and in NEMA 4X locations, unless noted otherwise.
 - b. Provide electro-zinc plated steel fittings in all other areas, unless noted otherwise.

2.04 CONDUIT SEALS AND SPECIAL FITTINGS

- A. Conduit Seals: Duct sealing compound, OZ Gedney Type DUX, or equal.
- B. Expansion Fittings: Crouse Hinds or Robroy type XJG, or equal, for rigid, IMC, or PVC-coated rigid conduit. Crouse Hinds, type XD, or equal for PVC conduit.
- C. Expansion Deflection Fittings: O-Z type "DX," Crouse Hinds, type XD (PVC conduit only), or Appleton.
- D. Ground Bushings: Crouse Hinds Model GLL, or equal.
- E. Watertight Hubs: Diecast, insulated and gasketed, rated for wet or dry locations indoors or outdoors. Watertight hubs shall be Appleton HUBXXXDN, Crouse-Hinds Myers Hubs, or equal.

2.05 WIRE

- A. All wire for permanent installation shall be new stranded copper delivered to project in unopened cartons or reels, except where specifically noted and be UL listed for the use intended. No wire smaller than 12 AWG shall be used unless specifically noted. The use of multiconductor cable is NOT ALLOWED.
- B. Motor circuit branch wiring and associated control wiring:
 - 1. Insulation type shall be THHN (indoors).

2. Minimum size for motor control wiring shall be 14 AWG.
 3. Control wiring for supervisory equipment shall be shielded, sized per equipment manufacturer's recommendations, or as shown on drawings.
- C. All wiring within control panels shall be insulation-type MTW, minimum size 16 AWG.
 - D. Wiring in dry locations shall be THHN. Wiring in damp and wet locations shall be XHHW-2. Damp and wet locations shall include, but not be limited to, exterior buried conduits and exterior locations.
 - E. All available colors shall be used; however, green shall be used only for equipment grounds. Where color-coded wire in larger sizes is not available, one wrap of 1-inch-wide colored self-adhesive tape at each terminal end shall be used for identification. Initial phase color shall be used throughout the run, even for switch legs. Colors must meet code requirements for each class voltage. Do not duplicate colors, including neutral, on different voltages.
 - F. Refer to Section 26 05 53 – Electrical Identification for conductor labeling and insulation color requirements.
 - G. Branch circuit wiring for exit lights, emergency lights, and exterior lights in excess of 75 feet shall be minimum 10 AWG. Circuits 150 feet or over shall be sized for a maximum 2% voltage drop.

2.06 WIRING CONNECTIONS AND TERMINATIONS

- A. Provide crimp type UL or ETL listed terminations for 6 AWG and smaller stranded conductor connections to electrical devices and equipment such as receptacles, switches, and terminal strips. Crimp devices shall be Sta-kon, or equal.
- B. Provide insulated, silicone-filled spring wire connectors with plastic caps for 8 AWG conductors and smaller. Connectors shall be King Silicone-Filled Safety Connectors, or equal. Spring wire connectors shall only be allowed in junction, outlet, or switch boxes. Spring wire connectors are not allowed for terminating motor conductors.
- C. All feeder cable connections to motor leads up to 600 volts shall be insulated and sealed with factory-engineered kits. Motor connection kits shall consist of split-bolt connector and motor-lead pigtail splice kit. Individual components shall be as follows:
 1. Split-bolt connectors shall be for use with copper conductors only.
 2. Pigtail splice kit shall consist of one-hole lug cover, locking pin, silicone grease, and mastic sealing strip. Kit shall be as manufactured by 3M, or equal, 5300 series, and be selected based on motor, feeder, and lug sizes installed.
- D. No splices will be allowed unless reviewed by Engineer.

2.07 TERMINAL BLOCKS AND ACCESSORIES

- A. Terminal Blocks: ANSI/NEMA ICS 4: UL listed.
- B. Power Terminal Blocks: Unit construction type, closed-back type, tin-plated copper, with tubular pressure screw connectors, rated 600 volts as manufactured by Allen-Bradley 1492-PDL, or equal.
- C. Signal and Control Terminal Blocks:
 1. General-Purpose Terminal Blocks:

- a. Terminal blocks shall be rated up to 600 volts AC/DC.
 - b. Terminal blocks shall accept center-mounted jumper bars without increasing the installed space.
 - c. Terminal blocks shall be Allen-Bradley Bulletin 1492-J, or equal.
 - d. Terminal block color shall be gray.
2. Grounding Terminal Blocks:
 - a. Terminal blocks shall be Allen-Bradley Bulletin 1492-JG, or equal.
 - b. Terminal block color shall be green/yellow.
3. Disconnect-type Terminal Blocks (300-Volt Class):
 - a. Terminal blocks shall be feed-through type with a knife-blade disconnect.
 - b. Terminal blocks shall be Allen-Bradley Bulletin 1492-JKD, or equal, depending on the application.
 - c. Terminal block color shall be gray.
4. Fuse-type Terminal Blocks with Indicator (300-Volt Class):
 - a. Terminal blocks for applications from 100 to 300 volts AC shall be Allen-Bradley Bulletin 1492-H4, or equal, with neon blown-fuse indicator.
 - b. Terminal blocks for applications from 10 to 50 volts AC/DC shall be Allen-Bradley Bulletin 1492-H5, or equal, with LED blown-fuse indicator.
 - c. Terminal block color shall be black.
5. Fuse-type Terminal Blocks with Indicator (600-Volt Class):
 - a. Terminal blocks shall be Allen-Bradley Bulletin 1492-J3P, or equal, with associated indicating-type fuse plug.
 - b. Terminal block color shall be gray.
6. Terminal Blocks for Current Transformers: Provide test-disconnect terminal blocks for disconnecting, shorting, and testing current transformers and for disconnecting and testing voltage sensing inputs. Provide test-disconnect terminals for individual current transformer or voltage sensing installations, and provide a group of terminals for all current transformer and voltage sensing inputs for each power meter installation.
 - a. Provide a pair of terminal blocks for each current transformer including one feed-through terminal block, one sliding disconnect terminal block with a cross-connection short-circuit slider. The pair of terminal blocks shall include the following:
 - 1) Feed-through terminal block shall be Weidmüller Model WTD 6/1 EN, or equal.
 - 2) Sliding disconnect terminal block shall be Weidmüller Model WTL 6/1 EN, or equal.

- 3) Short-circuit slider shall be Weidmüller Model WKS 2/2, or equal. The short-circuit slider shall cover the terminal block conductor screws on the meter-side of the terminal blocks when in the non-shorting position, and expose the terminal block conductor screws when slid into the shorting position.
 - 4) Provide two cross-connection sliders Weidmüller Model STB, or equal, with connecting sleeves Weidmüller Model VH, or equal. Provide one slider fixing screw Weidmüller Model BS, or equal. Connecting sleeves and fixing screws shall be color coded for each current transformer.
- b. Provide disconnecting terminal blocks for each voltage sensing and neutral connection. The terminal blocks shall include the following:
 - 1) Sliding disconnect terminal block shall be Weidmüller Model WTL 6/1 EN, or equal.
 - 2) Provide one cross-connection slider Weidmüller Model STB, or equal, with connecting sleeve Weidmüller Model VH, or equal, for each voltage sensing and neutral connection terminal block. Provide one slider fixing screw Weidmüller Model BS, or equal. The neutral connecting sleeve shall be a different color than the voltage sensing connecting sleeves.
 - c. Terminal block colors shall be gray. Provide end plates and end brackets as required to complete the test-disconnect terminal block assembly.
7. Terminal blocks shall have self-locking screw compression clamps rated for the size of conductors being terminated and upstream overcurrent protection for each application.
 8. The same manufacturer and style of terminal block shall be used throughout the entire project for all applications.
 9. Terminal blocks shall have tin-plated copper current bars and tin-plated steel screws. Terminal housings shall be completely finger safe from all live circuits and be constructed of self-extinguishing material with minimum UL 94-V0 flammability rating.
 10. Terminal blocks shall accept pre-printed, snap-in labeling cards on both sides without increasing the installed space. Provide terminal block manufacturer's end barriers and screw-type retainers for all terminal block groupings.
 11. Terminal blocks shall mount on standard DIN rail and shall be able to be removed without removing adjacent terminal blocks.
 12. Multi-level terminal blocks and stacked, single-level terminal block installations are not acceptable.
- D. Refer to Section 26 05 53 – Electrical Identification for terminal block labeling requirements.

2.08 PULL AND JUNCTION BOXES

- A. Cast Boxes: NEMA 250; Type 4, flat-flanged, surface-mounted junction box, UL-listed as watertight. Cast aluminum or feraloy box and cover with ground flange, neoprene gasket, and stainless-steel cover screws, Crouse-Hinds WCB Series, or equal.
- B. PVC-Coated Cast Boxes: Provide PVC-coated cast boxes in areas where PVC-coated conduit is used. Boxes shall be by the same manufacturer as the conduit.

- C. NEMA 4X Boxes: PVC or FRP, Carlon NS Series, or equal with proper cover and gasket.
- D. Boxes specified in this section are not allowed to have knockouts and are not allowed to be used as enclosures for control panels.

2.09 SUPPORTS

- A. Individual Conduit Runs:
 - 1. Galvanized or malleable one-hole straps.
 - 2. Provide clamp backs in wet locations.
 - 3. Galvanized conduit hanger with bolt (mineralac or equal).
 - 4. Beam clamps or concrete anchors with threaded rod and "U" or ring type hangers.
- B. Suspended Multiple Conduit Runs:
 - 1. Trapeze hanger assemblies consisting of beam clamps or concrete anchors with galvanized threaded rod, Unistrut channel with split pipe clamps.
 - 2. Same as above except with galvanized angle iron and "U" bolts in lieu of Unistrut and split pipe clamps.
- C. Surface Multiple Conduit Runs:
 - 1. Channel anchored to surface with split pipe clamps.
- D. Allow 25% space capacity on all racks installed for multiple runs.
- E. Anchoring:
 - 1. Hollow Masonry: Toggle Bolts, expandable anchors.
 - 2. Solid Masonry and Concrete: Lead expansion anchors, self-drilling, steel wedge and preset type anchors.
 - 3. Metal: Beam clamps, machine bolt, welded studs and sheet metal screws.
 - 4. Wood: Wood screws.
 - 5. Others: As noted or detailed on the drawings.

PART 3 – EXECUTION

3.01 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduits for branch circuit conductors, control wires, and instrumentation cables so as to have not less than 25% spare capacity after installation; ¾-inch minimum size. Minimum size for liquidtight flexible metal conduit is 1/2 inch.
- B. Maintain at least 1 inch of separation between conduit sizes to 1 1/2 inches and 2 inches between conduits 1 1/2 inches or larger. Maintain 1 foot of separation between signal conduits (below 100 volts) and power conduits (100 volts and above).
- C. All conduit shall be supported in accordance with the NEC and as specified herein. This shall apply to all conduit types, including flexible conduit.
- D. Provide for the proper application, installation, and location of inserts, supports, and anchor bolts for a satisfactory raceway system. Where any component of the raceway system is damaged, replace or provide new raceway system.

- E. Run conduits concealed to avoid adverse conditions such as heat and moisture, to permit drainage, and to avoid all materials and equipment of other trades. Maintain a minimum clearance of 6 inches from any high-temperature piping or ductwork.
- F. Conduits shall be attached to building surfaces and not suspended unless installed in a Unistrut-type conduit rack as specified herein. Individual conduits shall not be suspended. Clevis hangers are not allowed.
- G. Center conduit in structural slabs (other than topping), clear of reinforcing steel and spaced on centers equal to or exceeding three times the conduit diameter. Outside diameter of conduit shall not exceed one-third the slab thickness for each run of conduit 1 1/4 inches or larger. Provide shop drawings when it will be installed in structural slabs. Conduits shall not be run in slabs-on-grade or structural topping slabs.
- H. Independently support or attach the raceway system to structural parts of construction in accordance with good industry practice. Conduits through roofs shall be rigid metal conduit and be equipped with pitch pockets.
- I. Conduit attached to building surfaces that may be damp shall be spaced out to avoid rust and/or corrosion using fittings approved for the use. Use back straps on all conduit in damp or wet locations, or mount conduit with Unistrut straps, or equal. Watertight hubs shall be used in all damp locations. Damp locations shall include, but not be limited to, all areas below grade, and exterior locations.
- J. Conduits shall be securely fastened to building structure at intervals not exceeding 8 feet or closer, if necessary. Where hangers are necessary, 3/8-inch rod/eyelets/rings/or trapeze type in Unistrut channel and pipe clamps shall be used. Wire or perforated strap iron is not acceptable. PVC conduit shall be securely fastened to building structure at intervals not exceeding 3 feet.

3.02 GENERAL CONDUIT INSTALLATION REQUIREMENTS

- A. Interior conduit shall be run concealed in walls, building cavities, chases, attic spaces, and buried below floor slabs. Exterior conduit shall be buried below grade and concealed in structure walls. Exposed conduit runs shall be avoided. Conduit may be run exposed only where it is impossible to conceal.
- B. Run exposed conduit grouped and parallel or perpendicular to construction. All conduit shall be run exposed in structures below grade.
- C. All conduit installed below grade shall be buried a minimum of 2 feet 0 inches. All conduit installed below floor slabs shall be buried a minimum of 1 foot below slab.
- D. PVC conduit installed in earth (interior and exterior) shall be bedded in compacted sand with a minimum of 6-inch cover on all sides.
- E. Ream conduit smooth at ends, cap upon installation, rigidly attach to structural parts of the building, and securely fasten to all outlet boxes, panel cabinets, junction boxes, pull boxes, splicing chambers, safety switches, and all other components of the raceway system.
- F. Provide all empty raceways 2-1/2 inches and over with No. 10 galvanized fishwire, and nylon cord for conduits smaller than 2-1/2 inches. Empty raceways and fishwire/nylon cord shall be identified with permanent label, and label shall include conduit termination point. All empty conduits shall be threaded, capped and flush with finished floor. Exposed conduits shall be threaded and capped.

- G. Conduit seals shall be provided where conduits pass from the interior to exterior of the building, and any conduit entering a NEMA 4X area.
- H. Liquidtight flexible conduit shall be installed in such a manner that liquids tend to run off the surfaces and not drain toward the fittings.
- I. All runs of flexible conduit to equipment and devices shall be as short as practicable, of the same size as the conduit it extends, and with enough slack to reduce the effects of vibration to a minimum. A minimum of 18 inches of flexible conduit shall be installed for each motor.
- J. Provide conduit expansion-deflection fittings as specified herein in all conduit runs where movement perpendicular to axis of conduit may be encountered.
- K. Conduits shall be pitched so that drainage is away from all structures.
- L. Conduit bends for PVC conduit shall be made using a hot box, heat blanket, or glycol bender. Open flame or point heat sources of any type are not allowed.
- M. The PVC-coated rigid conduit manufacturer's touch-up compound shall be used on all conduit interior and exterior bare steel exposed because of nicks, cuts, abrasions, thread cutting, and reaming; minimum six coats.
- N. Where below-grade PVC conduit is connected to rigid metal conduit, the length of PVC conduit shall be a minimum of 10 feet. For short, below-grade conduit runs where required lengths of rigid metal conduit limit the length of PVC conduit to less than 10 feet, rigid metal conduit shall be used for the entire run.

3.03 CONDUIT PENETRATIONS AND TERMINATIONS

- A. Where fittings are brought into an enclosure with a knockout, a gasket assembly consisting of an O-ring and retainer shall be installed on the outside. Fittings shall be insulated throat type.
- B. Conduit penetrations for control panels or enclosures containing electronic equipment shall utilize watertight hubs and enter the sides or bottom of the enclosure. Conduits shall not penetrate the top of the enclosure.
- C. Provide conduit expansion fittings as specified herein in all conduit runs that cross a structural expansion joint, for conduits protruding from earth where the conduit is terminated within 5 feet of finished grade.
- D. Provide firestopping for all conduits penetrating fire barriers.
- E. All conduits that protrude from poured concrete shall be PVC-coated rigid conduit. Conduit shall extend continuously (i.e., no joints) a minimum of 4 feet beyond the poured concrete (both sides).
- F. Conduits passing through masonry, concrete, or similar construction shall be cast in place using PVC-coated rigid conduit extending completely through the construction.
- G. Where above-grade conduits pass through cores in existing structures or through masonry walls, grout openings between conduit and walls or floors with sand cement mortar.

3.04 CONDUIT INSTALLATION FOR EMERGENCY LIGHTING AND POWER CIRCUITS

- A. All emergency egress lighting and power circuits shall be installed in dedicated conduits.
- B. Conduits for emergency egress lighting and power circuits shall be installed and permanently marked in accordance with the NEC.

3.05 CONDUIT INSTALLATION SCHEDULE

- A. The following schedule lists specific conduit types allowed in designated areas. Those areas not listed under a specific conduit type shall not have that type of conduit installed:
1. Rigid steel:
 - a. Structural slabs.
 - b. Interior locations requiring mechanical protection.
 - c. All exposed interior locations.
 - d. All concealed interior locations.
 2. PVC-coated rigid steel:
 - a. Conduits protruding from concrete.
 - b. Exterior locations requiring mechanical protection.
 - c. Earth.
 - d. Exterior locations and locations exposed to weather.
 - e. Within 6 feet of building or structure footing or wall.
 3. PVC:
 - a. Earth, except within 6 feet of a building or structure footing or wall.
 - b. NEMA 4X areas (indoors only).
 - c. Buried below slabs on grade.
 4. Liquidtight flexible metal conduit not over 3 feet in length for final connections to:
 - a. Equipment in wet locations.
 - b. Equipment with sliding bases or flexible positioning.
 - c. Equipment with vibration isolation mounting.
 - d. Equipment housing ferromagnetic cores or with integral moving components capable of generating noise or vibrations, including transformers and motors.
 - e. All pumps and associated equipment

3.06 GENERAL WIRING METHODS

- A. Install electrical wire and connectors in accordance with the manufacturer's written instructions, applicable requirements of the NEC, the National Electrical Contractors Association's "Standard of Installation," and in accordance with recognized industry practices to ensure that products serve the intended functions. Use appropriate wiring methods and materials for the equipment or environment.
- B. Stranded conductors shall be terminated using crimp-type devices specified herein. Conductors may not be wrapped around a terminal screw.
- C. Place an equal number of conductors for each phase of a circuit in same raceway.
- D. Torque conductor connections and terminations with calibrated torque wrench to manufacturer's recommended values. Provide permanent marking on lug, bolt, nut, or connection for conductors larger than 4 AWG.

- E. Splice only in junction or outlet boxes. Splicing is not allowed in disconnects, motor control centers, panelboards, control panels, equipment, etc. Avoid splices between terminals of interconnecting power and control wiring.
- F. Spring wire connectors shall only be used in junction, outlet, or switch boxes. Equipment wireways (e.g., motor control centers, panelboards, disconnects, etc.), and control panels shall not have any spring-wire connectors installed; all terminations shall be on terminal strips.
- G. Neatly train, lace, and tie wrap all wiring inside boxes, equipment, control panels, MCCs, and panelboards.
- H. Make conductor lengths for parallel circuits equal.
- I. The same color shall be used for each numbered wire throughout its entire length.
- J. Terminate all wiring on terminal blocks in control panels, starter cubicles, and similar equipment. This shall include all spare or unused wires.
- K. Provide a dedicated neutral for each branch circuit or feeder requiring a neutral. Ampacity of neutral conductor shall match that of the branch circuit or feeder.
- L. Do not use a pulling means that can damage the raceway.
- M. Signal wiring (below 100 volts) must be in a conduit separate from power and/or control wiring (over 100 volts). Signal wire shall include, but not be limited to, loop-powered devices, and communication wiring (i.e., DeviceNet, RS-232, etc.). Analog wiring shall be in a conduit separate from all other wiring. Intrinsically safe wiring shall be separated and identified in accordance with Article 504 of the NEC.
- N. Provide junction or pull boxes to facilitate the “pulling in” of wires or to make necessary connections. All raceways and apparatus shall be thoroughly blown out and cleaned of foreign matter prior to pulling in wires.
- O. Thoroughly clean wires before installing lugs and connectors.
- P. Make splices, taps, and terminations to carry full capacity of conductors without perceptible temperature rise.
- Q. Terminate spare conductors within equipment, MCCs, control panels, etc., on terminal strips and label as “SPARE.” Spare wiring in pull or junction boxes may be terminated with electrical tape and labeled as “SPARE.” All spare conductor labels shall indicate where the conductors terminate. Refer to Section 26 05 53 – Electrical Identification, for additional requirements.
- R. Feeder connections to motors shall be installed within the motor junction box utilizing factory engineered kits as specified herein. Spring wire connectors are not allowed for connections to motors.

3.07 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL-listed wire-pulling lubricant for pulling 4 AWG and larger wires. Wax-based pulling lubricant is not allowed unless it includes a Teflon additive.
- B. Install wire in raceway after interior of building is enclosed, watertight, and dry, and all mechanical work likely to injure conductors has been completed.

- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Conductors No. 6 AWG and larger shall be pulled into conduits utilizing a tugger with built-in tension meter. Contractor shall provide a report to Engineer for each pull indicating maximum tension reached during the pull along with manufacturer's maximum pulling tension. Motorized machines of any type are NOT ALLOWED for any wire pulling.
- E. Conductors shall be installed in conduit system in such a manner that insulation is not damaged, conductors are not overstressed in pulling, and walls are not damaged. No splices are permitted except in junction boxes or outlet boxes.
- F. Contractor shall observe code limitation on the number and size of wires in an outlet box. Contractor shall either lay out work so that the wires do not exceed the particular box limitation or provide larger boxes approved for additional capacity.
- G. Panel riser feeder conductors shall be identified with colored tape at panel lugs. The same phase relation shall be maintained throughout.
- H. Circuiting is indicated diagrammatically on the drawings.

3.08 TERMINAL BLOCK INSTALLATION

- A. A maximum of one conductor shall be installed on the field-wired side of each terminal block. If rated to accept more than one conductor, a maximum of two conductors shall be installed on the enclosure-wired side of each terminal block. Provide additional terminal blocks and shorting jumpers as required.
- B. Provide a separate ground-type terminal block for each shielded-cable drain conductor.
- C. Provide ten percent spare terminal blocks for each type of connected terminal block, minimum five spare terminal blocks total. For each grouping of terminal blocks, provide 25% spare DIN rail space.
- D. Maintain a minimum of 1 1/2 inches between terminal blocks and adjacent devices and enclosure wireways.
- E. For current transformer shorting terminal blocks, the short-circuit slider shall cover the terminal block conductor screws on the meter-side of the terminal blocks when in the non-shortening position, and expose the terminal block conductor screws when slid into the shortening position.
- F. Provide terminal blocks where required to extend current transformer lead wires. Terminal blocks shall be mounted in a small junction box or have a removeable barrier covering the terminals to prohibit wire removal without first opening the enclosure or removing the barrier. Provide a nameplate on the junction box/barrier reading: "DANGER: DO NOT DISCONNECT CT WIRES UNDER LOAD."

3.09 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings and as necessary for splices, taps, wire pulling, cable bending radii, equipment connections, and code compliance.
- B. Electrical box locations shown on the drawings are approximate. Verify location and size of floor boxes and outlet boxes in all work areas prior to rough-in.

- C. Where dedicated raceways are provided for different voltage systems or wiring, separate boxes shall also be provided unless acceptable to Engineer. Where acceptable to ENGINEER, combined boxes shall be physically divided to separate the wiring.
- D. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of access doors.
- E. Locate and install to maintain headroom and to present a neat appearance.
- F. All boxes attached to building surfaces that may be damp shall be spaced to avoid rust and/or corrosion. All boxes in damp locations shall be on 1/2-inch standoffs. Damp locations shall include, but not be limited to, all basement areas, tunnel areas, exterior locations, all areas below grade.

3.10 PULL AND JUNCTION BOX INSTALLATION

- A. Support pull and junction boxes independent of conduit.
- B. Knockout punches or saws shall be used for holes; boxes with prepunched holes are not acceptable.
- C. Refer to Section 26 05 53 – Electrical Identification for junction box labeling requirements.
- D. All interior exposed junction and pull boxes shall be cast type with cover, unless noted otherwise.
- E. All exterior junction and pull boxes shall be NEMA 4X. Boxes in areas subject to damage shall be stainless-steel.

3.11 DEVICES

- A. Install all devices level and plumb.
- B. Refer to all mounting heights as referenced on drawings or other portions of the specification.

3.12 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor provide:
 - a. Grounding and Bonding of electrical equipment, materials and accessories as specified herein and as shown on the plan documents.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Section 26 24 16 – Panelboards
 - 2. Section 26 28 16 – Enclosed Safety Switches

1.03 SUBMITTALS

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

1.04 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 UL 467 for grounding and bonding materials and equipment.

PART 2 – PRODUCTS

2.01 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.

2.02 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Provide and install bonding type bushings in panelboards and distribution equipment. Provide bonding conductors to and through bushings interior of equipment. Connect to grounding bus of equipment.

2.03 GROUNDING ELECTRODES

- A. Ground Rods: Copper; 3/4 inch by 10 feet in length. (Service Ground Field)
- B. Ground Rods: Copper, 5/8 inch by 8 feet in length. (Lighting pole bases)

PART 3 – EXECUTION

3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2 AWG minimum. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.

3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 12 inches below final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 - 2. For grounding electrode system, install at least one rod and connect to the service grounding electrode conductor (GEC).
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity 200 kVA and Less: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect/Engineer promptly and include recommendations to reduce ground resistance.

3.05 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Conduit and equipment support members.
 - 2. Fastening hardware.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 QUALITY ASSURANCE

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.03 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23– Submittals.

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Support Members:
 - 1. 316 stainless-steel or fiberglass in exterior locations and NEMA 4X areas. PVC-coated steel where used with PVC-coated conduit.
 - 2. Galvanized steel in all other areas.
- B. Hardware:
 - 1. Stainless steel in exterior locations and NEMA 4X areas.
 - 2. Galvanized steel in all other areas.
- C. Manufacturers: Unistrut P-1000, B-line, Superstrut, or equal.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. All supporting devices and support structures shall be constructed such that the structure adequately supports the load of the equipment installed on it including any wind and/or snow loads. Provide additional support members to those shown on the Drawings to adequately support load.
- B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors or support members. Do not use spring steel clips and clamps. Provide standoffs as specified in other technical sections.

- C. Use toggle bolts or hollow wall fasteners in hollow masonry, partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; studs; and wood screws in wood construction.
- D. Where support members are used for conduit, cutoff ends shall be ground smooth. Cutoff PVC-coated support members shall be ground smooth and touched up with PVC coating material from the manufacturer.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- F. Do not use powder-actuated anchors.
- G. Do not drill structural steel members.
- H. Fabricate supports with welded end caps and all welds and surfaces ground smooth for neat appearance. Use hexagon head bolts with steel spring-lock washers under all nuts.
- I. In wet locations, install electrical equipment to walls with standoffs and caulk.
- J. Install surface-mounted cabinets with a minimum of four anchors.
- K. Do not use chain, wire rope, or perforated strap hangers.
- L. All welds shall be continuous and ground smooth.

END SECTION.

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Nameplates.
 - 2. Labeling tags.
 - 3. Wire markers.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23– Submittals.
- B. Provide schedule for nameplates and labeling tags with shop drawings. Reference drawings for type used.

PART 2 – PRODUCTS

2.01 NAMEPLATES

- A. Type “A”:
 - 1. Use:
 - a. Each separately mounted disconnect switch.
 - b. Each device in motor control centers.
 - c. Cabinets, enclosures, pull, and junction boxes.
 - d. Field devices (flowmeter transmitters, level transmitters, chemical scales, chemical leak detectors, etc.).
 - 2. Size: 2-inch by 3-inch.
 - 3. Material: 3-layer laminated Micarta.
 - 4. Background Color: Black.
 - 5. Character Color: White.
 - 6. Character Size: 1/4-inch.
 - 7. Engraving: See MCC schedule, one-line, and I/O list for labels, or as requested by Engineer. Label shall include equipment number and description.
 - 8. Mounting Location: Front exterior.

- B. Type "B":
 - 1. Use: Motor Control Centers.
 - 2. Size: 4-inch by 4-inch.
 - 3. Material: 3-layer laminated Micarta.
 - 4. Background Color: Black.
 - 5. Character Color: White.
 - 6. Character Size: 2-1/4-inch.
 - 7. Engraving: Label shall include equipment number and description.
 - 8. Mounting Location: Equipment: Top wire way.

- C. Type "C":
 - 1. Use: Control stations, thermostats, etc.
 - 2. Size: 3/8-inch by 2-inch.
 - 3. Material: 3-layer laminated Micarta.
 - 4. Background Color: Black.
 - 5. Character Color: White.
 - 6. Character Size: 1/8-inch.
 - 7. Engraving: Control station number and equipment description.
 - 8. Mounting Location: Device front at top.

2.02 LABELING TAGS

- A. Use: Field-Mounted Devices (Valves, Limit Switches, Level Transmitters, Flow Transmitters, etc.).
 - 1. Size: 2-inch diameter round.
 - 2. Material: 3-layer laminated Micarta.
 - 3. Character Size: 1/8-inch.
 - 4. Engraving: As requested by ENGINEER.

2.03 WIRE AND CABLE MARKERS

- A. Wire and cable markers shall be permanently-attached, heat-shrink type labels.
 - 1. Sleeve: Permanent, PVC, white, with legible machine-printed black markings.
 - 2. Acceptable Manufacturers: Raychem Model D-SCE or ZH-SCE, Brady Model 3PS, or equal.
 - 3. Grounding Conductor: Provide green wire marker; minimum 2 inches wide.
- B. Wire or cable numbering preprinted on the conductor or cable insulation, flag-type labels, and individual wraparound numbers (such as Brady preprinted markers) are not acceptable. All wire markers shall be the same throughout the project.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates parallel to equipment lines.
- C. Affix nameplates with weatherproof, UV-resistant adhesive in outdoor locations and sticky back adhesive in indoor locations.
- D. Affix labeling tags with stainless steel leaders; vinyl locking wire ties are not acceptable. Provide 3/8-inch hole to accommodate wire tie.
- E. Prepare and install neatly-typed directions in all panels, including existing panels where Work is done under this Contract.

3.02 WIRE IDENTIFICATION

- A. Provide wire markers on each conductor, including neutral and spare conductors, in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Neutral conductor labels shall include the associated branch circuit number. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams for control wiring. Spare conductors shall have control wire number or shall indicate termination point of wire.
- B. Conductors in pull boxes, motor control centers, supervisory control panels, control panels, cabinets, and panelboards shall be grouped as to circuits and arranged in a neat manner. All conductors of a feeder or branch circuit shall be grouped, bound together with nylon ties, and identified. Phase identification shall be consistent throughout the system. All wiring labels shall be able to be read without removing wire management (i.e., wiring trough covers, spiral windings, etc.) or twisting the wire/cable.
- C. Power Conductor Insulation Color Code:
 - 1. 6 AWG and Larger: Provide general-purpose, flame-retardant, permanent tape at each termination and at accessible locations such as junction and pull boxes, panelboards, motor control centers, etc. Apply tape with at least six full, overlapping wraps; minimum 2 inches wide.
 - 2. 8 AWG and Smaller: Provide conductors with color-coded insulation.
 - 3. Colors:

| System | Conductor | Color |
|---|---|--------------------------------|
| All Systems | Equipment Grounding | Green |
| 120/208 Volts Three-Phase, Four Wire | Grounded Neutral Phase A Phase B Phase C | White* Black Red Blue |
| 480 Volts Three-Phase, Three Wire | Phase A Phase B Phase C | Brown Orange Yellow |
| Note: Phase A, B, C implies direction of positive phase rotation. | | |
| * When installed as part of a 120-volt branch circuit, provide a color-coded stripe on the white neutral conductor insulation matching the branch circuit insulation. | | |

D. Control Panel and Field-Installed Control Conductor Insulation Color Code:

1. All conductors shall have color-coded insulation.
2. Colors:

| System | Conductor | Color |
|--|--|--|
| Supply Voltage | Ungrounded Circuit Conductors Neutral | Black White |
| Discrete 120-volt AC Input/Output | Control Circuit Conductor Neutral | Red White |
| Discrete 12/24-volt DC Input/Output | Control Circuit Conductor Common | Blue White with Blue Stripe |
| Conductors energized | Control Circuit Conductor AC Neutral DC Common | Orange White White with Blue Stripe |
| when the main disconnect is in the "off" position (e.g. foreign supply voltages) | Ground | Green |

E. Circuit Identification:

1. Identify power, instrumentation, and control conductors at each termination and at accessible locations such as junction and pull boxes, panelboards, motor control centers, etc.
2. Conductors for panelboard circuits shall identify circuit matching the circuit directory designations, including the neutral conductor.
3. Control conductor identification shall match the associated terminal block label.
4. Circuits Not Listed in Circuit Directories:
 - a. Assign circuit name based on unique device or equipment at load end of circuit.
 - b. Where unique device or equipment names are not available or apparent, add a unique number or letter modifier to each otherwise identical circuit name.

3.03 JUNCTION BOX IDENTIFICATION

- A. All junction boxes shall be labeled with permanent labels. Labels shall indicate circuit or load served, as well as the power source and highest voltage present on any conductor.

3.04 TERMINAL BLOCK IDENTIFICATION

- A. Terminal blocks shall be labeled on both sides of each terminal block. Terminal block numbering shall match the numbers shown on the project-specific wiring diagrams.
- B. Fused terminal blocks labels shall be located on top of the terminal blocks and include the fuse voltage and amperage rating.

3.05 LABELING FONT REQUIREMENTS

- A. The font for all conductor, cable, and device labels shall be Arial with black characters on white background, and minimum font size 12.

- B. The text for all conductor, cable, and device labels shall be machine printed. Handwritten labels are not acceptable.

END SECTION.

SECTION 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor Provide:
 - a. Electrical Branch-circuit panelboards.

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Section 26 05 00 – Basic Materials and Methods
 - 2. Section 26 05 53 – Electrical Identification

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.
- F. TVSS: Transient Voltage Surge Suppressor.

1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
- C. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
 - 1. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.

1.07 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.08 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D / Group Schneider. (Basis of Design Product)

2.02 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 3. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
 - 1. Material:
 - a. Hard-drawn copper, 98 percent conductivity – Distribution and Branch Panelboards.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus Configured Terminators: Mechanical type.
- D. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.03 SURGE PROTECTION DEVICES (TVSS)

- A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1.
- B. Features and Accessories:
 - 1. Integral disconnect switch.

2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 3. Indicator light display for protection status.
 4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 5. Surge counter.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:
1. Line to Neutral: 1200 V for 480Y/277 V.
 2. Line to Ground: 1200 V for 480Y/277 V.
 3. Line to Line: 2000 V for 480Y/277 V.
- E. SCCR: Equal or exceed 100 kA.
- 2.04 PANELBOARD SHORT-CIRCUIT RATING
- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.
1. Rated as indicated on panel schedules. – See drawings.
- 2.05 DISTRIBUTION AND BRANCH-CIRCUIT PANELBOARDS
- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- 2.06 OVERCURRENT PROTECTIVE DEVICES
- A. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
 4. Main Breaker: See Schedule for requirements.
 5. Connection to Bus: Bolt-on type.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26, Section 26 05 00 – Basic Materials and Methods.
- C. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Install overcurrent protective devices and controllers.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26, Section 26 05 53 - Electrical Identification.
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

- A. Connect wiring according to Division 26, Section 26 05 00 - Basic Materials and Methods.

3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test continuity of each circuit.
 - 2. Test functionality of breaker on-off / make-break.
 - 3. Visually inspect all breakers for loose parts or manufacturing discrepancies.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform each electrical test and visual and mechanical inspection. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Arrange circuits to properly load system to within 20% tolerance across phases.

3.05 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards and load centers. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.06 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 24 19

MOTOR CONTROL CENTERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Motor control devices, accessories, and general requirements.
 - 2. Magnetic motor starters.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 REFERENCES

- A. ANSI/NEMA ICS 6–Enclosures for Industrial Controls and Systems.
- B. NEMA AB 1–Molded Case Circuit Breakers.
- C. NEMA ICS 2–Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA ICS-18–Motor Control Centers.
- E. NEMA KS 1–Enclosed Switches.
- F. NEMA PB 1–Panelboards.
- G. NEMA PB 1.1–Instruction for Safe Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

1.03 QUALITY ASSURANCE

- A. Manufacturers of Motor Control Equipment: Firms regularly engage in the manufacture of motor control equipment of the types and capacities required whose products have been in satisfactory use in similar service for not less than 10 years.
- B. UL Labels: Provide motor control devices, manual motor controllers, magnetic motor starters, combination motor starters, motor control centers, etc., which have been listed and labeled by Underwriters Laboratories.

1.04 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23 – Submittals.
- B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 33 23 – Submittals. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.06 DELIVERY, STORAGE, AND HOLDING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.07 SPARE PARTS

- A. Furnish spare parts for equipment specified herein as listed in Section 01 77 00—Contract Closeout.

1.08 COORDINATION

- A. To promote proper coordination between Section 26 29 13—Enclosed Controllers, and equipment specified herein, all equipment specified in this section shall be supplied as part of the Controls and Instrumentation package described in Section 26 29 13. This shall include, but not be limited to, equipment such as MCCs and control stations. Drawings for MCCs, motor controllers, and motor control equipment shall be provided by the system supplier. Drawings from equipment manufacturers will not be accepted as shop drawings or O&M documents.

1.09 WARRANTY

- A. Standard One-Year Warranty: Unless otherwise stated below, manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of one year from the earlier of either the date established for partial utilization in accordance with GC14.04 and 14.05, as modified in the Supplementary Conditions, or Substantial Completion of the project.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Motor control devices, motor starters, and motor control centers shall be as manufactured by Allen-Bradley, or equal, as approved by Engineer and in accordance with substitutions under provisions of the General Conditions. All equipment specified in this section and provided by Contractor shall be by the same manufacturer.
- B. The drawings and specifications were prepared based on Allen-Bradley. Contractor shall include in the Bid and shall be responsible for the cost of any changes to accommodate other equipment including, but not limited to, structural, mechanical, and electrical work. Contractor shall also pay additional costs necessary for revisions of drawings and/or specifications by Engineer.

2.02 MOTOR CONTROL DEVICES, ACCESSORIES, AND GENERAL REQUIREMENTS

- A. Indicating Lights: NEMA ICS 2; heavy-duty, oiltight (30 mm), LED, push-to-test type as shown on the drawings. Indicating lights in indoor, corrosive locations shall be rated NEMA 4X.
- B. Selector Switches: NEMA ICS 2; heavy-duty, oiltight, (30 mm) as shown on the drawings. Selector switches in indoor, corrosive locations shall be rated NEMA 4X.

- C. Relays for motor control circuits, hard-wired control logic, and for loads less than 10 amps shall be general purpose, industrial, square base relays. Relays for lighting circuits and small motor loads shall be industrial, electrically-held power relays. Relays shall meet the following requirements:
1. General purpose relays:
 - a. Configuration: DPDT or 3 PDT as required by system supplier.
 - b. Mounting: DIN rail with screw terminal base socket.
 - c. Voltage: 120 Vac.
 - d. Contact rating: 15 A, minimum; 3/4 hp.
 - e. Operating life: 10 million cycles.
 - f. Status: On-Off flag type or LED indicator.
 - g. UL listed.
 - h. Manufacturer: Allen-Bradley, 700-HB, or equal.
 2. Power relays.
 - a. Configuration: Electrically-held, 2-12 poles.
 - b. Mounting: DIN rail, square base.
 - c. Voltage: 120 Vac.
 - d. Contact rating: 20 A continuous; 1 hp.
 - e. Operating life: 10 million cycles.
 - f. UL listed.
 - g. NEMA rated.
 - h. Manufacturer: Allen-Bradley, 700-PK, or equal.
- D. All starters shall be equipped with the auxiliary devices to meet the requirements of the Drawings and Specifications. Each starter operating at other than 120-volt, single-phase shall be equipped with a control transformer providing 120-volt secondary for control power. Transformer shall have fused primary and secondary connections and shall be sized per manufacturer's recommendations. Coils and pilot lights in all starters shall be 120 volts.
- E. Enclosures for Stand-Alone Controllers and Control Devices:
1. Enclosures in indoor dry locations shall be NEMA 1 gasketed.
 2. Enclosures in indoor damp or wet locations shall be NEMA 4X, stainless steel.
 3. Starters and disconnect devices for motors shall be installed in common enclosures, combination type, with all accessories such as terminal blocks, push-to-test pilot lights, and H-O-A switches.
 4. All wiring within starter enclosures shall be landed on terminal blocks. This shall include internal control wiring, field wiring, and any spare or unused wiring.
 5. Control stations shall include devices as shown on the Drawings and specified in Section 26 29 13–Enclosed Controllers.

- F. Hardwired Motor Controls:
 - 1. Equipment and wiring specified to be hardwired shall be physically wired independent of controllers, programmable relays, and communication systems to allow manual operation in the event of an emergency.
 - 2. Motor control wiring and logic shall be set up such that in the event of a power failure, equipment shall automatically restart if previously running, or remain off if previously off. A manual reset shall not be required to restart equipment following a power failure.
- G. Well 13 fusible disconnects shall be placed within the existing motor control center. Well 31 fusible disconnects shall be placed adjacent to the proposed equipment as required.
- H. Non-fusible disconnects shall be placed adjacent to proposed equipment in both well houses.

2.03 MAGNETIC MOTOR STARTERS

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower. Each magnetic starter shall be equipped with a solid-state overload relay, Allen-Bradley E1 Plus, Bulletin 592-EE, or equal. Starters for submersible pumps and mixers shall include ground fault protection.
- B. Full-Voltage Starting: Nonreversing type as shown on the drawings.
- C. Coil Operating Voltage: 120 volts, 60 Hz.
- D. Size: NEMA ICS 2; size as shown on the drawings. Contactors shall be Allen-Bradley, Bulletin 509 (Nonreversing), or equal.
- E. Overload relays shall have the following features:
 - 1. Self-powered, solid-state.
 - 2. Up to 5:1 adjustment range.
 - 3. DIP switch settings for trip class and reset mode.
 - 4. Current transformers (no heaters).
 - 5. Thermal memory.
 - 6. Ambient temperature compensation.
 - 7. Visible trip indicators.
 - 8. Phase loss protection.
 - 9. Low energy consumption.
 - 10. Ground fault protection as specified herein.
- F. Magnetic motor starters in motor control centers shall be combined with magnetic only molded case circuit breakers. Magnetic motor starters in combination motor starters or control panels shall be combined with thermal-magnetic molded case circuit breakers.
- G. Through-the-door overload reset pushbuttons shall be provided for all magnetic starters installed in motor control centers and combination motor starters.

- H. All work shall include the installation of electronic overload switches, magnetic motor starters and associated appurtenances within an existing motor control center.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Provide motor control equipment in accordance with manufacturer’s instructions and drawings.
- B. Motor Starter Panelboard Installation: In conformance with NEMA PB 1.1.
- C. Overloads shall be selected on the basis of nameplate horsepower and service factor. Selection of overloads based on horsepower shown on the drawings is not acceptable. Where power factor correction capacitors are provided, overload protection shall be compensated for the lower motor running current because of improved power factor.
- D. All motor control wiring shall be installed in accordance with control wiring diagrams furnished.
- E. Wireways in MCCs shall be used only for routing of conductors. Splices are not allowed within wireways.
- F. All wiring within MCCs shall be landed on terminals inside buckets or equipment compartments and not left unterminated within wireways. This shall include all internal MCC wiring and external field wiring, including spare wires.
- G. Motor Data: Provide neatly typed label inside each motor starter enclosure identifying motor served, nameplate horsepower, full-load amperes, code letter, service factor, and voltage/phase rating.
- H. Control wiring and field wiring (120 V and below) within MCCs shall be separated from power wiring (277 V and above). Where possible, route control and field wiring in separate raceways or wireways. Provide a minimum of 2 inches separation between control wiring, field wiring, and power wiring.
- I. All motors will be provided by other divisions, ready for connections. Contractor shall be responsible for electrical connections for power and control circuit wiring, proper phase relationships, and correct motor rotation.
- J. Provide motor circuit wiring for each motor from the source of supply to the terminal box on the motor including all intermediate connections at devices such as motor starters, disconnect switches, etc.
- K. All feeder cable connections to motor leads up to 600 volts shall be insulated and sealed with factory-engineered kits, as specified in Section 26 05 00 – Basic Materials and Methods.
- L. Provide motor starters as specified for all motors, unless shown or specified that starters or control equipment will be furnished by others.
- M. Provide motor circuit disconnect devices for all motors, unless shown or specified that disconnect devices or starters are furnished with other equipment.

END SECTION.

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: Hinged cover enclosures.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern Work in this section.

1.02 REFERENCES

- A. NEMA 250–Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. ANSI/NEMA ICS 1–Industrial Control and Systems.
- C. ANSI/NEMA ICS 6–Enclosures for Industrial Control Equipment and Systems.

PART 2 – PRODUCTS

2.01 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250, larger than 12 inches in any dimension. Acceptable manufacturers: Hoffman, B-Line, or equal.
- B. Covers: Continuous hinge, applicable NEMA rating with hasp and staple for padlock.
- C. Back Panel for Mounting Terminal Blocks or Electrical Components: 14-gauge steel, white enamel finish.
- D. All enclosures with double doors or that are free-standing shall have a 3-point latch.

2.02 FABRICATION

- A. Shop-assembled enclosures housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs on all enclosures.
- C. Provide protective pockets inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.
- D. Provide gasketed surfaces for all enclosure doors and covers.

2.03 ENCLOSURE RATING

- A. Enclosures shall be rated as listed below, unless noted otherwise on the Drawings:
 - 1. Indoor locations not within Chemical Rooms: NEMA 12, steel.
 - 2. Outdoor locations and Chemical Rooms: NEMA 4X, stainless steel.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install enclosures plumb. Anchor securely to wall and structural supports at each corner minimum.
- B. Refer to Section 26 05 53 – Electrical Identification for enclosure labeling requirements.
- C. Provide accessory feet for free-standing equipment enclosures.
- D. All enclosures attached to building surfaces which may be damp shall be spaced out to avoid rust and/or corrosion. All enclosures in damp locations shall be on 1-inch standoffs. Damp locations shall include, but not be limited to, all areas below grade, and exterior locations.

END SECTION.

SECTION 26 27 26

WIRING DEVICES

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Wall switches.
 - 2. Cover plates.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 REFERENCES

- A. NEMA WD 1–General-Color Requirements for Wiring Devices.
- B. NEMA WD 5–Specific-Purpose Wiring Devices.
- C. Drawings–Bill of Materials.

1.03 QUALITY ASSURANCE

- A. Manufacturers of switches, outlets, boxes, lamps, fuses, lugs, etc.: Firms regularly engaged in the manufacture of these products, of the types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with at least 5 years of successful installation experience on projects with electrical wiring installation work similar to that in this project.
- C. Code Compliance: Comply with National Electrical Code (NFPA 70) and any and all local codes as applicable to construction and installation of electrical wiring devices, material, and equipment herein specified.
- D. UL Labels: Provide electrical cable, raceways, wire, connectors, outlets, switches, etc., which have been listed and labeled by Underwriters Laboratories.
- E. NECA Standard: Comply with applicable portions of National Electrical Contractor's Association's "Standard of Installation."

1.04 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23–Submittals.
- B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

PART 2 – PRODUCTS

2.01 WALL SWITCHES

- A. A-C general use Industrial specification grade, snap switch, 20 amperes, 277 volts, one of the following: Cooper 222*, Leviton 122*, or Pass and Seymour PS20AC*.

- B. Provide ivory-colored handles.
- C. Manual motor switches or manual motor controllers for 120 V or 240 V motors on circuits 20 amps or less shall be specification grade snap switch as specified above. Manual motor switches or manual motor controllers for 120 V or 240 V motors on circuits 30 amps or less shall be Cooper 303*, Leviton 303*, or Pass and Seymour PS30AC*. Manual motor switches for three-phase motors 30 amps or less shall be as specified in Section 26 28 16–Enclosed Switches.

*Complete catalog number for pole arrangement necessary.

2.02 COVER PLATES

- A. Each and every flush box shall be provided with standard 302 series stainless steel plates, blank, receptacle, switch, or cord as designated by outlet symbol. Surface boxes shall have plates to match Crouse-Hinds, Appleton, or equal, cast boxes.
- B. NEMA 4X and weatherproof switch covers shall be Thomas and Betts, Industrial Gray, toggle switch cover, Model E98TSCN-CAR, or equal.
- C. While in use, receptacle covers for exterior use shall be Leviton M5979, or equal. Receptacle covers for NEMA 4X locations shall be Leviton 5980, or equal.
- D. Cover plates for manual motor switches, manual motor controllers, and NEC required equipment disconnects shall have provisions for locking the switch in the On or Off position.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install wall switches 48 inches above floor (top of box), “Off” position down, except as otherwise noted.
- B. Install convenience receptacles 15 inches above floor (bottom of box), grounding pole on bottom except as otherwise noted.
- C. Install devices and cover plates flush and level.
- D. Back wiring is not allowed for switches and receptacles. Wires shall be terminated with the device screw terminal.
- E. Individual labels shall be placed on the back of all switch faceplates and receptacle faceplates indicating the lighting panel and circuit from which the switch or receptacle is fed. Labels shall be white background with black lettering no smaller than 12-point font. Provide permanently attached self-adhesive type, machine fed, and self-laminating labels, or equal. All labels must be by the same manufacturer, same size, and same font. Handwritten labels are not acceptable.

END SECTION.

SECTION 26 28 13

FUSES

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor Provide:
 - a. Cartridge fuses rated 600V and less for use in switches.
 - b. Spare fuses. (3 of each type / size provided)

1.02 RELATED WORK

- A. Specified Elsewhere:
 - 1. Section 26 28 16 – Enclosed Safety Switches

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA FU 1.
- C. Comply with NFPA 70.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.02 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
- B. Provide 3 spare fuses of each type and size as provided for installation in electrical equipment here-in specified and as listed on the drawings.

PART 3 – EXECUTION

3.01 FUSE APPLICATIONS

- A. Branch Panelboard / Distribution Protection: Class RK1, Dual Element / Time Delay.
- B. Branch Motor Protection: Class RK5, Time Delay.
- C. Branch Resistive Loads: Class RK1, Fast Acting.

3.02 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Turn over all spare fuses to using agency. Provide proof of receipt for record.

3.03 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fuse switch.

3.04 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 28 16

ENCLOSED SAFETY SWITCHES

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor provide:
 - a. Individually mounted, enclosed switches.
 - b. Non-fusible switches.
 - c. Fusible switches.

1.02 RELATED WORK

- A. Section 26 05 00 – Basic Materials and Methods
- B. Section 26 05 53 – Electrical Identification

1.03 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Operation and maintenance data.

1.04 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.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 NONFUSIBLE / FUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Division.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D/Group Schneider.

- B. Nonfusible or Fusible Switch, 240V or 600V, 100 A and Smaller: NEMA type 1 or 3R per schedule, Type Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
 - 1. Phases and Poles as noted on plan schedule.
- C. Nonfusible or Fusible Switch, 240V or 600V, 200 A and Larger: NEMA type 1 or 3R per schedule, Type Heavy Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
 - 1. Phases and Poles as noted on plan schedule.
- D. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- E. Coordination:
 - 1. Contractor shall reference plan disconnect schedule for specific requirements of each unit required.
 - a. Contractor shall review all plan sheets and provide / install all units as shown whether indicated on the schedule or not.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Comply with applicable portions of the National Electrical Code (NFPA 70), NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches with tops at uniform height, unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Division 26 Section "Basic Materials and Methods"
- D. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."

3.02 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch type and labeling verification.
 - 3. Verify rating of installed switch with equipment rating and manufacturers requirements.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical tests of switch and ability to transfer from open to closed with connected load. Test for proper phase and ground connections. Reconnect as required for proper operation.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.03 PAYMENT

- A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: Controls and instrumentation equipment provided with equipment.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 QUALITY ASSURANCE

- A. UL labels: All electrical equipment and material shall be listed and labeled by Underwriters Laboratories, except where UL does not include the equipment in their listing procedures. Electrical equipment shall include, but not be limited to, control panels, power supplies, controllers, relays, wire, selector switches, pilot lights, overcurrent devices, and connectors. Control panels shall bear a serialized UL label indicating that it is UL approved as an assembled unit. Panels which have individual components which are UL labeled, but do not have UL approval as an assembled unit are not acceptable.
- B. NEMA/ANSI Compliance: Comply with National Electrical Manufacturer's Association, American National Standards Institute and other standards pertaining to material, construction and testing, where applicable.
- C. Code Compliance: Comply with the National Electrical Code (NFPA 70) and any and all local codes as applicable to construction of electrical wiring devices, material, and equipment herein specified.

1.03 SUBMITTALS

- A. Manufacturer's Data: Submit manufacturer's data, specifications, and installation recommendations for each item specified herein.
- B. Submit shop drawings and product data in accordance with provisions of Section 01 33 23 Shop Drawings, Samples, and Product Data.
- C. Provide product data on all equipment and devices specified herein, as well as wiring schematics for all systems.
- D. Provide load calculations showing battery runtimes and UPS sizing including all equipment specified herein.
- E. Submit HMI graphic displays and written control descriptions for approval by filter supplier at least two months before system startup.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 33 23 - Shop Drawings, Product Data and Samples
- B. Include spare parts data listing, source, and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store in a clean dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect equipment from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to equipment components, enclosure, and finish.

PART 2 – PRODUCTS

2.01 EQUIPMENT ENCLOSURES

- A. New enclosures shall be front access only, minimum No. 12 gauge steel, hinged doors, rotating, lockable handle, three-point latch on each equipment compartment door (not screws or bolts), with top and bottom bolts actuated by one rotating handle on large doors. Quick-opening hasps may be substituted for rotating, lockable handle latch where approved by Engineer. Panels shall include door stop kit, data pockets for panel wiring diagrams, and minimum 18-inch fluorescent light and switch. Panels shall include nonfused main disconnect with interlock to prevent opening the panel with switch in "On" position. A def eater shall be provided to bypass this interlock, with handle lockable in "Off" position. Painting shall include phosphate treatment, zinc chromate iron oxide primer, baked rust-inhibiting enamel, and Owner-selected exterior color. All doors and panels shall be gasketed, and panels installed outdoors or nonconditioned spaces shall be insulated. Enclosures shall be as manufactured by Hoffman or Saginaw. Enclosure rating shall be as follows, unless noted otherwise on the drawings, or in the associated specification section. Indoor and/or dry locations: NEMA 12.
- B. Where necessary for the installed conditions, including direct sunlight or high-temperature environments, control panels shall be provided with louvers and filtered forced-air cooling as required to maintain internal ambient air temperatures 10°F below the rated operating temperature of all internal control panel equipment. Where the installed cooling system does not adequately maintain ambient air temperatures inside the control panel, additional cooling equipment shall be provided by the supplier at no cost to Owner.
- C. The equipment mounted within the enclosures shall be mounted on the enclosure back panel, neatly organized, and shall be in accordance with the manufacturer's recommendations. For outdoor panels, indicating and control devices shall be mounted on a swing-out inner door.
 - 1. All wiring within control panels shall be insulation-type MTW, minimum size 16 AWG. Wiring within the enclosure shall be routed through plastic wiring troughs with removable covers. Maximum fill for wiring troughs shall be 60%. Terminal blocks located adjacent to wiring troughs shall have a minimum of 1 1/2 inches between terminal block and trough. All wiring in control panels not in wiring troughs shall be bound with continuous-type spiral windings.
 - 2. All I/O devices shall be wired to DIN rail-mounted terminal blocks.
 - 3. Field wiring in dry locations shall be insulation-type THHN, minimum size 14 AWG. Field wiring in damp or wet locations shall be insulation type XHHW-2, minimum size 14 AWG. All field wiring shall terminate at rail-mounted terminal blocks. Field wiring

terminals shall be clearly identified as to which I/O terminals they are wired. Wire markers shall be permanently attached, wraparound adhesive, or heat-shrink-type markers. Wire numbering preprinted on the conductor and individual wraparound numbers are not acceptable.

4. Jumpers between adjacent terminal blocks shall be copper jumper bars supplied by the terminal block manufacturer.
 5. All panels with DIN rail-mounted equipment shall include a minimum of 25% spare DIN rail space.
 6. In addition to spare I/O specified herein, provide a minimum of 25% spare hot and neutral terminals, wired to terminal strips. Spare terminals shall be provided for all-voltage sources within the panel (e.g., 120 V, 24 V).
- D. Tubing and instruments containing water shall be in separate compartments, located and constructed so that leakage or spray at 100 psi pressure cannot touch electrical conductors or devices. Leakage shall be conducted to the floor in duct or pipe.
- E. All wiring for new panels shall be done in the factory, Class II, Type C with master terminal strips for exterior connections. Terminal blocks shall be mounted either at the bottom or on the side of the enclosure, depending where the I/O conduits penetrate the enclosure. Splices are not allowed within enclosures or wireways. All enclosures must pass through doors to point of installation, and if enclosures are shipped in sections, all wiring and connections between sections shall be done by Contractor. All wiring shall be labeled at each end with corresponding numbers. This numbering shall be shown on the shop and record drawings.
- F. All door-mounted devices shall be furnished flush-mounted, and an exterior engraved phenolic nameplate worded by the manufacturer and reviewed by Owner (upon receipt of shop drawings) shall be provided for each compartment, device, light, etc. All components within the enclosures shall be identified with interior-mounted engraved labels. Labels shall be installed on the enclosure back panel and not on the device or wireway. Devices shall be grouped for each device or unit being controlled.
- G. Equipment enclosures that include motor controllers shall have a main disconnect for the enclosure.
- H. Manufacturer of Accessories:
1. The plastic wiring duct shall be Electrovert "Electro-Duct," Panduit, or equal.
 2. Terminal blocks shall meet the requirements of Section 26 05 00 Basic Materials and Methods.
 3. Wire markers shall meet the requirements of Section 26 05 53 Electrical Identification.
 4. Circuit breakers shall be Square D Type QO with mounting bases, or equal. Circuit breakers can be rail-mounted type, Square D, Class 9080, Type GCB-150, or equal.
 5. Power supplies shall be Sola, DIN rail mount, SPD or SDN Series, or equal.
 6. Signal conditioners shall be Action Instruments, DIN rail mount, or equal.

2.02 COMMON REQUIREMENTS ALL EQUIPMENT

- A. All indicating and recording devices shall be electric or electronic.
- B. Power supplies shall be protected against short circuits and contain their own overcurrent and overvoltage protection. Twelve and 24 Vdc power supplies shall be provided and installed in the enclosures for powering all analog input signals where required.
- C. All motor control power shall be 120-volt with suitable circuit protection fuses or breakers. Fuse holders shall be provided with integral LEDs to indicate when the fuse is blown.
- D. Devices powered at 120 volts from control panels shall be fused. This shall include, but not be limited to, solenoid valves, motor-operated valves, motorized ball valves, flow meters, scales, and transducers.
- E. Provide lightning protection, isolation transformers, and fused disconnects at each end of each power circuit, supervisory circuit, and local supervisory circuit with transformers and relays, if necessary, to obtain supervisory power. Lightning protection shall be completely solid-state and self-healing and not require the use of fuses. Lightning protection shall be as manufactured by Citel, Model DS4xS, or equal. Surge protection shall be provided for all phases and neutral.
- F. Each panel shall have a GFI, duplex, 20-ampere, 120-volt receptacle.
- G. Control panels that include programmable or electronic controllers (e.g., PLCs) shall be provided with a 120-volt AC true on-line UPS backup that will provide continuous operation for at least 30 minutes following a power failure.
 - 1. UPS power shall be provided, at a minimum, to the following equipment:
 - a. PLCs and I/O cards, controllers, and OIPs.
 - b. Network switches, signal converters, and other communication devices.
 - c. Power fail and communication indicating lights and alarm devices.
 - d. Power supplies for loop-powered instruments.
 - e. Intrinsic safety barriers.
 - 2. The UPS shall be plug connected inside the control panel with a dedicated receptacle and overcurrent protection device. All UPS-powered devices shall be continuously powered through the UPS under normal operating conditions. Provide relays to automatically bypass the UPS when the UPS output rises 110% above or falls 80% below the nominal supply voltage, or when the UPS is deenergized (e.g., line-side plug disconnected, upstream overcurrent device opened, etc.).
 - 3. Each UPS shall be provided with a relay card that provides a dry contact output to the programmable or electronic controller to activate an alarm in the event that the UPS batteries need replacement.
 - 4. UPS shall be APC with relay I/O module, Liebert GXT4 with relay card, or Eaton 9130. Provide a stand or shelf within each control panel for the UPS so that the UPS does not sit on the bottom of the enclosure.
- H. Where PLCs or Operator Interface Panels (OIPs) are installed in control panels, two copies of all programs with associated passwords shall be turned over to Owner at final completion. Copies shall be a bound hard copy and electronic compact disk.

- I. If enclosure and panel space is needed for future installation of devices, lights, etc., the enclosure and panel shall be constructed for such installation. Supports shall be provided for future equipment, and panel openings shall be made and covered with neat cover plates matching the panel.
- J. Control panels that include PLCs shall have an exterior panel-mounted receptacle and programming port mounted to the front or side of the panel, as applicable to the installation. Receptacle and programming port shall be provided to allow for PLC programming via laptop without opening the panel door. Programming port shall match that of the network being installed (e.g., Ethernet, data highway, etc.).
- K. Contractor shall furnish one complete extra set of fuses and similar parts which may need replacement in normal service and an identification list of all component parts and where they may be obtained for operating the system for 3 years from start-up.
- L. Where a certain accuracy of sensing and transmitting levels or flows and controlling operations are called for, means must be provided to read or determine that the levels or flows are within the limits or accuracy specified of the sensing, transmitting, and controlling devices. Where no accuracy is specified, but a knowledge of levels is necessary to set operating points, an indicating device of accuracy consistent with the operation of the system is required.
- M. All internal wiring shall be color-coded and numbered, and each wire shall be terminated on terminal blocks. Schematic and wiring layout drawings complying with Section 26 29 13 – Enclosed Controllers which show all connections to external devices, a complete bill of materials, interior and exterior panel layouts, and a detailed description of operation, shall be submitted for each control panel.
- N. Each analog signal entering or leaving a control panel and leaving a building shall be provided with a surge protection device as manufactured by Citel, Model DLA-24D3, or equal. Each transmitter shall be provided with a surge protection device as manufactured by Citel, Model TSP15M on the output and Citel, Model No. DS4xS on the power supply, or equal.
- O. An anti-condensation heater shall be provided in all control panels located outdoors. The anti-condensation heater shall be as manufactured by Hoffman, Model D-AH, X000 Series, sized as required.
- P. The “Hand” mode for all “Hand-Off-Auto” selector switches shall be hard-wired directly to the associated motor starter completely bypassing any PLC or controller.

2.03 CONTROL PANEL DEVICES

- A. All control panel devices shall comply with Section 26 29 13 – Enclosed Controllers.
- B. Overcurrent protection and disconnecting means for equipment shall be provided as specified in the specification section for the associated equipment. Molded case thermal magnetic circuit breakers shall include integral thermal and instantaneous magnetic trip in each pole. Motor controllers shall include molded case circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Nonfusible switch assemblies shall consist of quick-make, quick-break load interrupter enclosed knife switch with externally operable handle.
- C. Push buttons: NEMA ICS 2; heavy-duty, oiltight (30 mm).

- D. Indicating Lights: NEMA ICS 2; heavy-duty, oiltight (30 mm), LED, push-to-test type.
- E. Selector Switches: NEMA ICS 2; heavy-duty, oiltight, (30 mm).
- F. Timing Relays: UL Listed with On and Timing Out LEDs.
- G. Contactors: All contactors for starters specified herein shall be NEMA rated. IEC contactors are not allowed. Contactors shall be Allen-Bradley, Bulletin 509, or equal.
- H. Elapsed Time Meters: Redington/Engler 722 series, 3 inches round, flush door mounted, capable of reading up to 99,999.9 hours, nonreset type.
- I. Control Power Transformers: 240/120-volt secondary. Each motor starter shall have a dedicated control power transformer.
- J. Relays for motor control circuits, hard-wired control logic, and for loads less than 10 amps shall be general purpose, industrial, square base relays. Relays for lighting circuits and small motor loads shall be industrial, electrically-held power relays. Relays shall meet the following requirements:
 - 1. General purpose relays:
 - a. Configuration: DPDT or 3 PDT as required by system supplier.
 - b. Mounting: DIN rail with screw terminal base socket.
 - c. Voltage: 120 Vac.
 - d. Contact rating: 15 A, minimum; 3/4 hp.
 - e. Operating life: 10 million cycles.
 - f. Status: On-Off flag type or LED indicator.
 - g. UL listed.
 - h. Manufacturer: Allen-Bradley, 700-HB, or equal.
 - 2. Power relays.
 - a. Configuration: Electrically-held, 2-12 poles.
 - b. Mounting: DIN rail, square base.
 - c. Voltage: 120 Vac.
 - d. Contact rating: 20 A continuous; 1 hp.
 - e. Operating life: 10 million cycles.
 - f. UL listed.
 - g. NEMA rated.
 - h. Manufacturer: Allen-Bradley, 700-PK, or equal.
- K. Programmable Logic Controllers (PLCs) and unmanaged network switches shall comply with Section 26 29 13 – Enclosed Controllers. PLCs shall be by the same manufacturer and match the communication protocol (e.g., Ethernet/IP) provided under Section 26 29 13 – Enclosed Controllers. Network switches shall be by the same manufacturer. Coordinate requirements with the system supplier.

2.04 WIRE AND CABLE MARKERS

- A. Wire and cable markers shall be permanently-attached, heat-shrink type labels.
 - 1. Sleeve: Permanent, PVC, white, with legible machine-printed black markings.
 - 2. Acceptable Manufacturers: Raychem Model D-SCE or ZH-SCE, Brady Model 3PS, or equal.
 - 3. Grounding Conductor: Provide green wire marker; minimum 2 inches wide.
- B. Wire or cable numbering preprinted on the conductor or cable insulation, flag-type labels, and individual wraparound numbers (such as Brady preprinted markers) are not acceptable. All wire markers shall be the same throughout the project.

2.05 OPERATOR INTERFACE PANEL

- A. Shall be as manufactured by Allen Bradley Panelview Plus 1000

2.06 TVSS DEVICES FOR CONTROL PANELS AND INSTRUMENTATION EQUIPMENT

- A. The incoming power supply of each control panel supervisory control center shall be protected with a transient voltage surge suppression (TVSS) device. TVSS unit shall be as manufactured by Citel Model DS4xS, or equal. Surge protection shall be provided for all phases and neutral.

2.07 INDUSTRIAL ETHERNET SWITCHES

- A. Unmanaged Ethernet switches shall be provided for networks shown on the drawings. Unmanaged switches shall be as manufactured by Hirschman, Spider Series, N-Tron, 300 Series or Siemens SCALANCE X-100 Series and include copper ports to accommodate wiring shown on the drawings. Each switch shall include the following.
 - 1. Full/half-duplex operation.
 - 2. Auto-sensing speed and flow control.
 - 3. IEEE 802.3 compliance.
 - 4. DIN rail mounting.
 - 5. Store and forward switching.
 - 6. Redundant power inputs.
 - 7. Minimum of 4 copper ports.

PART 3 – EXECUTION

3.01 GENERAL

- A. Refer to requirements specified in Division 1 for equipment installation, quality control, testing, supervision, start-up, and operator training.

3.02 INSTALLATION

- A. All control panels and equipment enclosures shall be cleaned of debris and wires neatly arranged with surplus length cutoff. Spare wires shall be labeled as “spare” and where the wires terminate.

- B. Where louvers are provided in enclosures or control panels, louvers shall be vacuumed free of all dust and dirt. Where air filters are provided in enclosures or control panels, all filters shall be replaced with new at the time of final completion.
- C. Equipment shall be thoroughly cleaned of all stains, paint spots, dirt, and dust. All temporary labels not used for instruction or operation shall be removed.
- D. All electrical equipment shall be provided with factory-applied prime finish, unless otherwise specified. If the factory finish on any equipment furnished by Contractor is damaged in shipment during construction, the equipment shall be refinished by Contractor. One can of touch-up paint shall be provided for each different color factory finish that is to be the final finished surface of the product.

3.03 WIRE IDENTIFICATION

- A. Conductors shall be grouped as to circuits and arranged in a neat manner. Phase identification shall be consistent throughout the system. All wiring labels shall be able to be read without removing wire management (i.e., wiring trough covers, spiral windings, etc.) or twisting the wire/cable.
- B. Power Conductor Insulation Color Code:
 - 1. 6 AWG and Larger: Provide general-purpose, flame-retardant, permanent tape at each termination.
 - 2. 8 AWG and Smaller: Provide conductors with color-coded insulation.
 - 3. Colors:

| System | Conductor | Color |
|--|---|-------------------------------------|
| All Systems | Equipment Grounding | Green |
| 120/240 Volts Single-Phase, Three Wire | Grounded Neutral One Hot Leg Other Hot Leg | White* Black Red |
| 120/208 Volts Three-Phase, Four Wire | Grounded Neutral Phase A Phase B Phase C | White* Black Red Blue |
| 277/480 Volts Three-Phase, Four Wire | Grounded Neutral Phase A Phase B Phase C | White* Brown Orange Yellow |
| Note: Phase A, B, C implies direction of positive | | |
| *When installed as part of a 120-volt or 277-volt branch circuit, provide a color-coded stripe on the white neutral conductor insulation matching the branch circuit insulation. | | |

C. Control Panel Control Conductor Insulation Color Code:

1. All conductors shall have color-coded insulation.
2. Colors:

| System | Conductor | Color |
|--|--|--|
| Supply Voltage | Ungrounded Circuit Conductors Neutral | Black White |
| Discrete 120-volt AC Input/Output | Control Circuit Conductor Neutral | Red White |
| Discrete 12/24-volt DC Input/Output | Control Circuit Conductor Common | Blue White with Blue Stripe |
| Conductors energized when the main disconnect is in the "off" position (e.g. foreign supply voltages) | Control Circuit Conductor AC Neutral DC Common Ground | Orange White White with Blue Stripe Green |
| Intrinsically Safe | Control Circuit Conductor DC Common | Light Blue White with Two Light Blue Stripes |

D. Circuit Identification:

1. Identify power, instrumentation, and control conductors at each termination.
2. Conductors fed from remote panelboard circuits shall identify circuit matching the circuit directory designations, including the neutral conductor.
3. Control conductor identification shall match the associated terminal block label.

E. Data/Voice Cable and Communication Equipment Identification: All communication cables shall be labeled on both ends.

F. Terminal Block Identification:

1. Terminal blocks shall be labeled on both sides of each terminal block. Terminal block numbering shall match the numbers shown on the project-specific wiring diagrams.
2. Fused terminal blocks labels shall be located on top of the terminal blocks and include the fuse voltage and amperage rating.

G. Labeling Font Requirements:

1. The font for all conductor, cable, and device labels shall be Arial with black characters on white background, and minimum font size 12.
2. The text for all conductor, cable, and device labels shall be machine printed. Handwritten labels are not acceptable.

3.04 SYSTEM START-UP AND SUPPORT SERVICES

A. Final acceptance and payment for panels that include programmable controllers will not be made until the system has operated satisfactorily for a minimum of 30 consecutive days. System Supplier shall include in Bid field follow-up to ensure proper adjustments and operation during the first year following project final completion. Prior to beginning the 30-day test, the following criteria shall be met:

1. Satisfactory operation of I/O control loops.

2. Satisfactory operation of software.
 3. Satisfactory operation of control program.
 4. Satisfactory operation of peripheral equipment.
 5. The necessary debugging programs have been performed.
 6. Data output is reliable.
 7. Control loops are operational.
 8. Checking and calibrating of systems have been completed.
- B. System Supplier shall provide the following support services:
1. Field Service Engineer: Field Service Engineer shall be responsible for programming of system PLCs in the factory and at the site. Field Service Engineer shall be present for start-up of all systems and available throughout the entire construction process until final completion. Service technicians sent for system start-up will not be acceptable. Support shall include on-site time. Services shall include, but not be limited to:
 - a. Commissioning, installation, start-up, and testing of equipment.
 - b. Revising or rewriting manuals to incorporate an installed and accepted system.
 - c. On-site training.
 - d. Software modifications.
 2. In-Factory support shall include consultation following the acceptance testing and shipment. Services shall include, but not be limited to:
 - a. Researching and answering questions related to the system operation, documentation, and system use and functions.
 - b. Program modifications.
 - c. Revising or rewriting manuals.
 3. Post start-up support shall include follow-up services during the 1-year period following final acceptance. Service shall include follow-up recalibration and replacement of defective equipment, as well as additional training, software modifications, and control configurations as requested by Owner. Enhancement hours and associated trips to the site shall be as specified in the individual specification sections.

END SECTION.

SECTION 26 29 23

VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 – GENERAL

1.01 WORK INCLUDES

- A. Base Bid:
 - 1. Electrical Contractor provide:
 - a. Separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.02 DEFINITIONS

- A. CE: Conformance Europeene (European Compliance).
- B. CPT: Control power transformer.
- C. DDC: Direct digital control.
- D. EMI: Electromagnetic interference.
- E. OCPD: Overcurrent protective device.
- F. PID: Control action, proportional plus integral plus derivative.
- G. RFI: Radio-frequency interference.
- H. VFC: Variable-frequency motor controller.

1.03 SUBMITTALS

- A. Product Data: For each type and rating of VFC indicated.
- B. Shop Drawings: For each VFC indicated.
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufactures Include:
 - 1. Danfoss

2. ABB
3. Square D
4. Siemens
5. Eaton Corp
6. General Electric

2.02 SYSTEM DESCRIPTION

- A. General Requirements for VFCs:
1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A.
- B. Application: variable torque.
- C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
1. Units suitable for operation of NEMA MG 1 motors.
 2. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- F. Unit Operating Requirements:
1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
 2. Input AC Voltage Unbalance: Not exceeding 5 percent.
 3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 4. Minimum Efficiency: 96 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
 6. Minimum Short-Circuit Current (Withstand) Rating: 65 kA.
 7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
 8. Humidity Rating: Less than 95 percent (noncondensing).
 9. Altitude Rating: Not exceeding 3300 feet.
 10. Vibration Withstand: Comply with NEMA ICS 61800-2.

11. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 13. Speed Regulation: Plus or minus 5 percent.
 14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
 15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- G. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.
- H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: Electrical.
- I. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 0.1 to 999.9 seconds.
 4. Deceleration: 0.1 to 999.9 seconds.
 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- J. Self-Protection and Reliability Features:
1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.
 2. Surge Suppression: Field-mounted surge suppressors complying with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits," UL 1449 SPD, Type 2.
 3. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 4. Under- and overvoltage trips.
 5. Inverter overcurrent trips.
 6. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
 7. Critical frequency rejection, with three selectable, adjustable deadbands.
 8. Instantaneous line-to-line and line-to-ground overcurrent trips.
 9. Loss-of-phase protection.
 10. Reverse-phase protection.
 11. Short-circuit protection.
 12. Motor-overtemperature fault.

- K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- M. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- P. Integral Input Disconnecting Means and OCPD: UL 489, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.
 - 1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
 - 2. NO alarm contact that operates only when circuit breaker has tripped.

2.03 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
 - 1. Power on.
 - 2. Run.
 - 3. Overvoltage.
 - 4. Line fault.
 - 5. Overcurrent.
 - 6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
 - 1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
 - 1. Real-time clock with current time and date.
 - 2. Running log of total power versus time.
 - 3. Total run time.

4. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (V dc).
 9. Set point frequency (Hz).
 10. Motor output voltage (V ac).
- E. Control Signal Interfaces:
1. Electric Input Signal Interface:
 - a. A minimum of two programmable analog inputs: 4- to 20-mA dc Operator-selectable "x"- to "y"-mA dc.
 2. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc 4- to 20-mA dc operator-selectable "x"- to "y"-mA dc), which can be configured for any of the following:
 - a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (V dc).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set point frequency (Hz).

2.04 BYPASS SYSTEMS

- A. Bypass Operation: Manually transfers motor between power converter output and bypass circuit. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
1. Bypass Contactor: Load-break, NEMA-rated contactor.
- B. Bypass Contactor Configuration: Full-voltage (across-the-line) type.
1. NORMAL/BYPASS selector switch.
 2. HAND/OFF/AUTO selector switch.
 3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.

4. Contactor Coils: Pressure-encapsulated type.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT control power source of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 100 VA.
6. Overload Relays: NEMA ICS 2.

2.05 ENCLOSURES

- A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 1. Dry and Clean Indoor Locations: Type 1.

2.06 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
 1. Push Buttons: Unguarded.
 2. Pilot Lights: Push to test.
 3. Selector Switches: Rotary type.
- B. Reversible NC/NO bypass contactor auxiliary contact(s).

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 - Fuses.
- C. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.
- D. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- E. Comply with NECA 1.

3.02 CONTROL WIRING INSTALLATION

- A. Install wiring between VFCs and remote devices and facility's central-control system.

- B. Bundle, train, and support wiring in enclosures.

3.03 IDENTIFICATION

- A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 – Electrical Identification.
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each VFC with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. VFCs will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.05 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Set field-adjustable circuit-breaker trip ranges as specified.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

3.07 PAYMENT

A. The cost of this work shall be considered incidental to the contract lump sum price for the project.

END SECTION.

SECTION 27 13 43

COMMUNICATION SERVICES CABLING

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: This specification contains the requirements for instrument wire and cable as opposed to electrical power wire and cable.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.

1.02 QUALITY ASSURANCE

- A. Standards: Comply with standards specified in this section as listed in Division 1.
- B. Qualifications of Installers: Skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

1.03 PRODUCT HANDLING

- A. Instrument cable shall be furnished in lengths as necessary.
- B. Reels, coils, or package rolls of instrument cable shall be identified with the project name and other tagging identification as called for.

1.04 SUBMITTALS

- A. Submit shop drawings and product data in accordance with provisions of Section 01 33 23 – Shop Drawings, Samples, and Product Data.

1.05 QUALIFICATIONS

- A. Contractor shall have at least four years of experience in the installation of similar systems. Contractor shall provide documentation upon request to certify that all assigned staff have attended training courses corresponding to the type of cabling and equipment specified herein.
- B. Contractor shall currently be licensed to install low voltage electronic cabling systems in the state of the project.
- C. Contractor shall currently meet all manufacturer's requirements for the provision and installation of all equipment specified herein.

PART 2 – PRODUCTS

2.01 SHIELDED PAIR CABLING FOR ELECTRONIC INSTRUMENTS

- A. Shielded pair cabling shall have stranded, tinned-copper conductors twisted with 2-inch lay.
- B. Insulation of conductors shall be 15 mil, 90°C minimum PVC, rated for 300 volts. Materials shall equal or exceed UL 13 requirements for physical properties.
- C. Color coding shall be manufacturer's standard or as stated.

- D. The outer jacket shall be flame-retardant and weather-and ultraviolet-resistant PVC, 35 mils thick, and 80°C minimum rating. The outer jacket shall contain a ripcord and shall equal or exceed the requirements of UL 1277. Cable shall be UL labeled as power-limited circuit cable.
- E. A 100% coverage shield shall be applied over the insulated conductors. The shield shall consist of a 0.85 mil minimum thickness aluminum mylar tape. A stranded, tinned-copper drain wire shall be furnished in continuous electrical contact with the shield.
- F. Single-pair shielded cables shall be Belden 9316, or equal.

2.02 SHIELDED PAIR CABLING FOR CURRENT TRANSFORMERS

- A. Shielded pair cabling shall have stranded, tinned-copper conductors twisted with 2-inch lay.
- B. Insulation of conductors shall be 15 mil, 90°C minimum PVC, rated for 600 volts. Materials shall equal or exceed UL 13 requirements for physical properties.
- C. Color coding shall be manufacturer's standard or as stated.
- D. The outer jacket shall be flame-retardant and weather-and ultraviolet-resistant PVC, 47 mils thick, and 80°C minimum rating. The outer jacket shall contain a ripcord and shall equal or exceed the requirements of UL 1277. Cable shall be UL labeled as power-limited circuit cable.
- E. A 100% coverage shield shall be applied over the insulated conductors. The shield shall consist of a 0.85 mil minimum thickness aluminum mylar tape. A stranded, tinned-copper drain wire shall be furnished in continuous electrical contact with the shield.
- F. Single-pair shielded current transformer cables shall be Belden 9343 with No. 14 AWG conductors and No. 14 AWG drain wire. Current transformer cable runs over 25 feet in length, including the length of potted transformer leads, shall be Belden 9344 with No. 12 AWG conductors and No. 12 AWG drain wire.

2.03 INDUSTRIAL ETHERNET CABLE

- A. 600-Volt Rated Shielded Cable:
 1. For communication with plant SCADA Systems and equipment in supervisory control centers, motor control centers, switchgear, switchboards, control panels, etc., over 300 volts, and other areas or raceways with power wiring over 300 volts, provide 600-volt-rated, 4-pair, shielded (F/UTP), twisted-pair cables. Transmission characteristics of the cables shall meet full Category 6 performance criteria as defined by the ANSI/TIA-568-C.2 standard.
 2. Cable conductors shall be minimum 23 AWG with PVC jacket and aluminum foil shield with 100% coverage. The cable outer jacket shall be industrial-grade PVC with a maximum overall cable diameter of 0.34 inches. Cable shall be CMR rated, UL listed, 600 V UL AWM rated, and be Belden 7953A or equal.
 3. Cable jacket color shall be red.
 4. Provide a shielded RJ45 connector on one end of each cable and an unshielded RJ45 connector on the other end of each cable.

- B. 300-Volt Rated Unshielded Cable:
 - 1. For communication with plant SCADA Systems and equipment in communication racks, supervisory control centers, and control panels without VFDs, etc., under 300 volts, and other areas or raceways with power wiring under 300 volts, provide 300-volt-rated, 4-pair, unshielded (U/UTP), twisted-pair cables. Transmission characteristics of the cables shall meet full Category 6 performance criteria as defined by the ANSI/TIA-568-C.2 standard.
 - 2. Industrial Ethernet cable shall be minimum 23 AWG with PVC jacket. The cable outer jacket shall be industrial-grade PVC with a maximum overall cable diameter of 0.24 inches. Cable shall be CMR rated, UL listed, and shall be Systimax Solutions 1071E, or equal.
 - 3. Cable jacket color shall be light blue.
 - 4. Provide unshielded RJ45 connectors on both ends of each cable.
- C. Patch cables shall be provided premanufactured by the cable manufacturer or connector manufacturer in sufficient length to connect the associated equipment to any port on the equipment, patch panel, or switch. Field-attached plugs shall be insulation displacement type and shall be by the same manufacturer as the cable.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS AND SPECIAL CONSIDERATIONS

- A. Shielded pair and industrial Ethernet cabling specified in this section shall be installed in conduit, and may not be run free-air or in nonmetallic tubing such as innerduct.
- B. Armor may be necessary on instrument cables installed in nonmagnetic electrical ducts:
 - 1. Single Pair electronic instrument wiring shall be a steel wire armor of 24 gauge AISI 1006 soft annealed steel wire covering the inner jacket.
 - 2. The armor shall be covered by a flame-retardant and weather- and ultraviolet-resistant PVC, outer jacket 35 mil minimum thickness and 80°C minimum rating. The outer jacket shall contain a ripcord and shall equal or exceed the physical characteristics of UL 1277. Cable shall be UL labeled as power limited cables.

3.02 GROUNDING

- A. Shielded cabling shall be installed in accordance with manufacturer's instructions and to minimize electrical noise and interference to associated instruments. Refer to instrument manufacturer's instructions for additional requirements.
- B. Ends of signal wires shall be sealed to prevent the migration of moisture into the cable and to prevent unintentional grounding of the shield at the open end. Seal signal wires using a minimum 1-inch piece of heat-shrink tubing installed over PVC jacket and individual wires, and heat-shrink to a watertight fit.
- C. All shields must be grounded.
- D. Shields shall be grounded at one point only. Shielded cabling shall be isolated and left open at the instrument. The single-pair electronic instrument cable shields shall be connected to the multipair electronic instrument cable overall shield in the field junction box.

- E. Cable shield grounds shall be isolated from control system signal grounds, except at instrument system grounding electrodes.

END SECTION.

SECTION 46 33 05

PRE-FORMED HYDROUS MANGANESE OXIDE (HMO) CHEMICAL BLEND AND FEED SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

- A. Work Included: This section includes furnishing, installing, and placing into successful operation one pre-mixed, pre-formed HMO chemical feed system as shown in the drawings and specified herein at the specified sites with the specified systems:
 - 1. City of Rockford Well House 13: System is comprised of two bulk tanks, two transfer pumps, one day tank, one metering pump and all associated appurtenances.
 - 2. City of Rockford Well House 31: System is comprised of two bulk tanks, two transfer pumps, two day tanks, one metering pump and all associated appurtenances.
- B. Related Sections and Divisions: Applicable provisions of Division 1 shall govern work in this section.
- C. Provide all labor, equipment and material for complete and proper installation, testing, and start-up of the chemical feed systems and accessories.

1.02 DEFINITIONS

- A. The following definitions or abbreviations apply to the work and products of this section: HMO-Hydrous Manganese Oxide chemical blend.

1.03 SUBMITTALS

- A. The chemical feed system schematics included in the drawings are only intended to show the minimum level of equipment, piping, etc., required to provide a complete feed system. The supplier of the HMO feed system shall verify that this schematic has been reviewed and provide any additional equipment that may be required. Any equipment that is not shown on the schematic, but is required, shall be included and submitted, for review by Engineer, with the shop drawings.
- B. Certified shop drawings, including any modifications to the schematic, and characteristic performance curve showing flow rate as a function of RPM and pressure shall be submitted for review. As a part of the shop drawing submittal. Provide to-scale elevation drawings showing the layout of piping, pumps, and appurtenances for review.

1.04 WARRANTY

- A. Standard One-Year Warranty: Unless otherwise stated below, manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of one year from the earlier of either the date established for partial utilization in accordance with GC14.04 and 14.05, as modified in the Supplementary Conditions, or Substantial Completion of the project.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. All polyethylene tanks shall be the product of one manufacturer and be capable of storing the minimum volume of solution as specified without deformation, as manufactured by Poly Processing, or equal.
- B. Chemical Pumps:
 - 1. Chemical transfer pump shall be manufactured by Lutz, or equal.
 - 2. Chemical feed pump shall be manufactured by Rotho, or equal.
- C. Mixers: All mixers shall be provided by one manufacturer. Mixers shall be manufactured by National Oilwell Varco (NOV), or equal. Mixers shall be capable of continuously suspending the tank solids throughout the volume of the tank.
- D. Bulk Tank and Day Tank Level Transducers: Provide ultrasonic level transducers as manufactured by Vega – Vega C11 with Vegamet 842 displays. No substitutes.

2.02 EQUIPMENT DESCRIPTION

- A. Manganese sulfate and sodium permanganate are delivered to the site and mixed with water to create a 10% HMO solution. SDS sheets available through Owner upon request. Viscosity of the solution is near that of water. The HMO chemical is a fine, crystalline solid that is filterable and abrasive. Materials in contact with the HMO solution shall be resistant to abrasion and the chemical solution.
- B. All products in contact with the HMO solution shall be approved for potable drinking water or food grade applications or be NSF-certified.
- C. Polyethylene Tanks-Bulk Tank:
 - 1. The bulk receiving tank shall serve as a delivery tank to receive and store a 10% hydrous manganese oxide solution.
 - 2. Provide tank size penetrations, bracing, hinges, and fittings as shown on the drawings.
 - 3. Shop drawings shall include cover tank detail showing all penetrations, fittings, supports, and hinges.
- D. Polyethylene Tanks–Chemical Day Tank:
 - 1. The chemical day tank shall serve to dispense the HMO solution added to the filtration process.
 - 2. Provide tank size penetrations, bracing, hinges, and fittings as shown on the drawings.
 - 3. Shop drawings shall include cover tank detail showing all penetrations, fittings, supports, and hinges.
- E. Chemical Transfer Pump: Provide Lutz B36 0.85HP motor with Lutz MMS-PP 41-R SS/HC pump set for acids and base solutions, or equal. Pump shall be suitable and compatible with transfer of 10% HMO solution and pump suction will be submerged under normal operating conditions. Pump motor shall meet the requirements as specified herein. Chemical transfer pump tube shall reach within 12-inches of the bottom of the bulk tank.

- F. Peristaltic HMO Metering Pump:
1. HMO metering pump shall be installed on a metal stand at the height shown in the plans.
 2. Provide Rotho S10 model (Configuration KPSF3-S10-I-K-EP) with 0.5 HP inverter duty motor, or equal.
 - a. Well 13: Pump, with gear reducer, shall have a pumping capacity of at least 12.6 gph and 115 psi of head.
 - b. Well 31: Pump, with gear reducer, shall have a pumping capacity of at least 17.5 gph and 115 psi of head.
 3. Pump shall consist of an enclosed housing with bolted clear cover and roller compressor mechanism designed for operation with a hose. Hose shall be rigidly mounted to the pump body with NPT connections. Contractor to provide 12-inches of PE piping to connect to the two NPT connections before hard piping begins for easy removal of hose.
 4. Housing: Cast aluminum with a corrosion resistant PTFE Teflon Coating.
 5. Rotor: PTFE Teflon coated carbon steel with selectable shaft position for hose.
 6. Shafts: Corrosion resistant 316 stainless steel.
 7. Rollers: Two permanently sealed 316 Stainless Steel rollers with adjustable pressure points located 180 degrees apart from each other. Rollers shall be removable without the use of tools. Rollers shall have multiple set points identified by visual marking. One roller shall at all times be fully engaged with tubing providing complete compression to prevent back flow or siphoning.
 8. Cover: Removable one-piece clear polycarbonate viewing cover.
 9. Connections: Rigid inlet and outlet connections shall be MNPT with PVDF (KYNAR) or as required for service. MNPT port connection size shall be ½ inch.
 10. Gearbox: Gearbox shall be of the permanently sealed, maintenance free right angle worm design and an AGMA Class II continuous duty rating, NEMA 56C input.
 11. Hose:
 - a. Rubber hose shall be designed specifically for use with peristaltic pumps, working pressures to 115 psi and with the HMO solution. They shall be constructed from the highest quality compounded rubber materials, reinforced with multiple layers of braided nylon and have a durometer rating of 55 to 70 Shore A. Wetter layer shall be EPDM or as required for service. Hose lubrication will be with a food grade silicon grease. Hose capacity shall be 0.006 gallon/revolution. Tube leak detection with dry contact for remote indication shall be provided.
 - b. Provide 6 spare hoses.
 12. Motor: Motor shall be meet the requirements as specified herein.
 13. VFDs:
 - a. Drive shall be rated for 24-hour operation and drive enclosure shall be NEMA 4X/IP66 rated.

- b. Voltage: 120/240V, single phase input, three phase output/.
 - c. Drive speed shall be variable.
 - d. Drive shall have a keypad and LED display. Local controls on keypad shall include: Stop/Reset, Forward, Reverse, Speed increase, and Speed Decrease. Programming functions shall also be accessed through keypad.
 - e. Drive shall be capable of accepting a 4-20 mA speed control and start/stop signal from HMO control panel when in Remote mode. Drive shall be capable of sending running and VFD fault signals to HMO control panel.
 - f. VFD shall be manufactured by Lenze model ESV371N01SXE , or equal.
- 14. Gear Reducers: Provide 38 rev/min (max) gear reducer, or as recommended by manufacturer to achieve desired flow rate.
 - 15. Control Interface: Pump is required to interface with HMO control panel. Following Inputs and Outputs are required at the metering pump skid.
 - a. Control Inputs shall include 4-20 mA speed control and start/stop control.
 - b. Control Outputs shall include In Remote Status, Run status, VFD fault, motor overtemperature, and Tube Leak Alarm.
 - 16. Performance: Pump shall be capable of self-priming when completely dry with a suction lift capability of 27-feet. Pump shall be capable of running dry without damaging effects to the pump or tube.
 - 17. Installing contractor shall provide check valve immediately downstream of the discharge of the HMO pump and at the bottom of the suction pipe in the HMO tank.
- G. Mixers:
- 1. Mixers shall be equipped with a minimum of one Type SC3 high efficiency impellers.
 - 2. All wetted parts shall be made of 316 SS.
 - 3. Provide 316SS shaft lengths as recommended by manufacturer. Verify installation elevation of equipment according to manufacturer's recommendations.
 - 4. Motors shall meet the requirements as specified herein.
 - 5. Mixer assemblies shall be direct drive with mixer attached to motor by a positive chuck assembly or driven by gear reducer and keyed coupling above water level based on mixer size. Gear drive shall be NOV Chemineer Model 50 DTC with 0.75 HP motor, or equal.
 - 6. Mixer shall be angled 10 to 13 degrees inclination. Mixer shall have an assumed mounting height of 6-inches with the bottom impeller to be 7.3-inches off of the bottom.
 - 7. Mixer motor shall be supplied with factory furnished coatings.
 - 8. Mixers shall be designed to keep a 10% pre-mixed solution of HMO chemical in suspension throughout tank volume.

2.03 CHEMICAL FEED ACCESSORIES:

- A. Furnish and install the following accessories. Accessories shall be fabricated of materials resistant to the HMO chemical solution and chemicals used as specified or required by the HMO system manufacturer.
1. Provide 1-inch corporation cocks with Mueller thread, check valve and solution tube for point of application. Materials in contact with solution shall be compatible with the chemical solution.
 2. Level Transducers:
 - a. Provide additional controls including level transducers (one for each bulk tank and one for each day tank), Vegapuls C11.
 - b. Provide two Vegamet 842 indicators for HMO tanks. The bulk tanks shall be displayed in gallons and the day tanks in pounds.
 - c. The Vegamet 842 indicator shall be provided with two channels to allow connection to two different level transducers
 - d. The bulk tank and day tank shall be calibrated
 - 1) Well 13: 0 to 600 gallons and 0 to 800 gallons pounds, respectively.
 - 2) Well 31: 0 to 600 gallons
 3. Provide all additional appurtenances shown in the HMO schematic and any additional equipment deemed necessary by the manufacturer of the HMO system.
 4. Provide glued Schedule 80 PVC piping, fittings, manual control valves, automated control valves, and appurtenances to allow automatic start controlled chemical feed, and carrier water at injection point, chemical feed line flushing, and stop of the HMO Chemical Feed System for the HMO day tank. The following shall be included:
 - a. Solenoid valves shall be ASCO Red Hat style Series 8210 compatible with the range of flows and HMO chemical used.
 - b. Actuated valves shall be Asahi/America Series 94 electric actuators. Actuated valves shall have a thermally protected, bi-directional (reversing type), capacitor run motor with a permanently lubricated gear train. 120 VAC and 220 VAC motors shall conform to CE and be indicated on motor housing. Actuator shall have engineered resin housing with stainless steel trim, rated Type 4X. Each actuator to have declutchable manual override, visual position indication, ISO mounting configuration, as manufactured by Asaha/America.
 - c. All check valves with HMO feed system shall be "flapper" type.
 - d. Provide float switches as shown on the drawings with KwikSwitch as manufactured by Primex. Each float shall have molded polyethylene body, internal redundant foam floatation, potted switch and cable connections and fine-stranded AWG#18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall operate on 24 volts DC.
 - e. Provide the necessary appurtenances and control valves to regulate carrier water flow.

- f. System shall allow connections to glued Schedule 80 PVC piping for flushing and chemical feed pump discharge piping without dilution of the neat chemical tank solutions.
- g. Flushing shall be discharged to the injection point.
- h. Piping shall be assembled with all piping plumb, square, and threaded fittings using standard industry practices in a manner compatible with the solutions used. All connections shall be labeled for easy assembly and identification.
- i. Contractor shall supply solenoid valves for remote system operations, if necessary, and indicate their installation location in an overall HMO chemical feed schematic.
- j. Unless noted otherwise, all power to system shall be 120 VAC, single phase power, 60 Hz. Contractor shall coordinate with System Integrator if control loops or power is recommended.
- k. Carrier water will be supplied to system at a rate of at least 8 gpm. System shall be the point at which HMO solution is injected into carrier water.
- l. HMO Control Panel control description shall accurately coordinate operation between the Flushing and Carrier Water Control System and the HMO Chemical Feed Pump.
- m. Unions shall be provided within system to allow for easy maintenance of system components.
- n. True union fittings shall be placed on either side of any valves in the piping so sections may be removed for future alterations or repairs.

2.04 MOTORS (METERING PUMPS, MIXERS, AND TRANSFER PUMPS)

- A. HMO metering pumps, mixers, and transfer pumps motors shall conform to all applicable requirements of NEMA, ANSI, IEEE, and NEC standards and shall be UL listed for the service specified.
- B. Motors provided for the equipment shall meet the following requirements. Motors shall not be loaded beyond nominal rating, not including service factor, at any design condition.
 - 1. Physical Construction:
 - a. Copper leads and windings with ball or roller bearings in end brackets of steel or cast iron or aluminum brackets with steel bearing sleeves. Motor leads shall have the same insulation class as the windings.
 - b. Rotor bars shall be copper with a 45% non-phosphorous silver copper brazing.
 - c. Motor shaft shall be high strength steel protected by a bronze shaft sleeve secured to the shaft to prevent rotation. The maximum allowable no-load shaft run-out shall be 0.002-inch.
 - d. Motors shall be equipped with grease fittings and automatic grease reliefs. Bearings shall be prelubricated and field regreasable. Openings for addition of grease shall have grease fittings provided.
 - 2. Mounting: Horizontal (Pumps), Vertical (Mixers).
 - 3. Enclosure: Washdown duty, TEFC.

4. Efficiency: Standard efficiency as noted in schedule below.
 5. Service Factor: 1.15.
 6. Power requirements: 60 Hz, ±10% voltage variation, voltage as noted in schedule below.
 7. Load type: Constant torque.
 8. NEMA Design: B.
 9. Insulation: Class F. Class F and rated for a Class B temperature rise required for motors controlled from VFDs.
 10. Nominal operating speed: Single speed. Speeds for each equipment is noted in schedule below.
 11. Nameplate: Stainless-steel engraved attached to motor frame or enclosure with stainless-steel rivets.
 12. Conduit/Junction Box: Cast iron, diagonally split, fully rotatable, gasketed between cover and bar, and between box and frame. Motor lead opening in the frame shall also be gasketed. A clamp-type terminal shall be provided inside each motor conduit box for grounding.
 13. Accessories:
 - a. Over-sized motor junction box.
 - b. Lifting eyes.
 14. VFD requirements: Motors operating on VFDs shall be inverter duty rated, meet the requirements of NEMA MG1, Part 31, and be capable of a minimum speed turndown of 60:1.
- C. Motor Schedule: If motor horsepower is increased to meet the requirements of this specification, Contractor is responsible for increasing all wiring, starters, drives, and other electrical components as required by Code, at no additional cost to Owner.

| Equipment | Horsepower | Nominal Speed | Voltage | Full Load Amps | Efficiency | Starter/ Drive | Notes |
|--------------------------|------------|---------------|--------------------|----------------|------------|----------------|-------|
| HMO Metering Pumps (2) | 1/2 | 1800 | 230/460V, 3 ϕ | 0.8 A | 80.0% | VFD | 1 |
| HMO Day Tank Mixers (3) | 3/4 | 1800 | 230/460V, 3 ϕ | -- | Premium | FVNR Starter | |
| HMO Bulk Tank Mixers (4) | 3/4 | 1800 | 230/460V, 3 ϕ | -- | Premium | FVNR Starter | |
| HMO Transfer Pumps (4) | 0.85 | 3400 | 120V | -- | -- | FVNR Starter | |

NOTE: 1. Motors shall be factory wired for 460-volt connection.

2.05 HMO SYSTEM CONTROLS

- A. HMO metering pumps, mixers, and transfer pumps shall be powered and controlled from HMO control panel as specified in Section 26 29 13 – Enclosed Controllers.

- B. Equipment manufacturer shall review electrical wiring and control diagrams prepared by the Division 26 contractor. Manufacturer shall provide written approval to Contractor with copy to Engineer and Owner.

2.06 FINISHES

- A. It is the intent of these specifications that equipment, supports, and accessories be furnished factory shop-primed and factory-finished painted. Equipment and appurtenances shall be prepared in accordance with commercial grade SSPC specifications No. 6. Priming and finish painting shall be as recommended by manufacturer and shall be suitable for the chemicals present. Contractor shall field touch-up any damaged areas with factory provided touch-up coatings.

2.07 ANCHOR BOLTS

- A. Provide all anchor bolts required for the equipment furnished in accordance with Division 5.

PART 3 – EXECUTION

3.01 GENERAL

- A. See Division 1 for requirements related to equipment installation, field quality, control, testing supervision, and start-up.

3.02 INSTALLATION

- A. All pumps, tanks, and piping shall be installed with unions to allow for easy replacement.

3.03 TESTING

- A. During equipment startup, Owner shall be capable of mixing, transferring and dispensing the HMO chemical and verify operation is within the design range or setpoints of operation. The chemical feed system shall be modified by Contractor at no additional cost to Owner if the design conditions are not met.

END SECTION.

