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April 26, 2019 Letting

Notice to Bidders, Specifications and Proposal



**Illinois Department
of Transportation**

**Contract No. 66J68
IROQUOIS-LIVINGSTON Counties
Section (107)PS-3&(2SB-FAGH)PS-1
Route FAP 332A,FAP 649
District 3 Construction Funds**

Prepared by

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Checked by

(Printed by authority of the State of Illinois)



- 1. TIME AND PLACE OF OPENING BIDS.** Electronic bids are to be submitted to the electronic bidding system (iCX-Integrated Contractors Exchange). All bids must be submitted to the iCX system prior to 10:00 a.m. April 26, 2019 prevailing time at which time the bids will be publicly opened from the iCX SecureVault.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 66J68
IROQUOIS-LIVINGSTON Counties
Section (107)PS-3&(2SB-FAGH)PS-1
Route FAP 332A,FAP 649
District 3 Construction Funds**

Installing back up generators at 2 pump stations, and removal and replacement of all electrical, plumbing, HVAC, and mechanical equipment at the Reading pump station.

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.

(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the
Illinois Department of Transportation

Omer Osman,
Acting Secretary

FAP Route 332A (IL 1) & FAP Route 649 (IL 17)
 Section (107)PS-3 & (2SB-FAGH)PS-1
 Iroquois & Livingston Counties
 Contract No. 66J68

INDEX
 FOR
 SUPPLEMENTAL SPECIFICATIONS
 AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2019

This index contains a listing of SUPPLEMENTAL SPECIFICATIONS and frequently used RECURRING SPECIAL PROVISIONS.

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 4-1-16) (Revised 1-1-19)

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Iroquois & Livingston Counties
Contract No. 66J68

RECURRING SPECIAL PROVISIONS

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STATE OF ILLINOIS

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 for Materials" in effect on the date of invitation for bids, and the Supplemental Specifications and Recurring Special Provisions indicated on the Check Sheet included herein which apply to and govern the construction of FAP Route 332A (IL 1) & FAP Route 649 (IL 17), Section (107)PS-3 & (2SB-FAGH)PS-1, Iroquois & Livingston Counties, Contract No. 66J68 and in case of conflict with any part or parts of said Specifications, the said Special Provisions shall take precedence and shall govern.

LOCATION OF PROJECT

Location No. 1: This project is located on FAP 332A (IL 1) approximately 0.6 mile north of Milford in Iroquois County.

This work is associated with the "Milford Pump Station" at the CSX Transportation Railroad (Structure No. 038-0024).

Location No. 2: This project is located on FAP 649 (IL 17) approximately 1.3 miles west of IL 23 in Livingston County.

This work is associated with the "Reading Pump Station" at the BNSF Railway Viaduct (Structure No. 053-9902).

DESCRIPTION OF PROJECT

This work consists of all labor, materials, and equipment necessary to complete the work as described in the following items:

Location No. 1:

- Furnish and install a concrete slab.
- Furnish and install a natural gas emergency generator, service entrance, automatic transfer switch, and associated electrical components.
- Furnish and install an 8' chain-link security fence with gate.
- Remove and replace autodialer.
- Remove electric heaters and replace with natural gas heaters.
- Heaters shall be carefully removed and delivered to the Watseka Maintenance Facility.

Location No. 2:

- Remove and replace all electrical motor control panels and service panels (boxes).
- Remove existing pump motors located in the electrical room.
- Remove existing motor shafts and motor shaft bearings including supports located in the dry pit.
- Remove and replace existing pumps and all suction and discharge piping associated with the pumps.
- Remove and replace existing dry pit sump pumps and associated discharge piping.
- Remove and replace existing float controls and associated piping.
- Remove areaway drains.
- Reconstruction of the discharge box, areaways, and wet pit access.
- Rock fill at areaways.
- Clean and paint the exterior and interior (walls and ceiling) of the dry pit and electrical room.
- Remove and replace interior lighting.
- Remove and replace autodialer.
- Remove and replace heaters in the electrical house and dry pit.
- Remove and replace aluminum walkway and supports in dry pit.
- Remove and replace gate valves and related piping.
- Remove and replace access ladders in dry and wet pits.
- Remove concrete equipment pads in dry pit.
- Furnish and install a heating and ventilation system.
- Furnish and install a concrete slab.
- Furnish and install a propane (LP) gas emergency generator, service entrance automatic transfer switch, and associated electrical components.
- Furnish and install a 8' chain link security fence with gate.

Drawings of the existing building and equipment layout are included for informational purposes only and may or may not depict actual installation. The Contractor shall make an on-sight inspection to verify actual dimensions and equipment installed prior to the removal of any equipment.

COMPLETION DATE PLUS WORKING DAYS

(Effective January 1, 2016)

Replace Article 108.05 (b) of the Standard Specifications with the following:

(b) Completion Date Plus Working Days. When a completion date plus working days is specified, the Contractor shall complete all major items of work, except as specified below, and safely open all roadways to traffic by 11:59 p.m. on **Friday, December 27, 2019**.

The Contractor will be allowed to complete landscaping items, pavement marking, and other punch list items as approved by the Engineer within **10 working days**. Under extenuating circumstances, the Engineer may direct that certain items of work not affecting the safe opening of the roadway to traffic, may be completed with the specified number of working days. Temporary lane closures for this work may be allowed at the discretion of the Engineer.

KEEPING ROADWAY CLEAR OF WATER

The Contractor shall conduct his work so that two (2) pumps are in service at all time during construction operations or in lieu of this requirement, a portable pump with matching hydraulic ratings of the existing pumps must be provided at the jobsite and operational twenty-four (24) hours per day during construction operations. The Reading Pump Station may be reduced to one (1) pump once the replacement pumps are on site for a period no longer than 72 consecutive hours with prior approval by the Department.

In addition, the existing dry pit sump pumps, as indicated on plan details, shall remain in operation at all times during construction operations.

The Contractor shall be responsible for maintaining operation of the station twenty-four (24) hours per day upon commencement of construction and shall upon request, receive a key to the station.

All work associated with this requirement will not be paid for separately but will be included in the cost of the related construction items.

CONFINED SPACE

The Contractor is advised that the dry pit and wet pit area(s) are considered confined space(s) and shall take necessary precautions. The Contractor shall comply with the requirements of this Specification and all applicable Federal, State, and Local laws, codes, and regulations, including, but not limited to the regulations of the Occupational Safety and Health Administration (OSHA) and Illinois Department of Labor.

The Contractor shall comply with all applicable regulations even if the regulation is not specifically referenced herein. If a Federal, State, or Local regulation is more restrictive than the requirements of this Specification, the more restrictive requirements shall prevail.

Compliance with these requirements shall not relieve the Contractor of the health and safety of the workers involved.

Compliance with this Special Provision will not be paid for but shall be included in the cost of the related construction items involved, and no additional compensation for work derived from this compliance will be allowed.

SUBMITTAL REQUIREMENTS

Except as specified elsewhere herein, materials and equipment shall be in conformance with the requirements of Section 106 and 108 of the Standard Specifications.

Materials and equipment shall be the products of established and reputable manufacturers and shall be suitable for the service required. Unless otherwise specifically indicated, all materials and equipment shall be new. The Contractor is obligated to conduct his own search into the timely availability of the specified equipment and materials to ensure that they are in strict conformance with the contract documents and that delivery schedules are compatible with project time constraints. Materials or equipment items which are similar or identical shall be the product of the same manufacturer. The cost of submittals, certifications, any required samples, and similar costs shall not be separately paid for but shall be included in the pay item bid price for the respective material or work.

All equipment, products and materials incorporated in the work shall be submitted for approval.

Specific submittals required for individual elements of work are specified in the individual Specification sections. Except as otherwise indicated in Specification sections, requirements specified herein shall be complied with for each indicated type of submittal. Procedures concerning items such as listing of manufacturers, suppliers, subcontractors, construction progress schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.

Work-Related Submittals

- (a) Substitution or "Or Equal" Items include material or equipment Contractor requests Engineer to approve, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.
- (b) Shop Drawings include technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.

- (c) Product Data include standard printed information on manufactured products and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
- (d) Samples include both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.
- (e) Miscellaneous Submittals are work-related submittals that do not fit in the previous categories, such as warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

The contractor shall thoroughly review submittal and ensure that the submittal complete and meets contract documents. Any shop drawing submitted more than two times requires the contractor to be charged for all costs incurred by the Department.

Contractor shall deliver submittals for review, pickup reviewed submittals and distribute as directed by the Engineer.

Scheduling

- (a) A preliminary schedule of shop drawings and samples submittals shall be submitted for approval, in duplicate.
- (b) Each submittal shall be prepared and transmitted to Engineer sufficiently in advance of scheduled performance of related work and other applicable activities.
- (c) Within 60 days of the contract award, the Contractor shall submit, for approval, complete manufacturer's product data (for standard products and components) and detailed shop drawings (for fabricated equipment). Submittals need not include all project equipment and materials in one submittal, however, the submittals for the equipment and materials for each individual pay item shall be complete in every respect. Partial submittals may be returned without review. The Contractor may request, in writing, permission to make a partial submittal; the Engineer will evaluate the circumstances of the request and may accept to review such partial submittal. However, no additional compensation or extension of time will be allowed for extra costs or delays incurred due to partial or late submittals.

Each submittal shall be accompanied by a transmittal containing the following information:

- (a) Contractor's Name
- (b) Supplier's Name
- (c) Manufacturer's Name
- (d) Date of submittal and dates of previous submittals containing the same material
- (e) Project Route/Name
- (f) Section
- (g) Submittal and transmittal number
- (h) Contract identification
- (i) Identification of equipment and material with equipment identification numbers, motor numbers, and Specification section number Variations from Contract Documents and any limitations which may impact the Work Drawing sheet and detail number as appropriate
- (j) Variations from Contract Documents and any limitations which may impact the Work.
- (k) Drawing sheet and detail number as appropriate.

Multi-part submittal forms will be provided by the department to the Contractor to facilitate the submittal and review process. The Contractor shall complete all submittal information on the form and shall sign the submittal as indicated.

- (l) The resubmittal shall be complete in all respect and shall supersede earlier submittal in entirety and should not require referring to earlier multiple piece meal submittals.
- (m) Each submittal shall be dedicated for each subject. The different subjects and or systems associated with different engineering disciplines shall not be combined or mixed up together in one package of submittal.

Exceptions, Deviations, and Substitutions

- (a) In general, exceptions to and deviations from the requirements of the Contract Documents will not be allowed. It is the Contractor's responsibility to note any deviations from Contract requirements at the time of submittal and to make any requests for deviations in writing. In general, substitutions must demonstrate that the proposed substitution is superior to the equipment or material required by the Contract Documents. No exceptions, deviations, or substitutions will be permitted without approval.
- (b) Data for items to be submitted for review as substitution shall be collected into one submittal for each item of material or equipment.
- (c) Request shall be submitted with other scheduled submittals for the material or equipment allowing time for Engineer to evaluate the additional information required to be submitted. If Contractor requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, substitution submittal request shall be included in Submittal schedule and submitted as scheduled.

Shop Drawings

- (a) Shop drawing information shall be newly prepared and submitted with graphic information at accurate scale. The name of manufacturer or supplier (firm name) shall be indicated. Dimensions shall be shown and clearly noted which are based on field measurement; materials and products which are included in the Work shall be identified; revision shall be identified. Compliance with standards and notation of coordination requirements with other work shall be indicated. Variations from Contract Documents or previous submittals shall be highlighted, encircled or otherwise indicated.
- (b) The catalog cuts shall be highlighted identifying all selected options and project specific details. Generic catalog cuts shall be unacceptable.
- (c) Any deviation hidden in the submittals shall be unacceptable. The deviations if any shall be highlighted and contractor shall provide cost analysis justifying equal or better product. The Engineer shall be the sole authority for the acceptance or rejection without any justification.
- (d) List all shop drawings that are required for each discipline.
- (e) Each major equipment submittal shall have a detailed bill of material list.
- (f) The following information shall be included on each drawing or page:
 - 1) Submittal date and revision dates.
 - 2) Project name, division number and descriptions.
 - 3) Detailed specifications section number and page number.
 - 4) Identification of equipment, product or material.
 - 5) Name of Contractor and Subcontractor.
 - 6) Name of Supplier and Manufacturer.
 - 7) Relation to adjacent structure or material.
 - 8) Field dimensions, clearly identified.
 - 9) Standards or Industry Specification references.
 - 10) Identification of deviations from the Contract Documents.
 - 11) Contractor's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
 - 12) Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.
- (g) An 8-inch by 3-inch blank space shall be provided for Contractor and Engineer stamps.
- (h) Electronic copies that are searchable and bookmarked shall be submitted to the Engineer for review. Following approval, five (5) submittal copies shall be provided.
- (i) Materials, products or systems shall not be installed until copy of applicable product data showing only approved information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site.

- (j) Shop drawing submittal shall include pump control schematics, SCADA panel drawings, and detailed control system descriptions for auto/manual controls and operation and monitoring and monitoring of main and low flow pumps from the SCADA Panel and from the float control mode and also remote monitoring system descriptions.

Product Data

- (a) Required product data shall be collected into a single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, copies shall be marked to clearly identify not applicable and project specific information.
- (b) Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, data shall be submitted as a Shop Drawing and not as product data.
- (c) Submittal shall be final when returned by Engineer marked "Approved".
- (d) Five submittal copies shall be submitted to the Engineer.
- (e) Materials, products or systems shall not be installed until copy of applicable product data showing only approval information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site, available for reference by Engineer and others.

Samples

- (a) Where possible, samples shall be physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, multiple units (not less than 3 units) shall be submitted showing approximate limits of variations.
- (b) A full set of optional samples shall be provided where Engineer's selection required. Samples shall be prepared to match Engineer's selection where so indicated.
- (c) Each sample shall include generic description, source or product name and manufacturer, limitations, and compliance with standards.
- (d) Samples for Engineer's visual review and final check of coordination of these characteristics with other related elements of work shall be of general generic kind, color, pattern, texture.
- (e) At Contractor's option, and depending upon nature of anticipated response from Engineer, initial submittal of samples may be either preliminary or final submittal.

A preliminary submittal, consisting of a single set of samples, is required where specifications indicate Engineer's selection of color, pattern, texture or similar characteristics from manufacturer's range of standard choices is necessary. Preliminary submittals will be reviewed and returned with Engineer's "Action" marking.

Three sets of samples shall be submitted in final submittal, 1 set will be returned.

- (f) The returned final set of samples shall be maintained at Project site, in suitable condition and available for quality control comparisons throughout course of performing work.

Returned samples intended or permitted to be incorporated in the Work are indicated in Specification sections and shall be in undamaged condition at time of use.

Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Requirements for samples submittal shall be complied with to greatest extent possible. Transmittal forms shall be processed to provide record of activity.

Miscellaneous Submittals

(a) Inspection and Test Reports

- 1) Inspection and factory test reports shall be submitted for pumps, SCADA panel, generator and MCC.

- (b) Submittals for detailed factory and field test procedures for pumps. Submittals for detailed field test procedures for SCADA, generator and MCC.

(c) Warranties, Maintenance Agreements, and Workmanship Bonds

- 1) Refer to Specification sections and section Warranties of this Division for specific requirements. Submittal is final when returned by Engineer marked "Approved" or "Approved as Noted".
- 2) In addition to copies desired for Contractor's use, 2 executed copies shall be furnished. Two additional copies shall be provided where required for maintenance data.

(d) Certifications

- 1) Refer to Specification sections for specific requirements on submittal of certifications. Five copies shall be submitted. Certifications are submitted for review of conformance with specified requirements and information. Submittal shall be final when returned by Engineer marked "Approved".

- 2) Where certifications are specified, the information submitted for approval shall incorporate certification information. When a certification can be made prior to manufacture, the certification shall be included with initial submittal information. When certification is possible only after manufacture, the initial submittal information shall include a statement of intent to furnish the certification after equipment approval and manufacture.
- 3) Certifications involving inspections and/or tests shall be complete with all test data presented in a neat, descriptive format, with all test data, applicable dates, times, and persons responsible.
- 4) There should be a section in the report analyzing results and test data that meets the requirements of the contract and also list the items that fall short of contract requirements with conclusive remarks for acceptance/rejection of the equipment.

(e) Tools

- 1) Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units shall be submitted.
- 2) Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.
- 3) For each type of equipment provided under this Contract, a complete set of all special tools shall be furnished including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be of high grade, smooth forged alloy tool steel. Greaseguns shall be of the lever type.

Contractor's Stamp

- (a) Prior to submittal, the Contractor shall review the submittal material and shall affix his stamp of approval, with comments as applicable, signed by a responsible representative, to each appropriate submittal item. In the case of Subcontractor's submittals, both the Sub-contractor and the General Contractor shall review and stamp the submittal. Submittals which are not approved or approved-as-noted by the Contractor shall not be submitted to the Engineer. The Contractor shall not give an approved-as-noted status to submittals having incompleteness or major corrective notations as this will only delay the ultimate approval process.
- (b) The receipt of submittal information from the Contractor will be construed as the Contractor's assurance that he has reviewed the submittal information and attests to the submittal's accuracy and conformance to the requirements of the contract documents. Submitted information shall be complete and in sufficient detail to demonstrate compliance with all requirement of the contract documents, including fitting in the space provided and meeting all salient features of the specifications.

Submittal information must be particularly detailed in every respect. Product data shall present information to demonstrate the complete nature of the product, including dimensions, wiring diagrams, operating information, and the like. Shop drawings shall be extremely detailed and shall include all appropriate dimensions, fabrication details, component bill of material, information relative to mounting, detailed wiring, finish, and the like. Wiring diagrams shall include both schematic and point-to-point representations, complete with references to circuiting as indicated on the Contract Drawings as well as terminal points of component devices.

Unless required elsewhere, submittals shall be distributed to subcontractors, suppliers, governing authorities, and others as necessary for proper performance of work.

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

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

When submittals are marked "Approved as Noted" or "Approved Subject to Corrections Marked", Work covered by submittal may proceed provided it complies with both Engineer's notations or corrections on submittal and with Contract Documents. Acceptance of Work will depend on that compliance. The complete re-submittal shall be required for the "Approved as Noted" until the submittal attain "Approved" status, unless the reviewer's remarks indicate "Re-submittal is not required" which shall only be exercised for minor comments.

When submittals are marked "Examined and Returned for Correction or disapproved", Work covered by submittal shall not proceed. Work covered by submittal shall not be used at Project site or elsewhere where Work is in progress. The submittal shall be revised or a new submittal shall be prepared in accordance with Engineer's notations in accordance with Re-submittal Preparation procedures specified in this section. The submittal shall be resubmitted without delay and repeated if necessary to obtain different action marking.

Any need for more than one resubmission, or any other delay in Engineer's review of submittals, will not entitle Contractor to extension of the Contract Time.

Coordination

- (a) Preparation and processing of submittals shall be coordinated with performance of the work, other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.
- (b) Submission of different units of interrelated work shall be coordinated so that one submittal will not be delayed by Engineer's need to review a related submittal. Engineer may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

Unless otherwise indicated, warranties as specified herein shall be included with the submittal information of all applicable equipment and materials. Incompleteness, inaccuracy, or lack of coordination shall be grounds for rejection. The Contractor shall clearly understand no equipment or material shall be installed prior to approval and that any equipment or material installed prior to approval is subject to removal from the right-of-way solely at the Contractor's expense.

Re-submittal Preparation

Re-submittal Preparation shall comply with the requirements described in the SUBMITTAL PREPARATION subsection, of this section. In addition, it shall be identified on the transmittal form that the submittal is a resubmission. Re-submittal shall have previous comments and detailed point by point response to each previous comment.

Any corrections or changes in submittals required by Engineer's notations shall be made on returned submittal.

On the transmittal or on a separate page attached to Contractor's resubmission transmittal, all notations or questions indicated by Engineer on Engineer's transmittal form shall be answered or acknowledged in writing. Each response shall be identified by question or notation number established by Engineer. If Contractor does not respond to each notation or question, resubmission will be returned without action by Engineer until Contractor provides a written response to all Engineer's notations or questions.

Variations or revisions from previously reviewed submittal, other than those called for by Engineer, shall be identified on transmittal form.

Record Drawings

One record copy of all Contract Documents, reference documents and all technical documents submitted in good order shall be kept and maintained at the site. On bond media and using drafting symbols and standards consistent with the original documents, Contract Drawings shall be annotated in red to show all changes made during the construction period. Annotated drawings are to be made available to Engineer for reference at all times.

At completion of the Contract and before final payment is made, three (3) sets of clearly legible 11"x 17" bond media Contract Drawings reflecting all changes made during construction shall be delivered to the Engineer. The drawings shall each be stamped "Record Drawings", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's representative.

Record Drawings shall reflect the actual field installed equipment, locations, nameplates, electrical control logic, conduit locations with corresponding labeling, and wiring changes etc. Any deletions of the design drawings shall cross reference to the replaced drawings.

The Record Drawings must be submitted and must be acceptable to the Engineer prior to final acceptance.

The record drawings shall be submitted in PDF format on CDROM as well as hardcopy for review and approval. In addition to the record drawings, copies of the final catalog cuts which have been Approved or Approved as Noted shall be submitted in PDF format along with the record drawings. The PDF files shall clearly indicate either by filename or PDF table of contents the respective pay item number. Specific part or model numbers of items which have been selected shall be clearly visible.

In addition to the specified record drawings, the Contactor shall record GPS coordinates of the following electrical components:

- Last light pole on each circuit
- Handholes
- Conduit crossings
- Controllers
- Buildings
- Structures with electrical connections, i.e. DMS, lighted signs.
- Electric Service locations”

Warranties

All equipment shall be furnished complete with the manufacturer's standard trade warranty, applicable to the Illinois Department of Transportation, from the date of final acceptance. Such warranty shall accompany submittal shop drawings and product data.

Prior to final payment, the original and one copy of all bonds, warranties, and similar documents, including those customarily provided by manufacturers and suppliers shall be delivered to the Engineer.

The warranties shall include parts and labor and shall begin from the date of final acceptance by the Department.

Operation and Maintenance Manuals

Five copies of an Operation and Maintenance Manual shall be furnished to the Engineer for all equipment and associated control systems furnished and installed for review and approval. Four hard copies of approved O&M manuals and four scanned O&M Manuals CD's shall be submitted for Engineer's use.

The contractor shall submit three manuals for engineer, IDOT O&M and IDOT engineer's independent review when construction is at 75% complete stage. Based on the consolidated review comments and compliance, the contractor shall organize and compile required number of sets of O&M manuals and resubmit for review and approval along with point to point response to the previous comments. If it is determined by the Engineer that the manuals do not contain required details and are not revised per the previous comments, then all manuals shall be returned to the contractor for corrective action until the manuals are approved by the Engineer.

The manual shall consist of the following and shall be prepared and arranged subject wise and chronological order as follows:

- (a) Table of Contents broken down per discipline.
- (b) A section with details on warranty including warranty period, warranty start date, and contact for warranty work.
- (c) A section of a pump station data sheet (see sample form at end of section).
- (d) A section of an equipment data summary (see sample form at end of section) for each item of equipment.
- (e) A section of an equipment preventive maintenance data summary (see sample form at end of section) for each item of equipment.
- (f) A section of the equipment manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.
- (g) Approved power systems study including list of electrical relay settings and control, alarm contact, and timer settings with applicable ranges.
- (h) Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.
- (i) One valve schedule giving valve number and location for each valve installed.
- (j) All O&M Manual material and catalog pages shall be on 8-1/2 inch by 11 inch commercially printed or typed forms or an acceptable alternative format.
- (k) Comprehensive equipment technical data sheets for pumps, motors, equipment within switchgear, MCC, switchgear, transformers, breakers, valves, SCADA and control panel.
- (l) Details of equipment nameplates and technical ratings.
- (m) Detailed summary of quantities and bill of material with technical descriptions for major equipment such as MCC, switchgear, SCADA, and control panels, etc.
- (n) The manuals shall contain catalog cuts highlighting features and selected options of the equipment.
- (o) Legible 11-inch x 17-inch shop drawing and each shop drawing shall have "Record" stamp, signatures and date.
- (p) The catalog cuts of each device/equipment shall have engineer's "Approved" stamp, signature and date.
- (q) The manual shall include shop drawings of SCADA, control panels, MCC, switchgear, front and internal views, internal wiring and field interconnection termination details/terminal schedules.
- (r) The manual shall have CAD produced contract drawings having changes identified by red ink and contract documents shall have "Record" stamp, signature and date.
- (s) The manual shall include control schematic shop drawings for pumps and discharge/recirculation gate valves.
- (t) Mechanical and HVAC equipment schedules.
- (u) The manual shall contain a section for detailed system description of sequence of pump operations during rising and falling wet well water level through SCADA primary and backup level controls, float mode control, manual and auto operation of various level systems, remote monitoring of pump station signals and communications method.
- (v) All documents shall be legible.

- (w) The manual shall include shop drawings having engineer's approved stamp, signature and date.
- (x) The manual shall include section for field test reports for all major equipment including the MCC, generator, grounding system, SCADA, and all other monitoring and control equipment.
- (y) Four copies of Record Drawings shall be submitted to the Engineer for review.
- (z) Successful bidder will be provided with MicroStation drawings upon receipt of acceptable release.

Each manual shall be organized into sections paralleling the equipment specifications. Each section shall be identified using heavy section dividers with reinforced holes and numbered plastic index tabs. The data shall be compiled in high-quality heavy-weight, hard cover binders with piano style metal hinges or in an alternate approved format. 11"x17" reduced size legible drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders. The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled. All loose data shall be punched for binding. Composition and printing shall be arranged so that punching does not obliterate any data. The project title, and manual title, as furnished and approved by the Engineer shall be printed on the cover and binding edge of each manual.

All operating and maintenance material that comes bound by the equipment manufacturer shall be left in its original bound state. The appropriate sections of the Contractor's O&M manual shall be cross-referenced to the manufacturers' bound manuals.

The O&M Manuals must be submitted and must be acceptable to the Engineer prior to equipment start-up. Substantial completion is not achieved until O&M Manuals are approved by the Engineer.

REMOVE EXISTING EQUIPMENT

Description. This work will consist of the removal of existing equipment located in the electrical room, wet pit, and dry pit as shown on the plan details. Any concrete repair work or grouting required in the removal of existing equipment will not be paid for separately.

All removed equipment or materials shall become the property of the Contractor and shall be disposed of off the right-of-way unless otherwise noted.

Removed equipment will include the following:

1. All electrical and communication items at the pump station including but not limited to electrical enclosures, receptacles, switches, conduit and raceway, conductors, service entrance equipment and conductors, and autodialers.
2. Motor(s).
3. Motor shafts including all shaft bearing assemblies including supports and walkways in the dry pit.

4. Pump(s) and all related suction and discharge piping associated with the pump system including gate valve(s) and supports.
5. Float control(s) and all related piping associated with the float controls.

Method of Measurement. This work will be measured for payment as lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for PLUMBING EQUIPMENT, ACCESSORIES AND RELATED EQUIPMENT, which price will be payment in full to remove the equipment as stated and the satisfactory disposal off the right-of-way plus temporary work required to complete this work.

REMOVAL OF ELECTRIC SERVICE INSTALLATION

Description. This work shall consist of the complete removal of the electrical installation at the Reading Pump Station.

CONSTRUCTION REQUIREMENTS

General. This work consists of removing and disposing of electrical components including but not limited to existing electrical panels, utility boxes (meters), control panels, wiring, conduit, breakers, connections.

This work shall consist of removing all electrical components including electrical service, motor controls, electrical panels, safety switches, transformers, surge protection, conduit, wiring, switches, outlets, and related items located in the electrical house and dry pit area.

All removed materials shall become the property of the Contractor and be disposed of off the right of way.

Method of Measurement. This work will be measured for payment as each.

Basis of Payment. This work will be paid for at the contract unit price each for REMOVAL OF ELECTRIC SERVICE INSTALLATION, which price shall include all material and labor to satisfactorily complete the work.

CIVIL AND STRUCTURAL WORK

All structural and civil work shall be installed according to applicable portions of the department's Standard Specifications for Road and Bridge Construction, Adopted April 1, 2016. The following sections of the Standard Specifications are required in the Contract.

Earth Excavation	Section 202
Trench Backfill	Section 208
Aggregate Surface Course	Section 402
Concrete Structures	Section 503
Reinforcement Bars	Section 508
Chain Link Fence	Section 664

DISCHARGE BOX, AREAWAY AND WET PIT ACCESS RECONSTRUCTION

Description. This work shall consist of reconstructing (concrete removal and replacement of the existing discharge box, areaways and wet pit access.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars.....	508
(c) Coarse Aggregate	1004.04

Equipment. Equipment shall be according to the following.

Item	Article/Section
(a) Hand Vibrator	1103.17(a)
(b) Vibrating Screed.....	1103.17(g)
(c) Fogging Equipment	1103.17(k)

General. This work shall be according to applicable portions of Section 503, 508 and 584 of the Standard Specifications Adopted January 1, 2016 and as directed by the Engineer.

The discharge box, areaways, and wet pit access shall be reconstructed to the lines and elevation shown on plan details.

Reconstruction Methods.

1. Reconstruction of the discharge box shall consist of the removal and replacement of the top slab of concrete including a portion of the vertical walls as shown on plan details. Existing manhole frame and lid shall also be removed and replaced with "Frame and Lids, Special".
2. Reconstruction of Areaway No. 1 shall consist of the complete removal of the areaway concrete including floor and walls. Existing pipe drain at Areaway No. 1 shall be removed as specified elsewhere in the plans. The void created by the removal of the areaway shall be filled with approved aggregate and compacted to the satisfaction of the Engineer.

3. Reconstruction of Areaway No. 2 shall consist of the construction of a concrete slab over the areaway as shown on plan details. Existing pipe drain at Areaway No. 2 shall be plugged or removed as specified elsewhere in the plans.
4. Reconstruction of the wet pit access shall consist of the removal and replacement of the top slab of concrete including a portion of the vertical walls as shown on plan details. Existing frame and lid shall also be removed and replaced with "Frame and Lids, Special".

Method of Measurement. This work will be measured for payment as follows.

- a) This work will be paid for at the contract unit price per cu yd for concrete removal.
- b) At the contract unit price per cu yd for concrete structures.
- c) And at the contract unit price per pound for reinforcement bars, epoxy coated.

Basis of Payment. This work will be measured for payment as follows.

- a) This work will be paid for at the contract unit price per cu yd for CONCRETE REMOVAL.
- b) This work will be paid for at the contract unit price per cu yd for CONCRETE STRUCTURES.
- c) This work will be paid for at the contract unit price per pound for REINFORCEMENT BARS, EPOXY COATED.

These prices shall be payment in full to complete the work as shown on plan details.

PLUG EXISTING DRAINS

Description. This work consists of the satisfactory plugging of the existing areaway drains at locations and as detailed in the plans.

CONSTRUCTION REQUIREMENTS

General. The material used to plug the drains shall be an approved "Hydraulic Cement" and shall be placed according to applicable portions of Section 503 of the Standard Specifications.

Method of Measurement. This work will be measured for payment as each.

Basis of Payment. This work will be paid for at the contract unit price each for PLUG EXISTING DRAINS, which price shall include all material and labor to satisfactorily complete the work.

PIPE DRAIN REMOVAL

Description. This work consists of the satisfactory remove of existing pipe drains at Areaway No. 1 and Areaway No. 2 as shown on plan details.

CONSTRUCTION REQUIREMENTS

General. Method of removal shall be as follows:

- a) Areaway No. 1: After the concrete walls and floor of the area way has been removed the subgrade beneath the areaway shall be excavated to expose the existing pipe drain. The pipe drain shall be cut off flush with the exterior and interior faces of concrete wall and the pipe drain shall be removed including the exterior and interior sections of pipe as shown on plan details. Removal shall also include all brackets, braces, fitting, etc. and all spalls, holes remaining from the removal operations shall be filled/patched with an approved hydraulic cement to the satisfaction of the Engineer.
- b) Areaway No. 2: The existing pipe drain under areaway no. 2 shall be plugged or removed as shown on plan details. The section of pipe drains to be plugged shall be filled with an approved hydraulic cement. The pipe drain shall be filled, and the hydraulic cement shall be finished to the satisfaction of the Engineer.

The pipe drain section to be removed shall be cut off flush with the interior face of the concrete wall and the pipe drain shall be removed. Removal shall also include all brackets, braces, fitting, etc. and all spalls, holes remaining from the removal operations shall be filled/patched with an approved hydraulic cement to the satisfaction of the Engineer.

Method of Measurement. This work will be measured for payment as follows:

- a) Excavation required for the removal of the pipe drain at Areaway No. 1 will be measured for payment per cu yd.
- b) Removal of existing pipe drains will be measured for payment per foot of pipe removed.

The use of an approved "Hydraulic Cement" shall not be paid for separately but shall be included in the cost of "Pipe Drain Removal".

Basis of Payment. This work will be paid for according to the following.

- a) Excavation required for the removal of pipe drains will be paid for at the contract unit price per cu yd for EARTH EXCAVATION which price shall include all material and labor to satisfactorily complete the work.
- b) Removal of existing pipe drains will be paid for at the contract unit price per foot for PIPE DRAIN REMOVAL which price shall include all material and labor to satisfactorily complete the work.

FRAME AND LIDS, SPECIAL

Description. This work shall consist of furnishing and installing frame and lids at the discharge box and wet pit access as shown on plan details.

Materials. Materials shall be as follows:

Item	Article/Section
(a) Ductile Iron Castings	1006.15

CONSTRUCTION REQUIREMENTS

General. Frames and lids shall be according to applicable portions of Section 602 of the Standard Specifications, plan details and as directed by the Engineer.

Method of Payment. This work will be measured for payment per each.

Basis of Payment. When new construction is specified, this work will be paid for at the contract unit price per each for FRAMES AND LIDS, SPECIAL of the type and diameter specified.

STRUCTURAL STEEL REMOVAL

Description. This work shall consist of the complete removal and disposal of the existing walkway in the dry pit.

CONSTRUCTION REQUIREMENTS

General. This work shall be according to applicable portions of Section 501 of the Standard Specifications and as directed by the Engineer.

Removed materials shall have no salvage value, become the property of the Contractor and disposed of off the right of way.

Removal shall include the walkway grating, support beams, brackets, anchors and related items. Holes, depressions, spalls in the concrete remaining after removal shall be filled/patched with an approved hydraulic cement to the satisfaction of the Engineer.

Method of Measurement. This work will be measured for payment as lump sum.

Basis of Payment. This work will be paid for at the contract unit bid price per lump sum for STRUCTURAL STEEL REMOVAL which will be payment in full to furnish all labor and equipment to complete this work.

ACCESS LADDER

Description. This work shall consist of the removal and disposal of existing access ladders and the furnishing and installation of new fiberglass reinforced plastic (FRP) access ladders in the dry pit and wet pit.

Quality Assurance

- A. The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.
- B. Substitution of any component or modification of system shall be made only when approved by the Architect or Engineer.
- C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.
- D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

Design Criteria

- A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

Submittals

- A. Shop drawings of all FRP structural members, ladders and appurtenances shall be submitted to the Engineer for review.
- B. Manufacturer's catalog data showing:
 - 1. Materials of construction.
 - 2. Chemical resistance table
- C. Detail shop drawings showing:
 - 1. Dimensions.
 - 2. Sectional assembly.
 - 3. Location and identification mark.
- D. All shop drawings shall be sealed by Structural Engineer registered in the State of Illinois.

Shipping and Storage Instructions

- A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

- B. Items shall be covered and protected from exposure to sun or ultra violet light during storage.
- C. All materials and equipment necessary for the fabrication and installation of the ladders shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.
- D. Identify and match-mark all materials, items, and fabrications for installation and field assembly.

General

- A. Materials used in the manufacture of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.
- B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.
 - 1. Resins shall be VINYL ESTER resin for ladders that may be submerged in the wet well and in continuous contact with sewage.
- C. After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.
- D. All exposed surfaces shall be smooth and true to form.
- E. FRP Manufacturers:
 - 1. Strongwell-Chatfield Division, Chatfield, MN.
 - 2. Composite Structures International, Inc.
 - 3. Bedford Plastics, Inc.
 - 4. Augusta Fiberglass.
 - 5. Ultra, Inc.
 - 6. Or approved alternative manufacturer.

Fiberglass Ladders

- A. Ladders shall be fiberglass reinforced plastic (FRP) constructed of siderails, rungs, and brackets.
- B. Resins for ladders shall be vinyl ester resin.
- C. All finished surfaces of FRP items and fabrication shall be smooth, resin-rich, free of voids, and without dry spots, due to wear or weathering. All pultruded structural shapes shall be further protected for ultraviolet (UV) light.

The side rails and rungs shall be fiberglass reinforced pultruded structural shapes pigmented throughout in OSHA safety yellow.

The side rail shall be 1-3/4" square tube or greater with a wall thickness of 1/4" or greater. The rungs shall be 1" diameter or greater pultruded structural shapes, continuously fluted or gritted to provide a non-slip surface.

Type 304 or 316 stainless steel bolts shall be used for connecting brackets and other components to ladder.

Ladders systems shall meet the load and design requirements set forth in OSHA 1910.27 (latest edition). The ladder shall also be capable of supporting a concentrated vertical load of 1,200 pounds applied at the mid-span of the rung.

- D. Ladders shall be fully shop assembled. All rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both epoxy and rivets to provide both a chemical and mechanical lock, respectively.
- E. Ladders shall be equipped with a fall arrest system in compliance with OSHA and local building code safety requirements.
 - 1. Safety rail.
 - 2. 2 trolleys at each ladder.
 - 3. Safety belts. Verify size and quantity with Owner.
 - 4. Removable safety rail extensions on ladders accessible from top. Where permanent installation not possible, provide removable extension. Position extension on brackets near top of ladder so climber can readily install extension.
 - 5. Safety rail climbing devices shall allow worker to operate freely in normal climbing position during ascent or descent. Device shall enable worker to be attached to device during climb without having to remove hands from ladder to operate system effectively and be able to easily pivot onto and off work platforms or landings while safely attached to device.

Preparation

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages. Coordinate delivery of such items to project site.

Inspection and Testing

- A. The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.
- B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Department.
- C. Members and components shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

Installation, General

- A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
 - 1. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.
- B. Install items specified as indicated and in accordance with manufacturer's instructions.

Method of Measurement. This work shall be measured for payment per each.

Basis of Payment. This work shall be paid for at the contract unit bid price per each for ACCESS LADDER which will be payment in full to furnish all labor, materials and equipment to complete this work.

CONCRETE PAD

Description. This work shall consist of constructing reinforced concrete pads that will serve as bases for the proposed emergency generators, main pumps, sump pumps, and related plumbing/mechanical equipment, whenever required by the manufacturer, as shown on plan details.

Materials. Materials shall be as follows:

Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars	508
(c) Grout	1024.01

Equipment. Equipment shall be as follows.

Item	Article/Section
(a) Hand Vibrator	1103.17(a)
(b) Vibrating Screed	1103.17(g)
(c) Fogging Equipment	1103.17(k)

CONSTRUCTION REQUIREMENTS

General. This work shall be according to applicable portions of Section 503 and 584 of the Standard Specifications, plan details and as directed by the Engineer.

Concrete pads, when required by the manufacturer, shall be constructed to a minimum of two (2) times the mass of equipment supported or ten (10) times the mass of moving parts, whichever is greater. Concrete pads shall be constructed as shown on plan details. Dimensions (sizing) of the concrete pads shall be according to the manufacturer’s requirements.

All labor, equipment, and materials to construct the concrete pads, when required by the equipment manufacturer, shall be paid for according to Article 109.04 of the Standard Specifications.

STRUCTURAL REPAIR OF CONCRETE

Effective: March 15, 2006

Revised: April 1, 2016

Description. This work shall consist of structurally repairing concrete.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement Concrete (Note 1)	1020
(b) R1 or R2 Concrete (Note 2)	
(c) Normal Weight Concrete (Notes 3 and 4)	
(d) Shotcrete (High Performance) (Notes 5 and 6)	
(e) Reinforcement Bars.....	1006.10
(f) Anchor Bolts.....	1006.09
(g) Water.....	1002
(h) Curing Compound	1022.01
(i) Cotton Mats.....	1022.02
(j) Protective Coat.....	1023.01
(k) Epoxy (Note 7)	1025
(l) Mechanical Bar Splicers	508.06(c)

Note 1. The concrete shall be Class SI, except the cement factor shall be a minimum 6.65 cwt/cu yd (395 kg/cu m), the coarse aggregate shall be a CA 16, and the strength shall be a minimum 4000 psi (27,500 kPa) compressive or 675 psi (4650 kPa) flexural at 14 days. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125-175 mm) slump, but a cement factor reduction according to Article 1020.05(b)(8) is prohibited. A self-consolidating concrete mixture is also acceptable per Article 1020.04, except the mix design requirements of this note regarding the cement factor, coarse aggregate, strength, and cement factor reduction shall apply.

- Note 2. The R1 or R2 concrete shall be from the Department's approved list of Packaged, Dry, Rapid Hardening, Cementitious Materials for Concrete Repairs. The R1 or R2 concrete shall comply with the air content and strength requirements for Class SI concrete as indicated in Note 1. Mixing shall be per the manufacturer's recommendations, except the water/cement ratio shall not exceed the value specified for Class SI concrete as indicated in Note 1. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125-175 mm) slump, and a retarder may be required to allow time to perform the required field tests. The admixtures shall be per the manufacturer's recommendation, and the Department's approved list of Concrete Admixtures shall not apply.
- Note 3. The "high slump" packaged concrete mixture shall be from the Department's approved list of Packaged, Dry, Formed, Concrete Repair Mixtures. The materials and preparation of aggregate shall be according to ASTM C 387. The cement factor shall be 6.65 cwt/cu yd (395 kg/cu m) minimum to 7.05 cwt/cu yd (418 kg/cu m) maximum. Cement replacement with fly ash or ground granulated blast-furnace slag shall be according to Section 1020. The "high slump" packaged concrete mixture shall have a water-soluble chloride ion content of less than 0.40 lb/cu yd (0.24 kg/cu m). The test shall be performed according to ASTM C 1218, and the "high slump" packaged concrete mixture shall have an age of 28 to 42 days at the time of test. The ASTM C 1218 test shall be performed by an independent lab a minimum of once every two years, and the test results shall be provided to the Department. The coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). The packaged concrete mixture shall comply with the air content and strength requirements for Class SI concrete as indicated in Note 1. Mixing shall be per the manufacturer's recommendations, except the water/cement ratio shall not exceed the value specified for Class SI concrete as indicated in Note 1. A high range water-reducing admixture shall be used to obtain a 5-7 in. (125-175 mm) slump. The admixture shall be per the manufacturer's recommendation, and the Department's approved list of Concrete Admixtures shall not apply. A maximum slump of 10 in. (250 mm) may be permitted if no segregation is observed by the Engineer in a laboratory or field evaluation.

Note 4. The “self-consolidating concrete” packaged concrete mixture shall be from the Department’s approved list of Packaged, Dry, Formed, Concrete Repair Mixtures. The materials and preparation of aggregate shall be according to ASTM C 387. The cement factor shall be 6.65 cwt/cu yd (395 kg/cu m) minimum to 7.05 cwt/cu yd (418 kg/cu m) maximum. Cement replacement with fly ash or ground, granulated blast-furnace slag shall be according to Section 1020. The “self- consolidating concrete” packaged concrete mixture shall have a water-soluble chloride ion content of less than 0.40 lb/cu yd (0.24 kg/cu m). The test shall be performed according to ASTM C 1218, and the “self-consolidating concrete” packaged concrete mixture shall have an age of 28 to 42 days at the time of test. The ASTM C 1218 test shall be performed by an independent lab a minimum of once every two years, and the test results shall be provided to the Department. The concrete mixture should be uniformly graded, and the coarse aggregate shall be a maximum size of 1/2 in. (12.5 mm). The fine aggregate proportion shall be a maximum 50 percent by weight (mass) of the total aggregate used. The packaged concrete mixture shall comply with the air content and strength requirements for Class SI concrete as indicated in Note 1. Mixing shall be per the manufacturer’s recommendations, except the water/cement ratio shall not exceed the value specified for Class SI concrete as indicated in Note 1. The admixtures used to produce self-consolidating concrete shall be per the manufacturer’s recommendation, and the Department’s approved list of Concrete Admixtures shall not apply. The packaged concrete mixture shall meet the self-consolidating requirements of Article 1020.04.

Note 5. Packaged shotcrete that includes aggregate shall be from the Department’s approved list of Packaged High-Performance Shotcrete, and independent laboratory test results showing the product meets Department specifications will be required. The product shall be a packaged, pre-blended, and dry combination of materials, for the wet-mix shotcrete method according to ASTM C 1480. A non- chloride accelerator may be used according to the shotcrete manufacturer’s recommendations. The shotcrete shall be Type FA or CA, Grade FR, and Class I. The fibers shall be Type III synthetic according to ASTM C 1116.

The packaged shotcrete shall have a water-soluble chloride ion content of less than 0.40 lb/cu yd (0.24 kg/cu m). The test shall be performed according to ASTM C 1218, and the hardened shotcrete shall have an age of 28 to 42 days at the time of test. The ASTM C 1218 test shall be performed by an independent lab a minimum of once every two years, and the test results shall be provided to the Department.

Each individual aggregate used in the packaged shotcrete shall have either a maximum ASTM C 1260 expansion of 0.16 percent or a maximum ASTM C 1293 expansion of 0.040 percent. However, the ASTM C 1260 value may be increased to 0.27 percent for each individual aggregate if the cement total equivalent alkali content ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) does not exceed 0.60 percent. As an alternative to these requirements, ASTM C 1567 testing which shows the packaged shotcrete has a maximum expansion of 0.16 percent may be submitted. The ASTM C 1260, C 1293, or C 1567 test shall be performed a minimum of once every two years.

The 7 and 28-day compressive strength requirements in ASTM C 1480 shall not apply. Instead the shotcrete shall obtain a minimum compressive strength of 4000 psi (27,500 kPa) at 14 days.

The packaged shotcrete shall be limited to the following proportions:

The portland cement and finely divided minerals shall be 6.05 cwt/cu yd (360 kg/cu m) to 8.50 cwt/cu yd (505 kg/cu m) for Type FA and 6.05 cwt/cu yd (360 kg/cu. m) to 7.50 cwt/cu yd (445 kg/cu m) for Type CA. The portland cement shall not be below 4.70 cwt/cu yd (279 kg/cu m) for Type FA or CA.

The finely divided mineral(s) shall constitute a maximum of 35 percent of the total cement plus finely divided mineral(s).

Class F fly ash is optional, and the maximum shall be 20 percent by weight (mass) of cement.

Class C fly ash is optional, and the maximum shall be 25 percent by weight (mass) of cement.

Ground granulated blast-furnace slag is optional and the maximum shall be 30 percent by weight (mass) of cement.

Microsilica is required and shall be a minimum of 5 percent by weight (mass) of cement, and a maximum of 10 percent. As an alternative to microsilica, high-reactivity metakaolin may be used at a minimum of 5 percent by weight (mass) of cement, and a maximum of 10 percent.

Fly ash shall not be used in combination with ground granulated blast-furnace slag. Class F fly ash shall not be used in combination with Class C fly ash. Microsilica shall not be used in combination with high-reactivity metakaolin. A finely divided mineral shall not be used in combination with a blended hydraulic cement, except for microsilica or high-reactivity metakaolin.

The water/cement ratio as defined in Article 1020.06 shall be a maximum of 0.42. The air content as shot shall be 4.0 – 8.0 percent.

- Note 6. Packaged shotcrete that does not include pre-blended aggregate shall be from the Department's approved list of Packaged High-Performance Shotcrete, and independent laboratory test results showing the product meets Department specifications will be required. The shotcrete shall be according to Note 5, except the added aggregate shall be according to Articles 1003.02 and 1004.02 in addition to each individual aggregate meeting the maximum expansion requirements of Note 5. The aggregate gradation shall be according to the manufacturer. The shotcrete shall be batched and mixed with added aggregate according to the manufacturer.

Note 7. In addition, ASTM C 881, Type IV, Grade 2 or 3, Class A, B, or C may be used.

Equipment. Equipment shall be according to Article 503.03 and the following.

Chipping Hammer – The chipping hammer for removing concrete shall be a light-duty pneumatic or electric tool with a 15 lb. (7 kg) maximum class or less.

Blast Cleaning Equipment – Blast cleaning equipment for concrete surface preparation shall be the abrasive type, and the equipment shall have oil traps.

Hydrodemolition Equipment – Hydrodemolition equipment for removing concrete shall be calibrated and shall use water according to Section 1002.

High Performance Shotcrete Equipment – The batching, mixing, pumping, hose, nozzle, and auxiliary equipment shall be for the wet-mix shotcrete method and shall meet the requirements of ACI 506R.

CONSTRUCTION REQUIREMENTS

General. The repair methods shall be either formed concrete repair or shotcrete. The repair method shall be selected by the Contractor with the following rules.

- (a) Rule 1. For formed concrete repair, a subsequent patch to repair the placement point after initial concrete placement will not be allowed. As an example, this may occur in a vertical location located at the top of the repair.
- (b) Rule 2. Formed concrete repair shall not be used for overhead applications.
- (c) Rule 3. If formed concrete repair is used for locations that have reinforcement with less than 0.75 in. (19 mm) of concrete cover, the concrete mixture shall contain fly ash or ground granulated blast-furnace slag at the maximum cement replacement allowed.
- (d) Rule 4. Shotcrete shall not be used for any repair greater than 6 in. (150 mm) in depth, except in horizontal applications, where the shotcrete may be placed from above in one lift.
- (e) Rule 5. Shotcrete shall not be used for column repairs greater than 4 in. (100 mm) in depth, unless the shotcrete mixture contains 3/8 in. (9.5 mm) aggregate.

Concrete Removal. The Contractor shall provide ladders or other appropriate equipment for the Engineer to mark the removal areas. Repair configurations will be kept simple, and squared corners will be preferred. The repair perimeter shall be sawed a depth of 1/2 in. (13 mm) or less, as required to avoid cutting the reinforcement. Any cut reinforcement shall be repaired or replaced at the expense of the Contractor. If the concrete is broken or removed beyond the limits of the initial saw cut, the new repair perimeter shall be recut. The areas to be repaired shall have all loose, unsound concrete removed completely by the use of chipping hammers, hydrodemolition equipment, or other methods approved by the Engineer. The concrete removal shall extend along the reinforcement bar until the reinforcement is free of bond inhibiting corrosion. Reinforcement bar with 50 percent or more exposed shall be undercut to a depth of 3/4 in. (19 mm) or the diameter of the reinforcement bar, whichever is greater.

If sound concrete is encountered before existing reinforcement bars are exposed, further removal of concrete shall not be performed unless the minimum repair depth is not met.

The repair depth shall be a minimum of 1 in. (25 mm). The substrate profile shall be $\pm 1/16$ in. (± 1.5 mm). The perimeter of the repair area shall have a vertical face.

If a repair is located at the ground line, any excavation required below the ground line to complete the repair shall be included in this work.

The Contractor shall have a maximum of 14 calendar days to complete each repair location with concrete or shotcrete, once concrete removal has started for the repair.

The Engineer shall be notified of concrete removal that exceeds 6 in. (150 mm) in depth, one fourth the cross section of a structural member, more than half the vertical column reinforcement is exposed in a cross section, more than 6 consecutive reinforcement bars are exposed in any direction, within 1.5 in. (38 mm) of a bearing area, or other structural concern. Excessive deterioration or removal may require further evaluation of the structure or installation of temporary shoring and cribbing support system.

Surface Preparation. Prior to placing the concrete or shotcrete, the Contractor shall prepare the repair area and exposed reinforcement by blast cleaning. The blast cleaning shall provide a surface that is free of oil, dirt, and loose material.

If a succeeding layer of shotcrete is to be applied, the initial shotcrete surface and remaining exposed reinforcement shall be free of curing compound, oil, dirt, loose material, rebound (i.e. shotcrete material leaner than the original mixture which ricochets off the receiving surface), and overspray. Preparation may be by lightly brushing or blast cleaning if the previous shotcrete surface is less than 36 hours old. If more than 36 hours old, the surface shall be prepared by blast cleaning.

The repair area and perimeter vertical face shall have a rough surface. Care shall be taken to ensure the sawcut face is roughened by blast cleaning. Just prior to concrete or shotcrete placement, saturate the repair area with water to a saturated surface-dry condition. Any standing water shall be removed.

Concrete or shotcrete placement shall be done within 3 calendar days of the surface preparation or the repair area shall be prepared again.

Reinforcement. Exposed reinforcement bars shall be cleaned of concrete and corrosion by blast cleaning. After cleaning, all exposed reinforcement shall be carefully evaluated to determine if replacement or additional reinforcement bars are required.

Reinforcing bars that have been cut or have lost 25 percent or more of their original cross-sectional area shall be supplemented by new in-kind reinforcement bars. New bars shall be lapped a minimum of 32 bar diameters to existing bars. A mechanical bar splicer shall be used when it is not feasible to provide the minimum bar lap. No welding of bars shall be performed.

Intersecting reinforcement bars shall be tightly secured to each other using 0.006 in. (1.6 mm) or heavier gauge tie wire and shall be adequately supported to minimize movement during concrete placement or application of shotcrete.

For reinforcement bar locations with less than 0.75 in. (19 mm) of cover, protective coat shall be applied to the completed repair. The application of the protective coat shall be according to Article 503.19, 2nd paragraph, except blast cleaning shall be performed to remove curing compound.

The Contractor shall anchor the new concrete to the existing concrete with 3/4 in. (19 mm) diameter hook bolts for all repair areas where the depth of concrete removal is greater than 8 in. (205 mm) and there is no existing reinforcement extending into the repair area. The hook bolts shall be spaced at 15 in. (380 mm) maximum centers both vertically and horizontally and shall be a minimum of 12 in. (305 mm) away from the perimeter of the repair. The hook bolts shall be installed according to Section 584.

Repair Methods. All repair areas shall be inspected and approved by the Engineer prior to placement of the concrete or application of the shotcrete.

- (a) Formed Concrete Repair. Falsework shall be according to Article 503.05. Forms shall be according to Article 503.06. Formwork shall provide a smooth and uniform concrete finish and shall approximately match the existing concrete structure. Formwork shall be mortar tight and closely fitted where they adjoin the existing concrete surface to prevent leakage. Air vents may be provided to reduce voids and improve surface appearance. The Contractor may use exterior mechanical vibration, as approved by the Engineer, to release air pockets that may be entrapped.

The concrete for formed concrete repair shall be a Class SI Concrete, or a packaged R1 or R2 Concrete with coarse aggregate added, or a packaged Normal Weight Concrete at the Contractor's option. The concrete shall be placed and consolidated according to Article 503.07. The concrete shall not be placed when frost is present on the surface of the repair area, or the surface temperature of the repair area is less than 40 °F (4 °C). All repaired members shall be restored as close as practicable to their original dimensions.

Curing shall be done according to Article 1020.13.

If temperatures below 45°F (7°C) are forecast during the curing period, protection methods shall be used. Protection Method I according to Article 1020.13(d)(1), or Protection Method II according to Article 1020.13(d)(2) shall be used during the curing period.

The surfaces of the completed repair shall be finished according to Article 503.15.

- (b) Shotcrete. Shotcrete shall be tested by the Engineer for air content according to Illinois Modified AASHTO T 152. The sample shall be obtained from the discharge end of the nozzle by shooting a pile large enough to scoop a representative amount for filling the air meter measuring bowl. Shotcrete shall not be shot directly into the measuring bowl for testing.

For compressive strength of shotcrete, an 18 x 18 x 3.5 in. (457 x 457 x 89 mm) test panel shall be shot by the Contractor for testing by the Engineer. A steel form test panel shall have a minimum thickness of 3/16 in. (5 mm) for the bottom and sides. A wood form test panel shall have a minimum 3/4 in. (19 mm) thick bottom, and a minimum 1.5 in. (38 mm) thickness for the sides. The test panel shall be cured according to Article 1020.13 (a) (3) or (5) while stored at the jobsite and during delivery to the laboratory. After delivery to the laboratory for testing, curing and testing shall be according to ASTM C 1140.

The method of alignment control (i.e. ground wires, guide strips, depth gages, depth probes, and formwork) to ensure the specified shotcrete thickness and reinforcing bar cover is obtained shall be according to ACI 506R. Ground wires shall be removed after completion of cutting operations. Guide strips and formwork shall be of dimensions and a configuration that do not prevent proper application of shotcrete. Metal depth gauges shall be cut 1/4 in. (6 mm) below the finished surface. All repaired members shall be restored as close as practicable to their original dimensions.

For air temperature limits when applying shotcrete in cold weather, the first paragraph of Article 1020.14(b) shall apply. For hot weather, shotcrete shall not be applied when the air temperature is greater than 90°F (32°C). The applied shotcrete shall have a minimum temperature of 50°F (10°C) and a maximum temperature of 90°F (32°C). The shotcrete shall not be applied during periods of rain unless protective covers or enclosures are installed. The shotcrete shall not be applied when frost is present on the surface of the repair area, or the surface temperature of the repair area is less than 40°F (4°C). If necessary, lighting shall be provided to provide a clear view of the shooting area.

The shotcrete shall be applied according to ACI 506R and shall be done in a manner that does not result in cold joints, laminations, sandy areas, voids, sags, or separations. In addition, the shotcrete shall be applied in a manner that results in maximum densification of the shotcrete. Shotcrete which is identified as being unacceptable while still plastic shall be removed and re-applied.

The nozzle shall normally be at a distance of 2 to 5 ft. (0.6 to 1.5 m) from the receiving surface and shall be oriented at right angles to the receiving surface. Exceptions to this requirement will be permitted to fill corners, encase large diameter reinforcing bars, or as approved by the Engineer. For any exception, the nozzle shall never be oriented more than 45 degrees from the surface. Care shall be taken to keep the front face of the reinforcement bar clean during shooting operations. Shotcrete shall be built up from behind the reinforcement bar. Accumulations of rebound and overspray shall be continuously removed prior to application of new shotcrete. Rebound material shall not be incorporated in the work.

Whenever possible, shotcrete shall be applied to the full thickness in a single layer. The maximum thickness shall be according to Rules 4 and 5 under Construction Requirements, General. When two or more layers are required, the minimum number shall be used and shall be done in a manner without sagging or separation. A flash coat (i.e. a thin layer of up to 1/4 in. (6 mm) applied shotcrete) may be used as the final lift for overhead applications.

Prior to application of a succeeding layer of shotcrete, the initial layer of shotcrete shall be prepared according to the surface preparation and reinforcement bar cleaning requirements. Upon completion of the surface preparation and reinforcement bar treatment, water shall be applied according to the surface preparation requirements unless the surface is moist. The second layer of shotcrete shall then be applied within 30 minutes.

Shotcrete shall be cut back to line and grade using trowels, cutting rods, screeds or other suitable devices. The shotcrete shall be allowed to stiffen sufficiently before cutting. Cutting shall not cause cracks or delaminations in the shotcrete. For depressions, cut material may be used for small areas. Rebound material shall not be incorporated in the work. For the final finish, a wood float shall be used to approximately match the existing concrete texture. A manufacturer approved finishing aid may be used. Water shall not be used as a finishing aid. All repaired members shall be restored as close as practicable to their original dimensions.

Contractor operations for curing shall be continuous with shotcrete placement and finishing operations. Curing shall be accomplished using wetted cotton mats, membrane curing, or a combination of both. Cotton mats shall be applied according to Article 1020.13(a)(5) except the exposed layer of shotcrete shall be covered within 10 minutes after finishing, and wet curing shall begin immediately. Curing compound shall be applied according to Article 1020.13(a)(4), except the curing compound shall be applied as soon as the shotcrete has hardened sufficiently to prevent marring the surface, and each of the two separate applications shall be applied in opposite directions to ensure coverage. The curing compound shall be according to Article 1022.01. Note 5 of the Index Table in Article 1020.13 shall apply to the membrane curing method.

When a shotcrete layer is to be covered by a succeeding shotcrete layer within 36 hours, the repair area shall be protected with intermittent hand fogging, or wet curing with either burlap or cotton mats shall begin within 10 minutes. Intermittent hand fogging may be used only for the first hour. Thereafter, wet curing with burlap or cotton mats shall be used until the succeeding shotcrete layer is applied. Intermittent hand fogging may be extended to the first hour and a half if the succeeding shotcrete layer is applied by the end of this time.

The curing period shall be for 7 days, except when there is a succeeding layer of shotcrete. In this instance, the initial shotcrete layer shall be cured until the surface preparation and reinforcement bar treatment is started.

If temperatures below 45°F (7°C) are forecast during the curing period, protection methods shall be used. Protection Method I according to Article 1020.13(d)(1), or Protection Method II according to Article 1020.13(d)(2) shall be used during the curing period.

Inspection of Completed Work. The Contractor shall provide ladders or other appropriate equipment for the Engineer to inspect the repaired areas. After curing but no sooner than 28 days after placement of concrete or shooting of shotcrete, the repair shall be examined for conformance with original dimensions, cracks, voids, and delaminations. Sounding for delaminations will be done with a hammer or by other methods determined by the Engineer.

The acceptable tolerance for conformance of a repaired area shall be within 1/4 in. (6 mm) of the original dimensions. A repaired area not in dimensional conformance or with delaminations shall be removed and replaced.

A repaired area with cracks or voids shall be considered as nonconforming. Exceeding one or more of the following crack and void criteria shall be cause for removal and replacement of a repaired area.

1. The presence of a single surface crack greater than 0.01 in. (0.25 mm) in width and greater than 12 in. (300 mm) in length.
2. The presence of two or more surface cracks greater than 0.01 in. (0.25 mm) in width that total greater than 24 in. (600 mm) in length.
3. The presence of map cracking in one or more regions totaling 15 percent or more of the gross surface area of the repair.
4. The presence of two or more surface voids with least dimension 3/4 in. (19 mm) each.

A repaired area with cracks or voids that do not exceed any of the above criteria may remain in place, as determined by the Engineer.

If a nonconforming repair is allowed to remain in place, cracks greater than 0.007 in. (0.2 mm) in width shall be repaired with epoxy according to Section 590. For cracks less than or equal to 0.007 in. (0.2 mm) in width, the epoxy may be applied to the surface of the crack. Voids shall be repaired according to Article 503.15.

Publications and Personnel Requirements. The Contractor shall provide a current copy of ACI 506R to the Engineer a minimum of one week prior to start of construction.

The shotcrete personnel who perform the work shall have current American Concrete Institute (ACI) nozzlemen certification for vertical wet and overhead wet applications, except one individual may be in training. This individual shall be adequately supervised by a certified ACI nozzlemen as determined by the Engineer. A copy of the nozzlemen certificate(s) shall be given to the Engineer.

Basis of Payment. This work will not be paid for separately but shall be included in the various removal items.

With the exception of reinforcement damaged by the Contractor during removal, the furnishing and installation of supplemental reinforcement bars, mechanical bar splicers, hook bolts, and protective coat will be paid according to Article 109.04.

COMPLETE SPARE MAIN PUMP ASSEMBLY

Description. This work will shall consist of furnishing and transporting a spare main pump assembly in accordance with Section – Submersible Pumps for the Reading Pump Station to be stored at the Department's Watseka Maintenance Facility.

The spare main pump assembly shall be according the Special Provision for Submersible Pump. The spare main pump assembly will include the pump and motor assembly and all related accessories and fittings to install the spare pump when required.

The Contractor shall furnish, transport and unload the spare main pump assembly to the department's Pontiac Maintenance Facility located at, 12970 E. 1700N Rd., Pontiac, IL 61764. Contact person is Mark Emm (815) 644-6522.

The contractor shall provide heavy treated timbers to set the pump onto and moved to a location as directed by the maintenance field engineer.

Method of Measurement. This work will be measured for payment as lump sum.

Basis of Payment. This work will be paid for at the contract lump sum price for COMPLETE SPARE MAIN PUMP ASSEMBLY which will be payment in full to furnish all labor, materials and equipment to complete this work.

SUBMERSIBLE PUMP

Description. This work shall consist of furnishing and installing pumping equipment with all accessories including piping, fittings, brackets, and fasteners for two complete pumping systems and all related systems. In addition, field testing of all pumping systems and related systems shall be required at the Reading Pump Station.

Installation of submersible pump equipment will consist of the following:

- Furnish and install two dry pit submersible solids handling wastewater pumps.
- Furnish and install two 12" gate valves.
- Furnish and install two 12" flap valves.

Installation of accessories will consist of the following:

- Furnish and install a 12" diameter cement lined ductile iron pipe, pipe supports and anchors, rubber expansion joints and fittings for suction and discharge for two pump systems.
- Furnish and install air vent pipe in Discharge Chamber.

Field testing of pump systems, related accessories, and alarm systems:

Field testing shall include testing of the operation of the installed pumps and related systems including field testing of the new autodialer alarm system. The Contractor shall coordinate with the Engineer and a service representative of the alarm system manufacturer to ensure proper operation and compatibility of the new pump systems with the existing alarm system.

Known Suppliers for "Autodialers" (Chatterbox):

RACO Remote Alarms & Controls
RACO Manufacturing & Eng. Co.
1400 62nd Street
Emeryville, CA 94608
Phone: (800) 722-6999
Phone: (510) 658-6713
Fax: (510) 658-3153

SENSAPHONE
901 Tryens Road
Aston, PA 19014
Phone: (888) 369-4781
Fax: (610) 558-0222

OMNISITE
203 W. Morris St.
Indianapolis, IN 46225
Phone: (317) 885-6300

The proposed autodialer alarm system supplier/manufacturer shall be installed at "Reading and Milford Pump Stations".

Costs incurred due to the service representative's technical assistance or presence at the job site shall not be paid for separately but shall be included in the cost of the related plumbing and accessory installations.

Installation of Pumps

Refer to Section – Submersible Pumps for further requirements.

Pumps shall be set in strict accordance with the manufacturer's instruction and shall be performed in a workmanlike manner. All equipment shall be carefully set and aligned so that it operates without undue vibrations and stresses.

Piping and valves shall be supported independently of the pump so that no strain will be imparted to the pump members. The setting, alignment, and operation of the pumps shall be supervised and approved by the pump manufacturer's representative prior to station start-up.

A certification of compliance shall be furnished by the manufacturer's representative prior to final inspection.

Valves

Refer to Valves Section for further requirements.

ADDITIONAL REQUIREMENTS

Shop Drawings. Within thirty (30) days after award of contract and before any work is done, the Contractor shall submit for approval, five (5) copies of the complete drawings of all equipment which he is to furnish, and complete working drawings showing location and general arrangement of all equipment, anchor bolts and supports for same. All drawings furnished by the Contractor shall be subject to approval by the Engineer for compliance with the Engineer's plan and specifications. Approval of shop drawings will not relieve the Contractor from full responsibility for the successful operations of units and compliance with the specifications in all respects.

SUBMERSIBLE PUMPS

Description. Under this item, the Contractor shall furnish and install two (2) submersible non-clog pumps Main Pump No. 1 (MP-1) and Main Pump No. 2 (MP-2) with appurtenances and anchors as required and specified for the Reading Pump Station. Contractor shall also furnish a spare Main Pump No. 3 (MP-3) with Basis of Payment per Complete Spare Main Pump Assembly.

Quality Assurance and Testing.

- A. The pump manufacturer shall perform the following inspections and tests on the pumps before shipment from the factory.
 1. Impeller, motor rating and electrical connections shall first be checked for compliance to the customer's purchase order.
 2. A motor and cable insulation test for moisture content or insulation defects.
 3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

4. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water.
5. After operational test No. 4, the insulation test (No. 2) is to be performed again.
6. Factory Certified Performance Tests:
 - a. Perform on each pump in accordance with test requirements of Hydraulic Institute (HI) 14.
 - b. Pumps shall meet performance acceptance grade 1U requirements.
 - c. Determine capacity, head, brake horsepower and hydraulic efficiency.
 - d. Test each pump at minimum of 6 points including design duty point specified, shutoff and at flow rate greater than maximum capacity specified in Submersible Centrifugal Pumping Equipment Schedule(s).
 - e. Prepare and submit five (5) copies of certified and properly identified performance curves which shall reflect the operating characteristics of each pump being supplied. The curves shall indicate head, capacity, horsepower, efficiency and input KW.
 - f. Test actual assembled pumps to be provided. Results of prior tests on similar or identical pumps are not acceptable.

B. Prior to station operation, all equipment shall be inspected for proper alignment, quiet operation, proper connection and satisfactory performance by means of a functional test.

A written report stating the foregoing has been done shall be supplied with each pump at the time of shipment.

Submittals.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications. Additionally, provide:

1. Equipment Layout (plan and elevation)
2. Overall Dimensions
3. Anchor Bolt or Mounting Hole Dimensions
4. Weight Total and Weights of Shipping Units
5. Detail Dimensions
6. Materials of Construction
7. Capacity
8. Performance Curves
9. Nameplate Data
10. Wiring Diagrams and Schematics Diagrams
11. Interconnection Diagram (Electrical)
12. Mounting Details
13. Bill of Materials
14. Ambient Conditions Necessary for Efficient Operation

Warranty.

- A. The manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of two (2) years.
- B. The Contractor shall warrant the units being supplied to the Owner for a period of two (2) years.

Known Manufacturers.

- A. Flygt, Model NT 3171 LT3 613
- B. KSB

Submersible Pumps.

A. General Design Criteria

- 1. The pumps shall be capable of handling raw sewage, shall be capable of passing 3-inch spherical solids and shall comply with design criteria as indicated in SUBMERSIBLE PUMP SCHEDULE at the end of this Section. All submersible pumps shall be by the same manufacturer. All major parts, such as the stator casing, oil casing, sliding bracket, volute and impeller shall be of gray iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be of stainless steel.
- 2. Pump shall be designed for use in a dry pit application. Provisions shall be included so that the pump and motor will maintain proper cooling.
- 3. Pump case: Cast iron, ASTM A-48, Class 35B C.I.
- 4. Motor housing: Cast iron, ASTM A-48, Class 35B C.I.
- 5. Equipment shall be Class I, Div 2 Group D Explosion Proof

B. Impeller

- 1. The impeller(s) shall be Hard-Iron (ASTM A-532 (Alloy III A) 25% chrome cast iron) or gray cast iron, Class 35B. Impellers shall be dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impellers shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. A multi-vane, not vortex, impeller shall be used for maximum hydraulic efficiency. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impellers shall be keyed to the shaft, retained with an Allen head bolt and shall be capable of passing a minimum 3-inch diameter solid. Impellers shall be coated with an alkyd resin primer or acrylic dispersion zinc phosphate primer.

C. Pump Shaft

- 1. Pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T or A276 Type 420 Stainless Steel and shall be completely isolated from the pumped liquid.

D. Shaft Seal System

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. For special applications, other seal face materials shall be available.
2. The following seal types shall not be considered acceptable nor equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.
3. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.
4. Seal lubricant shall be FDA Approved, nontoxic.
5. Lower seal faces: Tungsten-carbide (rotating seal ring) versus Tungsten-carbide.
6. Upper seal faces: Silicon or Tungsten-carbide (rotating seal ring) versus Tungsten-carbide.

E. Bearings

1. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two-row angular contact ball bearing. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces.
2. Heavy-duty single row to provide minimum L-10 life of 50,000 hours at axial and radial loadings at any usable portion of the pump curve.

F. Pump Motor

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 120°C (260°F) shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.
2. The pump motor shall be 480v, 3-ph, 60 Hz. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.
3. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.
4. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

G. Pump Cable

1. The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. The cable entry junction box and motor shall be separated by a watertight stator lead sealing gland or terminal board which shall isolate the motor interior from foreign materials and water gaining access through the pump top. If epoxy cable entry is used in lieu of a rubber grommet and secondary sealing system each pump control shall be provided with an independent ground fault detection system indicator and manual reset which will prevent a pump from operating if a ground fault is sensed.

2. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable. A minimum of 40 feet of cable shall be supplied with the excess coiled and hung.
3. A suitable bracket shall be supplied and installed near top of the station to loop and hold cables within the stations. This is to prevent straining the cables at the sealing hub.

H. Seals

1. All mating surfaces of major parts shall be machined and fitted with nitrile O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by automatic compression in 2 planes and O-ring contact made on four surfaces, without the requirement of specific torque limits to affect this. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or normal.
2. Tolerances of all parts shall be such that allows replacement of any part without additional machining required to insure sealing as described above. No secondary sealing compounds, greases or other devices shall be used.

I. Cooling System

1. Each unit shall be provided with an adequately designed cooling system. A stainless-steel water jacket shall encircle the stator housing; thus, providing heat dissipation for the motor regardless of the type of installation. Impeller back vanes shall provide the necessary circulation of the cooling liquid through the water jacket. The cooling media channels and ports shall be non-clogging by virtue of their dimensions. Provisions for external cooling and seal flushing shall also be provided. The cooling system shall provide for continuous pump operation in liquid temperature of up to 104 degrees F. Restrictions below this temperature are not acceptable.

J. Thermal Sensors

1. Thermal sensors shall be used to monitor stator temperatures. There shall be one for each phase group in the motor. These shall be used in conjunction with and supplemental to external motor over current protection and available at the control panel. Sensors shall be set at 260-degree F to maintain Nema B design requirements. Thermal sensors monitoring pump stator shall turn pump off and activate an alarm if stator overheats. Sensors in excess of 260-degree F are not acceptable.

K. Leakage Sensor

1. A leakage sensor shall be used to monitor and detect water in the stator chamber. The leakage sensor shall be a float switch which when activated shall stop the motor and send an alarm. Leakage sensors that detect water in the oil chamber may be provided, however, those types of sensors shall be provided in addition to the leakage sensor in the motor chamber.

L. Thermal Motor Protection

1. Provide Internal Thermal Overload Protection for Motors. Protection automatically opens power supply circuit to the motor, or control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.

M. Pump Accessories

The submersible pump locations shall be furnished with the following accessories, by the pump manufacturer.

1. Cable holders. (also see paragraph G - Pump Cable).
2. Nameplate. Each unit to be complete with a stainless-steel nameplate securely attached to pump itemizing pump data including model number, serial number, impeller diameter and part number.

N. Base Elbow

1. A cast iron 10"x12" suction elbow with a 125 lb. flat-faced flange conforming to ANSI drilling shall be furnished for each pump.

O. Operation

1. The Owner shall operate the pumps and motors at a constant speed and be automatically turned on/off using wet well floats and/or manual controls.

Installation/Removal Assembly.

A. Lifting Device

1. The pump shall be provided with a lifting bail which permits the pump to be lifted with a single hook so that it hangs in true vertical position.

B. Lifting Chain

1. Provide one 60-feet of 3/16" diameter type 316 stainless steel lifting chain.

Anchor Bolts. Furnish and install Stainless steel, ASTM A276, Type 316 anchor bolts of the size and number recommended by the pump manufacturer.

Examination. Verify that anchor bolts are correct size and positioned properly.

Installation. Install submersible pumps, control equipment and accessories in accordance with manufacturer's instructions and as shown on the drawings. Install interconnecting electrical wiring, conduit, etc. between submersible pumps and control equipment so that when power and control wiring is brought to the control equipment, the submersible pump system will be a complete operational system.

Manufacturer's Services. The Contractor shall include with his bid the services of the pump manufacturer's field service technician for a period of one 8-hour day at the site. This service shall be for the purpose of check-out, initial start-up, certification, and instruction of plant personnel. A written report covering the technician's findings and installation certification shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

Extra Materials.

- A. One set of bearings for each installed pump.
- B. One mechanical seal set for each installed pump.
- C. One gasket set complete for each installed pump.

Schedule. See pump schedule herein.

SUBMERSIBLE PUMP SCHEDULE

Design Duty Points Condition

SUBMERSIBLE CENTRIFUGAL PUMP SCHEDULE 1	
Name of Pump(s)	Main Pump No. 1 and Main Pump No. 2 Spare Pump (Main Pump No. 3) basis of payment per Section - Complete Spare Main Pump Assembly
Tag Number(s)	MP-1 and MP-2 and MP-3 (spare)
Number of Pumps	Two
Fluid Pumped	Wastewater
Maximum Motor Horsepower	25
Maximum Full Load Amps	31
Maximum RPM	1,160
Discharge	10 inch
Suction	10 inch with 10"x12" Suction Elbow
Motor	480 volt, 3-phase, 60 Hertz
Minimum Spherical Solids Size	3-inch
Constant or Variable Frequency	Constant
Hazardous Classification	Class 1, Division 2, Group D

Performance Requirement at Rated Speeds	
Maximum Speed (rpm)	1,160
Design Operating Point (Hydraulic Institute 1U)	
Capacity (gpm)	2,600
Total Dynamic Head (ft)	27.3
Minimum efficiency	78
Operating Point 2 (Hydraulic Institute 2B)	
Capacity (gpm)	3,300
Total Dynamic Head (ft)	22.6
Minimum efficiency	78.6
Operating Point 3 (Hydraulic Institute 2B)	
Capacity (gpm)	4,000
Total Dynamic Head (ft)	16
Minimum efficiency	69.3
Minimum Shutoff Head	
Total Dynamic Head (ft)	48
<p>Note: Items listed above including Total Dynamic Head, Horsepower and connections are for "A" manufacturer. It is anticipated that the proposed discharge piping will include 10"x12" long radius 90 deg bend and follow alignment shown on drawings. Total Dynamic Head is based on 10"x12" long radius discharge elbow and 10"x12" suction elbow. Any realignment must be approved by the engineer and the respective TDH must be modified to reflect such changes. If "B" manufacturer requires higher TDH, horsepower or alternate sizing, then Contractor shall provide at no additional cost all electrical changes (including packaged engine generator system) and motor. Changes must be approved by the engineer. If "B" manufacturer requires piping modifications, then Contractor shall provide piping modifications at no additional cost.</p>	
<p>rpm = revolutions per minute gpm = gallons per minute ft = feet</p>	

PIPE HANGERS, SUPPORTS AND ANCHORS

Description. System of pipe supports and anchors with necessary inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, and other accessories.

Definitions. Submerged: At or below point 1 foot 6 inches above peak (maximum) water surface elevations in water holding structure.

References.

- A. MSS: Manufacturers Standardization Society
- B. ASTM: American Society for Testing and Materials
- C. ANSI: American National Standards Institute

System Description.

A. Design Requirements:

1. Design, detail, and installation of pipe support system shall be responsibility of Contractor.
2. Pipe support system components shall withstand dead loads imposed by weight of pipes filled with water plus insulation, plus live loads due to thermal expansion, vibration, internal test pressures, and have minimum safety factor of 5.
3. Absence of pipe supports and details on Drawings shall not relieve Contractor of responsibility for providing them throughout plant.
4. Supply design loading criteria to precast concrete manufacturer for piping supported from precast members.

Quality Assurance. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance. Single-Source Responsibility: Obtain pipe hangers, supports, and anchor components from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as unit as evidenced by records of prototype testing.

Submittals.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications. Additionally provide:

1. Pipe supporting system, including manufacturer's product data, dimensions, sizes, types, location, maximum loadings, thrust anchorage, and installation instructions.
2. Shop Drawing shall be stamped by a Structural Engineer registered in the State of Illinois.
3. Provide one reproducible and one print.

Manufacturers.

- A. B-Line.
- B. Grinnell.
- C. Carpenter-Patterson.
- D. Unistrut.
- E. Superstrut.

General.

- A. MSS types indicated are typical of types and quality of standard pipe supports and hangers to be employed. Special support and hanger details are shown to cover locations where standard catalog supports are inapplicable.

- B. Provide factory fabricated piping hangers and supports, clamps, hanger rod attachments, building attachments, saddles, shields, thrust anchorage, and other miscellaneous products of MSS SP69 type indicated or shop fabricated supports; comply with MSS SP58 and manufacturer's published product information. Where MSS type not indicated, provide proper selection for installation requirements and comply with MSS SP69, MSS SP89 and manufacturer's published product information.

Materials.

- A. Hangers, rods, clamps, protective shields, metal framing, support components, and hanger accessories shall be Type 316 stainless steel.

Horizontal Piping Hangers and Supports.

A. General:

1. Unless otherwise shown or specified, hangers for 2 1/2 inches and smaller pipe shall be split-ring, adjustable swivel, clevis or roller type, hangers for 3-inch pipe or greater shall be clevis or roller type.
2. Hangers for use with spring supports shall be split-ring or clamp type.
3. Hangers for fiberglass reinforced pipe shall be saddle type.
4. Each hanger shall be designed to permit at least 1/2-inch vertical adjustment after installation.

B. Adjustable Swivel Split Ring Hanger: MSS Type 6.

C. Adjustable Clevis Hanger: MSS Type 1, fabricated from steel.

D. Adjustable Band Hanger: MSS Type 7, fabricated from steel.

E. Adjustable Swivel-Band Hanger: MSS Type 10.

F. Clamp: MSS Type 4.

G. Single Roll Support: MSS Type 41, including axle roller and threaded sockets.

H. Adjustable Roller Hanger: MSS Type 43, including axle roller and clevis.

I. Roll/Stand: MSS Type 44, including roller, stand, and axle.

J. Adjustable Roller/Base: MSS Type 46, including roller, adjustable base, and stand.

K. Steel Brackets: Welded structural steel shapes complying with following:

1. Light Duty: MSS Type 31.
2. Medium Duty: MSS Type 32.
3. Heavy Duty: MSS Type 33.

L. Adjustable Saddle Support:

1. MSS Type 38, including saddle, pipe and reducer.
2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate. Use of threaded rod for pedestal support stanchions is not acceptable.

M. Stanchion Saddle Support:

1. MSS Type 37, including saddle and U-bolt.
2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate. Use of threaded rod for pedestal support stanchions is not acceptable.

N. Strap or wire hangers not acceptable.

Vertical Piping Clamps.

- A. 2-Bolt Riser Clamp: MSS Type 8, galvanized or plastic coated.
- B. 4-Bolt Riser Clamp: MSS Type 42, include pipe spacers at inner bolt holes, galvanized or plastic coated.

Hanger Rods and Attachments.

A. Hanger Rods:

1. ASTM A36, threaded both ends or continuous thread.
2. Rods shall conform to following sizes:

Pipe Size (inches)	Minimum Rod Diameter (inches)
Up to 2	3/8
2 1/2 and 3	1/2
4	5/8
6	3/4
8 to 12	7/8
14 and Up	1
Trapeze Hangers	As Required

- B. Turnbuckles: MSS Type 13.
- C. Weldless Eye Nut: MSS Type 17.
- D. Eye Socket: MSS Type 16.
- E. Clevis: MSS Type 14.

Building Attachments.

A. Individual Concrete Inserts:

1. MSS Type 18, malleable iron.
2. MSS Type 19, steel.
3. Minimum Safe Load: 1,100 pounds.

B. Continuous Concrete Inserts:

1. Unistrut, P-3200 Series.
2. B-Line.
3. Grinnel.
4. Superstrut.
5. Or equal.

C. Top Beam C-Clamp: MSS Type 19.

D. C-Clamps: MSS Type 23, steel.

E. Single-Side Clamp: MSS Type 25.

F. Top I-Beam Clamp: MSS Type 25.

G. Side Beam Clamp: MSS Type 20.

H. Concrete Anchors:

1. Provide in accordance with Section 05500.
2. Minimum Safety Factor: 5.

Saddles and Shields.

A. Protection Saddles: MSS Type 39.

B. Protection Shields: MSS Type 40.

C. Wood Insulation Saddle:

1. Elcen Metal Products Company.
2. Or approved equal.

Miscellaneous Materials.

A. Metal Framing Systems:

1. Unistrut, galvanized.
2. B-Line, galvanized.
3. Grinnell, galvanized.
4. Or approved equal.

B. Shop-Fabricated Anchors and Supports:

1. Steel Plates, Shapes, and Bars: ASTM A36.
2. Restraining Rods: ASTM A307.

C. Concrete: Minimum 28-day compressive strength of concrete – 3,000 pounds per square inch.

General.

- A. Proceed with installation of hangers, supports, and anchors after required building structural work is complete and concrete support structure has reached 28-day compressive strength as 3,000 pounds per square inch.
- B. Install hangers, supports, clamps, and attachments from building structure. Comply with MSS SP-69. Group parallel runs of horizontal piping to be supported together on trapeze type hangers where possible.
- C. Install supports to provide indicated pipe slopes and maximum pipe deflections allowed by ANSI B31.1 are not exceeded.
- D. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- E. Do not support piping from other piping. In cases where piping being removed is supporting other piping which is to remain, provide new pipe supports for remaining piping in accordance with this Section.
- F. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used, place 1/8-inch-thick Teflon, neoprene rubber or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and support.
- G. Prevent electrolysis in support of copper tubing by use of hangers and supports where are copper plated, plastic coated or by other recognized industry methods. Electrician's tape not acceptable isolation method.
- H. Apply anti-seize compound to nuts and bolts.

Installation of Building Attachments.

- A. Support piping from structural framing, unless otherwise noted.
- B. Concrete Inserts:
 - 1. Locate inserts so total load on insert does not exceed manufacturer's recommended maximum load. Location of inserts shall be approved by Engineer.
 - 2. Where necessary to anchor supports to hardened concrete or completed masonry, use concrete anchors.
- C. Attach to structural steel with beam clamps.

Thrust Anchors and Guides.

- A. Thrust Anchors:
 - 1. For suspended piping, center thrust anchors as closely as possible between expansion joints and between elbows and expansion joints. Anchors shall hold pipe securely and be sufficiently rigid to force expansion and contraction movement to take place at expansion joints or elbows and preclude separation of joints.
 - 2. Provide thrust anchors as required to resist thrust due to changes in diameter or direction or dead ending pipe lines. Anchorage shall be required wherever bending stresses exceed allowable for pipe. Wall pipes may be used as thrust anchors.

- B. Pipe guides shall be provided adjacent to sliding expansion joints in accordance with recommendations of National Association of Expansion Joint Manufacturers.

Pipe Support.

- A. Spacing:

Type of Pipe (inches)	Maximum Pipe Support Spacing (feet)
<i>Ductile Iron</i>	
1 and smaller	6
1 1/4 through 2 1/2	8
3 and 4	10
6	12
8	12
10 and 12	14
14	16
16 and 18	16
20	18
24 and larger	18
<i>(For cast iron soil pipe plumbing applications, support as 5 ft-0 in. spacing.)</i>	

- B. Where piping of various sizes is to be supported together, space supports for smallest pipe size or install intermediate supports for smaller diameter pipe.
- C. Provide minimum of 2 pipe supports for each pipe run.
- D. Where piping connects to equipment, support by pipe support and not by equipment, unless approved by equipment manufacturer.
- E. Unless otherwise shown or authorized by Engineer, place piping running parallel to walls approximately 1 1/2 inches out from face of wall and at least 3 inches below ceiling.
- F. Pedestal pipe supports shall be adjustable with stanchion, saddle, and anchoring flange. Use of threaded rod for pedestal support stanchions is not acceptable.
- G. Piping supports for vertical piping passing through floor sleeves shall be galvanized steel riser clamps.
- H. Piping passing through sleeves or openings in interior wall sleeves shall be carried by supports or hangers. Do not rest on wall.
- I. Support piping in manner preventing undue strain on valve, fitting or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise shown. Do not install pipe supports and hangers in equipment access areas.
- J. Install supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Piping shall be free to move when expands or contracts, except where fixed anchors are indicated. Where specified hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 inch per 100 feet for each 100 degrees F change in temperature exceed 1/2 inch, provide approved roller supports.
- L. Piping 6 inches and larger supported by trapeze hangers shall be supported with rollers.

- M. Stacked horizontal runs of piping along walls may be supported by metal framing system attached to concrete insert channels.
- N. Coat hangers, clamps, protective shields, metal framing support components, and hanger accessories in accordance with Section - Painting.

PROCESS-MECHANICAL PIPING SYSTEMS

Description. This section identifies process-mechanical piping systems to be provided, specifies unique requirements for each system identified, and references other sections where detailed requirements of piping components are specified. Process-Mechanical Piping Schedule included with this section identifies process-mechanical piping systems to be provided. Schedule includes application information and specifies unique system requirements.

Submittals.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications. Additionally provide:

1. Layout drawings for each process-mechanical piping system drawn to scale. Identify each piping system with same flow stream identifier as shown on Drawings.
 - a. Double-line layout for each piping system 3-inch pipe size and larger. Minimum scale of $\frac{1}{4}$ -inch = 1 foot.
 - b. Single-line or double-line layout for each piping system smaller than 3-inch pipe size. Minimum scale of $\frac{1}{4}$ -inch = 1 foot.
 - c. For each piping system include:
 - 1) Size for each pipe and fitting.
 - 2) Material, lining type, and system number for coating to be provided for each pipe and fitting.
 - 3) Pipe class, thickness or schedule for each pipe and fitting.
 - 4) Pipe end connections (joint type) and couplings.
 - 5) Location and type of supports, hangers, and expansion joints.
 - 6) Pipe couplings, saddles, sleeves, clamps, adapters, and other piping products.
 - 7) Pipe mounted equipment and instrumentation identified by tag number assigned on Drawings.
 - 8) Insulation to be provided.

Pipe and Fittings

- A. Provide pipe and fittings as shown on Drawings and as specified in sections identified in Process-Mechanical Piping Schedule presented at end of this section.

Products for Piping Support, Flexibility, Thermal Expansion, Anchorage, and Vibration Isolation

- A. Provide support system for each process-mechanical piping system in accordance with Section – Pipe Hangers, Supports, and Anchors.
- B. Provide anchors, restraints, and concrete blocks as required to resist hydraulic thrust and forces due to thermal expansion.
- C. Piping system, including support and anchorage system, shall allow for thermal expansion and contraction due to differences in operating temperature and temperature piping is exposed to during construction. Provide piping system products to allow for and control movement of piping due to thermal expansion and contraction.
- D. No attempt has been made to show all pipe supports, hangers, anchors, expansion joints, and other piping products required for piping support, thermal expansion, and anchorage. Absence of these products on Drawings does not relieve Contractor of his responsibility for providing them in accordance with these Specifications.
- E. Provide joints, couplings, and expansion joints as shown on Drawings and as required for piping flexibility and vibration isolation. No attempt has been made to show all joints, couplings, expansion joints, and other piping products required for piping flexibility and vibration isolation.

Other Piping Products

- A. Provide couplings, flanged coupling adapters, and service saddles in accordance with Section – Couplings and Service Saddles.
- B. Provide rubber expansion joints in accordance with Section – Rubber Expansion Joints.

COATINGS

- A. Coat exterior surfaces of non-insulated piping products with coating system in accordance with Section – Painting.

Preparation

- A. Use implements, tools, and facilities for handling and protection of piping products to avoid damage prior to installation.
- B. Inspect piping products before installation. Provide new or repair or recondition damaged piping products. Repair or reconditioning is subject to Engineer's approval. Patch damaged interior linings and exterior coatings or replace damaged product with new product. Patching is subject to Engineer's approval.
- C. Clean ends of piping products before installation. Remove foreign matter and dirt from inside of piping products and keep products clean until Work has been accepted.

Installation

A. Location:

1. Install piping parallel to structure lines unless shown otherwise on Drawings.
2. Do not install piping through beams, columns, or other structural members unless shown on Drawings.
3. Locate valves in piping system in accordance with manufacturer's instructions. In horizontal piping runs, do not orient valves so operating stem is below horizontal centerline.

B. Assembly:

1. Install piping without springing or forcing in manner which would cause stress in piping, valves, or connected equipment.
2. Set pipe flanges level, plumb, and aligned. Set flanged fittings so flange is true and perpendicular to pipe axis. Set flanges so bolt holes straddle vertical centerline of pipes.
3. For flanged connections, match bolt holes and obtain uniform contact over entire flange area prior to installation of flange bolts. Tighten bolts to uniformly compress gaskets and minimize flange stress. Tighten bolts to torque recommended by gasket manufacturer. Coat nuts and bolts with anti-seize thread compound.
4. Machine off raised-face of steel flange when mating with flat-faced flange.

C. Pump, Blower and Equipment Connections:

1. Align pipe, equipment, pumps, and blowers so stresses are not transmitted to connections. Support piping independently from pumps, blowers, and equipment. Do not support piping from equipment, blowers, and pumps. Anchor piping to prevent transmission of hydraulic thrust load to pumps, blowers, and equipment.
2. Install couplings, adapters, expansion joints, flanges, and unions so pumps, equipment, valves, and in-line instruments can be removed from service without disruption to other portions of piping system.
3. Install couplings, expansion joints and other vibration isolation components to isolate piping from pump, blower, and equipment vibration.
4. For welded nozzle connections, allow for shrinkage during welding to prevent excessive stresses on pumps and equipment.
5. Provide drain piping from pump and equipment drains and overflows to floor drain system.
6. Provide control lines such as air and bubbler level system piping necessary for operation of pumps, equipment, valves, and in-line instruments.

D. Install insulating flange, insulating coupling or dielectric union at each connection between ferrous and non-ferrous metal piping.

Field Quality Control

- A. Inspect installed piping products for dents, kinks, abrupt changes of curvature, damage to lining, and other damage. Repair or recondition damaged products as approved by Engineer or replace damaged products with new products.
- B. Inspect installed, unlined piping products for corrosion and scale on interior surfaces. Clean products to remove corrosion and scale or replace with new products.
- C. Test system in accordance with Section – Testing Piping Systems and as specified in Process-Mechanical Piping Schedule.

Cleaning

- A. After installation and before testing, remove dirt, rocks, debris and other foreign matter from interior of each piping system.
- B. Water flush each hydrostatically tested piping system unless specified otherwise.
 - 1. Flushing velocities of 2.5 feet per second shall be maintained until accumulated debris has been removed.
 - 2. Insert cone strainers at equipment connections prior to flushing. Remove cone strainers after flushing is complete.
 - 3. Remove accumulated debris through drains not less than 2 inches in diameter or by temporarily removing pipe spools, fittings, or valves.
 - 4. Drain piping after flushing and immediately dry piping with compressed air.
- C. Blow clean each pneumatically tested piping system with compressed air unless specified otherwise.

Process-Mechanical Piping Schedule

- A. **SERVICE** column: Presents Flow Stream Identifiers for process-mechanical piping systems shown on Process-Mechanical Drawings.
- B. **SIZE** column: Presents nominal pipe diameter(s) for each piping system shown on Process- Mechanical Drawings and continuation of piping system on Civil Drawings.
- C. **PIPE MATL** column: Identifies material type to be provided for piping system. Piping material shall conform to requirements of referenced sections:

Pipe Material	Section	Abbreviation in Piping Schedule
Cement Lined Ductile Iron Piping	DI Piping	CLDI
Unlined Ductile Iron Piping	DI Piping	ULDI

- D. **LOCATION** Column: Identifies installation location of piping system. Piping system components shall be suitable for condition specified.

- E. **MIN/MAX TEMP** column: Presents minimum and maximum operating temperature of piping system. Piping system components shall be suitable for operating temperatures shown.
- F. **MAX PRESSURE** column: Presents maximum operating pressure of piping system and type of test to be provided. Piping system components shall be suitable for maximum operating pressure shown and test pressure specified.
1. Provide hydrostatic testing in accordance with Section – Testing Piping Systems where maximum operating pressure value is followed by "-H".
 2. Test pressure for hydrostatic and high-pressure air testing shall be 1.5 times maximum operating pressure, minimum, unless specified otherwise in REMARKS column.
- G. **COLOR** column: Specifies color to be provided for piping systems.
- H. **REMARKS** column: Provides further description of piping system and specifies additional requirements.

PROCESS-MECHANICAL PIPING SCHEDULE							
Service	Size (in.)	Pipe Matl	Location	Min/Max Temp (°F)	Max Press (psig)	Color	Remarks
Pump Discharge	10, 12	CLDI	Inside Exposed, Embedded, Submerged	-20/110	30-H	Light Gray	
Pump Suction	12	CLDI	Inside Exposed, Embedded, Submerged	-20/110	30-H	Light Gray	
Vent	4	ULDI	Inside Exposed, Embedded, Outside Exposed	-20/110	N/A	Black	Vent from Discharge Chamber
Vent	4	Schedule 80 PVC	Outside Exposed	-20/110	N/A	Black	Vent from Discharge Chamber

DUCTILE IRON PIPING

Description. Detailed requirements for various ductile iron piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular ductile iron piping products to be provided under this Contract.

References.

- A. AWWA: American Water Works Association
- B. ANSI: American National Standards Institute
- C. ASTM: American Society for Testing and Materials
- D. AWS: American Welding Society

Quality Assurance. Manufacturer Qualifications: Firms experienced in manufacturing materials of types and capacities indicated that have record of successful in-service performance. Single-Source Responsibility: Obtain ductile iron piping from single supplier with responsibility for entire system.

Submittals.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications. Additionally provide:

A. Product Data:

1. Catalog cuts and product specifications for ductile iron piping specified.
2. Manufacturer's specifications, catalog cuts, and literature for the following:
 - a. Pipe.
 - b. Inside linings.
 - c. Flange joints.
 - d. Standard fittings.
 - e. Special fittings.
 - f. Wall pipe and floor pipe.

B. Shop Drawings:

1. Installation and assembly drawings and specifically prepared technical data for ductile iron piping.
2. Submit outside coating system for interior and submerged piping locations. Include submittal information in accordance with Section - Painting.
3. Submit all product data and coating system information specified above in one complete submittal.
4. Shop drawings showing layout for ductile iron piping systems shall be submitted in accordance with and transmitted under appropriate piping system Specification section.

C. Lining Reports:

1. Submit layout drawing showing location of each pipe spool and fitting identification number.
2. Submit notarized certification report for each pipe spool and fitting for approval prior to shipment.

Manufacturers

- A. American Cast Iron Pipe Company.
- B. U.S. Pipe and Foundry Company.
- C. McWane Ductile - Clow Water Systems Co.

Pipe

- A. Liquid and air service pipe: AWWA C151, ductile iron.
- B. Minimum Thickness/Pressure Class:
 1. Flanged joint pipe: Special Thickness Class 53.

Inside Lining

- A. Pipe and fittings shall be provided with inside lining as specified in Section – Process-Mechanical Piping Systems.
- B. Cement lining shall be in accordance with AWWA C104.

Joints

- A. Joint Type:
 1. Liquid and air service shall be flanged. As noted on Drawings or as specified in system Specification section if different than specified above for services and locations.
- B. Flanged Joints:
 1. Flanged pipe for liquid and air service shall be in accordance with AWWA C115.
 2. Fabrication of flanged pipe, including assembly of flange on pipe shall be performed by pipe manufacturer in accordance with AWWA C115. Assembly of flange on pipe outside of manufacturer's shop is unacceptable.
 3. Flange material for flanged pipe shall be ductile iron. Flanged pipe with gray iron flanges is not acceptable.
 4. Gasket material shall be suitable for service and maximum operating temperature of piping system as specified in Section – Process-Mechanical Piping Systems. Torque requirement of gaskets shall be less than torque rating of flange, bolt, and nuts.
 5. Gaskets shall be ring or full face, 1/8-inch thick, and conform to dimensions shown in Appendices to AWWA C110 and AWWA C115.
 6. Bolts:

- a. Size, length, and number as shown in AWWA C110 and AWWA C115.
- b. Material: Type 316 stainless steel. Provide bolt insulating sleeves to protect against dissimilar materials.
- c. Dimensions: ANSI B18.2.1, heavy hex.

7. Nuts:

- a. Size, length, and number as shown in AWWA C110 and AWWA C115.
- b. Material: Type 316 stainless steel. Provide bolt insulation sleeves for to protect against dissimilar materials.
- c. Dimensions: ANSI B18.2.2, heavy hex.

Fittings

- A. Pressure rating shall be 250 pounds per square inch, minimum.
- B. Standard fittings for liquid and air service:
 1. Flanged joint fittings:
 - a. Ductile iron.
 - b. AWWA C110.
 - c. Flange dimensions in accordance with AWWA C115.
- C. Special fittings for liquid and air service, not included in AWWA standards, shall be manufacturer's standard, based on AWWA design principles, and in compliance with applicable requirements of AWWA standards.
- D. Wall Pipe and Floor Pipe:
 1. Ductile iron.
 2. Wall thickness of body equal to or greater than wall thickness of connecting pipe.
 3. Flanges set flush with face of concrete shall be tapped for stud bolts.
 4. Collar dimensions as shown on Drawings.
 5. Collar cast integral with pipe or fabricated by welded attachment of collar to pipe.
 6. Fabricated wall pipe and floor pipe shall be as follows:
 - a. Rated for dead end thrust due to 250 pounds per square inch internal pressure.
 - b. Steel collar welded continuously around pipe on both sides of collar.
 - c. Weld in pipe manufacturer's shop by qualified welder.
 - d. Electrodes: AWS A5.15, Class ENiFe-CI or AWS 5.6, Class ECuAl-2.
- E. Miscellaneous Fittings:
 1. Provide miscellaneous fittings, such as cutting in sleeves, tapping sleeves, caps, plugs, and other fittings, as required for a complete system.
 2. Manufacturer of miscellaneous fittings shall be same manufacturer as pipe.
 3. Miscellaneous fittings shall be suitable for service.

Coatings

- A. Surface preparation, priming, and finish coating of piping shall be compatible and in accordance with Section - Painting.
- B. Finish color for interior and exterior piping shall be as specified in Section – Process-Mechanical Piping Systems.
- C. Coating for piping embedded in concrete is not required.

Installation. In accordance with Section – Process-Mechanical Piping Systems. Pipes to be cut in the field shall be gauged and within acceptable tolerances to ensure fit of connections.

Joint Assembly. Flanged joint in accordance with Section – Process-Mechanical Piping Systems, flanged pipe manufacturer's written instructions, and gasket manufacturer's written instructions.

Wall Pipe. Support by formwork to prevent contact with reinforcing steel.

Tapping. Taps for cement-lined and unlined pipe shall be in accordance with pipe manufacturer's instructions. Provide service saddles for tap sizes greater than 1-inch. Service saddles are not required for tap sizes 1-inch and smaller.

Testing. Test pipe and pipe products in accordance with Section – Testing Piping Systems.

COUPLINGS AND SERVICE SADDLES

Description. Couplings, flanged coupling adapters, and service saddles required for piping connections. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular products to be provided under this Contract.

References. ANSI: American National Standards Institute

Quality Assurance. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance. Single-Source Responsibility: Obtain couplings and service saddles from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as a unit as evidenced by records of prototype testing.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications.

Couplings

- A. Couplings for connecting plain-end steel or ductile iron pipe of same outside diameter:
 - 1. Dresser Style 38.
 - 2. Smith-Blair Product No. 411.
- B. Transition couplings for connecting plain-end steel or ductile iron pipe of different outside diameter:
 - 1. Dresser Style 162.
 - 2. Smith-Blair Product No. 413.
- C. Insulating couplings for connecting plain-end steel or ductile iron pipe and stopping flow of electrical current:
 - 1. Dresser Style 39.
 - 2. Smith-Blair Product No. 416.
- D. Pressure rating shall be greater than test pressure of piping system.
- E. Materials:
 - 1. Middle Ring and Gaskets: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.
 - 2. Followers: Ductile iron or steel.
 - 3. Bolts and Nuts: Type 316 stainless. Provide bolt insulating sleeves to protect against dissimilar materials.

Flanged Coupling Adapters

- A. Flanged coupling adapters for connecting plain-end steel or ductile iron pipe to flanged pipe, fitting, valve, instrument, or equipment item:
 - 1. Dresser Style 128.
 - 2. Smith-Blair Product No. 913.
- B. Pressure rating shall be greater than test pressure of piping system.
- C. Materials:
 - 1. Flange: Steel, faced and drilled to 150-pound class in conformance with ANSI B16.5.
 - 2. Body: Steel.
 - 3. Follower: Ductile iron or steel.
 - 4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.
 - 5. Bolts and Nuts: Type 316 stainless. Provide bolt insulating sleeves to protect against dissimilar materials.

Dismantling Joints

- A. Dismantling joint for valve, pump, meter, or other fitting installations with heavy duty joint restraint:
 - 1. Style 975, by Smith Blair, Inc.
 - 2. Or equal.
- B. Pressure and Service: Same as connected piping.
- C. Body: ASTM A53, ASTM A283 Gr C or carbon steel with a minimum yield of 30,000 psi.
- D. Follower Flange: Ductile iron per ASTM A536, Steel section per ASTM A576GR1020HR, or carbon steel having a minimum yield stress of 30,000 psi.
- E. Gasket: Recommended by the manufacturer.
- F. Bolts and Nuts: Alloy steel, corrosion-resistant, primer-coated. For submerged applications, provide stainless steel bolts complete with washers complying with ASTM F593, AISI Type 316 and nitrided stainless nuts.
- G. Type 316 stainless steel anchor studs installed in pressure-tight anchor boss for restraint. For submerged applications, provide external bolting and other hardware of Type 316 stainless steel, including tie bolts, bolt plates, lugs, nuts, and washers. Provide number of studs required to restrain test pressure and service conditions. Harness shall be as designed and recommended by manufacturer.

Service Saddles

- A. Service saddles for tapping pipe sizes shall be double strap design.
 - 1. Dresser Style 91.
 - 2. Smith-Blair Product No. 313.

B. Materials:

1. Body: Malleable iron or ductile iron.
2. Straps: Steel.
3. Nuts and Washers: Manufacturer's standard.
4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.

Anchors

- A. Provide anchors including, but not limited to, tie rods, lugs, harness assemblies, flanged spool pieces, friction collars and hardware for each coupling, and flanged coupling adapter. Anchors shall restrain pipe to prevent movement out of each coupling and flanged coupling adapter.
- B. Design each anchor to sustain force developed by test pressure of piping system.
- C. Anchor studs placed perpendicular to longitudinal axis of pipe is unacceptable.
- D. Anchorage with welded attachments to ductile iron piping is unacceptable.

Coatings. Coatings for couplings, flanged coupling adapters, and service saddles shall be same material as coatings for connected pipe.

Installation. Install couplings and service saddles in accordance with manufacturer's written instructions.

RUBBER EXPANSION JOINTS

Description. Rubber expansion joints with control units.

Quality Assurance. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance. Single-Source Responsibility: Obtain expansion joint components from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as unit as evidenced by records of prototype testing.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications.

Manufacturers

- A. General Rubber.
- B. Garlock.
- C. Mercer.

Joints

- A. Cover, body, seamless tube, and integral full-faced flanges. Standard 125-pound flange drilling. Provide 316 stainless steel hardware.
- B. Materials and construction shall be suitable for fluid service, maximum operating temperature, maximum operating pressure and test pressure of piping system.
- C. Single arch.
 - 1. Filled for wastewater, sludge and other fluids with suspended solids.
 - 2. Unfilled for air, clean water and other fluids without suspended solids.
- D. Split metal retaining rings coated in accordance with Section - Painting.
- E. Provide control unit for each expansion joint.
 - 1. Gusset plates, washers, bolts, and elastomeric bushings.
 - 2. No metal-to-metal contact to eliminate transmission of noise and vibration.
 - 3. Size control units for maximum operating pressure and test pressure of piping system.
- F. Minimum movement capability for single, unfilled arch joints:

Joint Size (inch)	Axial Compression (inch)	Axial Extension (inch)	Lateral Deflection (inch)
< 6	7/16	1/4	1/2
8 to 18	11/16	3/8	1/2
20 to 24	13/16	7/16	1/2
26 to 40	15/16	1/2	1/2
≥ 42	1-1/16	9/16	1/2

- G. Minimum movement capability for single, filled arch joints shall be at least 50 percent of movement specified above for unfilled arch joints.

Installation. Install expansion joint components in accordance with manufacturer's written instructions. Install rubber expansion joints where indicated on Drawings and elsewhere as determined by Contractor for adequate expansion compensation and vibration isolation of piping systems

VALVES

Description. Knife Gate Valves and Flap Valves. Some products specified in this Section may not be required for this Contract. Refer to piping system Specification section(s) and Drawings to determine particular products to be provided under this Contract.

Definitions.

- A. psi – pounds per square inch
- B. Deg F – Degree Fahrenheit
- C. CWP – cold working pressure

References. ANSI: American National Standards Institute

Quality Assurance. Manufacturer shall be responsible for all components identified for each valve type, accessory, and actuator specified in this Section.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications.

General

- A. All valves shall be complete with all necessary operating hand wheels, chain wheels, extension stems, worm and gear operators, operating nuts, chains, wrenches, and other accessories that are required for proper completion of Work included under this section.
- B. Valves installed in insulated piping systems shall be furnished with extended stem as required to allow operation of valve without damage to, or interference with, insulation system.
- C. Unless otherwise shown, valves shall be same size as adjoining pipe.
- D. All units shall have name of manufacturer and size of valve cast on body or bonnet or shown on permanently attached plate in raised letters.
- E. Service for all items specified herein are shown on Drawings or in Specifications. Note, this is a general specification; some types listed herein may not be part of the Work.

Knife Gate Valves w/ Handwheel Actuator

- A. Manufacturers:
 - 1. Red Valve Knife Gate Series D Flexgate
 - 2. Hilton.
- B. Wafer body, round port.
- C. Wetted parts 316 stainless steel.
- D. Flanged drilled to ANSI 125/150-pound standard.
- E. Rated 100 psi CWP.
- F. Resilient seat for drip tight shutoff.
- G. 12" Diameter Handwheel actuator, open by turning counter-clockwise.
- H. Provide 316 stainless steel hardware.

Flap Valves

- A. Flange style mount (ANSI 125#)
- B. Cast iron body and cover
- C. Bronze or Brass hinge bars.
- D. Anti-locking bar or positive stop to prevent jamming.
- E. 304 Stainless Steel pins and washers.
- F. Provide 316 stainless steel hardware.
- G. Neoprene Seat for tight sealing.
- H. Manufacturers - Subject to compliance with requirements provide flap valve of one of the following:
 - 1. Rodney Hunt
 - 2. Waterman Industries, LLC

Coatings

- A. Manufacturer is responsible for surface preparation and application of first coat (prime coat) of equipment prior to shipment. Coatings shall comply with Section - Painting.
- B. Contractor shall provide finish coats at Project Site. Finish coat products shall be manufactured by same manufacturer of first coat (prime coat).
- C. Stainless steel, bronze, and nonmetallic surfaces shall not be coated.
- D. Coat machined or bearing surfaces and holes with protective grease.

Installation

- A. Install valves in accordance with manufacturer's written recommendations and approved submittals.
- B. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Before installing flanged valves, the flanged faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseal or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints.

Field Quality Control

- A. Tests:
 - 1. Pressure test valves at same time connected piping is tested.
 - 2. Repair leaking joints.
 - 3. Protect parts of valves and actuators that could be damaged by test.

METAL FABRICATIONS

Description. Provide miscellaneous metal work shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1. Floor access hatches.
2. Miscellaneous items.

References.

- A. All reference standards shall be the latest edition.
- B. ASTM A36 - Structural Steel.
- C. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- D. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
- E. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- F. ASTM A276, Type 316L - Stainless Steel.
- G. ASTM A283 - Carbon Steel Plates, Shapes, and Bars.
- H. ASTM A325 - High Strength Bolts for Structural Steel Joints.
- I. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- J. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- K. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- L. ASTM A992 - Structural Steel Shapes.
- M. AWS A2.0 - Standard Welding Symbols.
- N. AWS D1.1 - Structural Welding Code.
- O. AISI - Standard for Stainless Steel.
- P. SSPC - Steel Structures Painting Council.
- Q. ANSI A14.3: Safety requirements for fixed ladders.
- R. Specifications for Aluminum Structures, The Aluminum Association.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications.

Quality Assurance. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society (AWS). Conform to AISC and AA standards.

Field Measurements. Verify that field measurements are as indicated on shop drawings and in accordance with manufacturers' recommendations.

Materials.

- A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, and roughness.
- B. Comply with following standards, as pertinent.
 1. Steel plates and shapes: ASTM A36 or A992.
 2. Square or rectangular tubing: ASTM A500, Grade B.
 3. Round tubing or pipe: ASTM A53, Type E or S, Grade B.

4. Stainless Steel:
 - a. Exterior and submerged uses: AISI, Type 316.
 - b. Interior uses: AISI, Type 304 or Type 316.
5. Aluminum shapes and plates: Alloy 6061-T6 or 6063-T6.
6. Connection Bolts:
 - a. For steel members: ASTM A325.
 - b. For aluminum members: Stainless steel.
7. Cast-in-place Anchor Bolts:
 - a. 1/2 in. min dia.
 - b. Nonsubmerged: ASTM A307, galvanized.
 - c. Submerged: Stainless steel.

Fabrication.

- A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
- B. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
- C. Fabricate with accurate angles and surfaces which are true to the required lines and levels, with projecting corners clipped, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.
- D. Weld shop connections and bolt or weld field connections.
- E. Use AISC standard 2-angle web connections or single plate framing connections capable of supporting min of 50% of total uniform load capacity of member.
- F. Connections shall consist of min two 3/4 in. dia bolts or welds developing min of 10,000 lbs capacity.
- G. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.
- H. Do not coat ferrous metal surfaces embedded in concrete.
- I. Galvanizing:
 - 1. Galvanize after fabrication.
 - 2. Galvanize by hot-dip process conforming to ASTM A123 and AHDGA specifications.

Finishes.

- A. Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.
- B. Shop prime structural steel members except members to be galvanized. Do not prime surfaces that will be field welded, contact surface for friction bolts, welded studs, deformed bar anchors and steel encased in concrete.
- C. Zinc used for hot-dip galvanizing coating shall conform to the Standard Specifications for Slab Zinc (Spelter) ASTM Designation B6 and shall be at least equal to the grade designated as "Prime Western". Thickness of coatings shall conform to ASTM Specifications A123, A153, and A385, as applicable for items coated.
- D. Quality of galvanizing shall be rigidly controlled, and it shall be understood that any defects as mentioned below shall be just grounds for rejection.
- E. Galvanized steel shall have no bare spots unless small and suitable for patching, pimples showing excessive contamination, flux, ash inclusions, or blisters.
- F. Where cutting existing galvanized metal Work or attaching to existing galvanized metal Work, such as by welding, the connection or bore edges shall be cold galvanized.
- G. Structural and miscellaneous metal Work shall be galvanized when located on the exterior and on the interior where so indicated and/or specified.
- H. Prime paint items in accordance with finish coat requirements.
- I. Repair all damage to field-primed surfaces.

Floor Access Hatches.

A. Prefabricated Standard Type:

1. Manufacturers:
 - a. Bilco Type K or KD.
 - b. Halliday Type S1S or S2S.
 - c. Or Approved Equal.
2. Provide access hatches and frames of material, type, and size as shown on Drawings.
3. Door leaves shall be 1/4 in. min diamond pattern plate with reinforcing on underside to withstand live load of 150 lbs/sq ft with max deflection of 1/150 span.
4. Frames shall be 1/4 in. min thick with strap anchors around perimeter.
5. Equip hatches with stainless steel hinges bolted to underside and pivot on torsion bars that counterbalance leaf for easy operation.
6. Equip hatches withhold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
7. Provide 316 stainless steel snap lock mounted on underside of leaf with removable topside handle and socket recessed in cover.
8. Hardware shall be stainless steel.
9. Factory finish on aluminum surfaces shall be mill finish with bituminous coating applied to surfaces in contact with concrete.
10. Manufacturer shall warranty in writing against defects in material and workmanship for 5 yrs.

B. Prefabricated Drainage Channel Type:

1. Manufacturers:
 - a. Bilco Type J or JD.
 - b. Halliday Type W1S or W2S.
 - c. Or Approved Equal.
2. Provide access hatches and frames of material, type, and size as shown on Drawings.
3. Door leaves shall be 1/4 in. min diamond pattern plate with reinforcing on underside to withstand live load of 300 lbs/sq ft with max deflection of 1/150 span.
4. Frames shall be 1/4 in. min thick channel to allow for adequate water drainage with anchor flange around perimeter.
5. Equip hatches with heavy stainless-steel hinges with 3/8 in. min stainless steel pins bolted to underside and pivot so cover does not protrude into channel frame.
6. Provide compression spring operators enclosed in telescoping tubes for smooth, easy and controlled door operation.
7. Equip hatches withhold-open arm with positive locking device with conveniently positioned release handle for easy and controlled closing.
8. Provide 316 stainless steel snap lock mounted on underside of leaf with removable topside handle and socket recessed in cover.
9. Provide drainage channel coupling.
10. Hardware shall be 316 stainless steel.

11. Provide continuous neoprene gasket on the frame.
12. Factory finish on aluminum surfaces shall be mill finish with bituminous coating applied to surfaces in contact with concrete.
13. Manufacturer shall warranty in writing against defects in material and workmanship for 5 yrs.

Miscellaneous Items

- A. Fabricate miscellaneous framing, supports, and items of structural shapes, plates, bars, and tubing of sizes and arrangements indicated and as required.

Examination. Verify that field conditions are acceptable and are ready to receive Work. Clean and strip primed steel items to bare metal where site welding is required. Supply items required to be cast into concrete with setting templates, to appropriate Sections.

Installation.

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Perform field welding in accordance with AWS D1.1.
- C. Obtain Engineer approval prior to site cutting or making adjustments not scheduled.
- D. Perform cutting, drilling, and fitting required for installation of metal fabrications. Set the work accurately. Provide temporary bracing and anchors in formwork for items to be built into masonry or concrete. Field weld joints not shop welded because of size limitations. Grind welds smooth and touch-up shop paint coat. Do not weld, cut or abrade surfaces that have been galvanized.
- E. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
- F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
- G. Protect aluminum in contact with dissimilar material with asphalt paint to provide 2 mil dry thickness. Paint miscellaneous metal work which is to be in contact with but not fully embedded in concrete or masonry with a heavy coat of asphalt paint. Coating shall not extend onto surfaces which will be exposed.
- H. Install hatches and manufactured items in accordance with manufacturer's instruction.
- I. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

TESTING PIPING SYSTEMS

Description. Hydrostatic pressure testing of piping systems. Systems to be tested, type of test to be performed, and test pressure shall be as specified in other sections of Specifications.

Submittals. Test report for each piping system tested. Include following:

1. Date of test.
2. Description and identification of piping system tested.
3. Type of test performed.
4. Test fluid.
5. Test pressure.
6. Type and location of leaks detected.
7. Corrective action taken to repair leaks.
8. Results of retesting.

General Testing. Test in presence of Engineer.

Contractor shall:

- Provide water for testing specified herein.
- Provide pumps and piping required to bring water to point of use.
- Provide air supply.
- Provide test pressure equipment, meters, pressure gauges, and other equipment, materials, and facilities necessary to perform specified tests.
- Provide bulkheads, flanges, valves, bracing, blocking, or other temporary sectionalizing devices that may be required.
- Remove temporary devices after testing complete.
- Perform tests on exposed piping after completely installed, including supports, hangers, and anchors.
- Perform tests on piping before insulation installed.
- Perform tests on piping that is clean and free of dirt, sand, or other foreign material.
- Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts.
- Add test fluid slowly.
- Include regulator set to avoid over-pressurizing and damaging piping.
- Perform pressure testing in accordance with local, state, and federal requirements.
- Correct leaks or defects and retest at no additional cost to Owner.

Hydrostatic Pressure Testing.

Perform hydrostatic pressure testing for piping systems identified in other sections. Test pressure shall be as specified in other sections.

Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test.

2. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to Engineer.
3. Maintain test pressure for sufficient length of time to permit Engineer to observe piping under test but not less than 2 hours.

With exception of buried piping with mechanical joints or push-on joints, piping systems shall show no visual evidence of weeping or leaking. If leakage is evident, make appropriate repairs and retest.

Maximum allowable leakage for buried piping with mechanical joints or push-on joints is as follows. If leakage is excessive, make appropriate repairs and retest.

$$L = \frac{NDP^{1/2}}{7,400}$$

Where:

L = Leakage, gallons per hr

N = Number of joints under test

D = Nominal diameter of piping, in.

P = Average pressure during test, lbs per sq in.

Tools and Appurtenances: Contractor shall furnish at his expense two (2) complete sets of all special wrenches and tools required for dismantling, maintaining or adjusting each unit. The wrenches shall be suitably mounted upon wrench boards. Tools shall be properly labeled and placed in a suitable metal box approved by the Engineer.

Equipment Guarantee: The Contractor shall furnish a warranty in which he guarantees the design and workmanship of the machinery to be as specified herein; that it will accomplish the work herein specified; that it is in accordance with the drawings and specifications accompanying the Contractor's bid, and that all work and material in said machinery is of the best and first-class in every particular. The Contractor shall further agree to replace said machinery or any part thereof shown deficient by the test herein described. If any repairs shall become necessary due to defective material or unskilled workmanship, the Contractor shall furnish all necessary materials or parts and shall make such repairs as necessary at his/her expense.

The Contractor shall furnish a written guarantee from the manufacturer. The Manufacturer shall furnish a statement of overall efficiency which he guarantees as rated capacity and rated head.

Field Tests: The Contractor shall, in the presence of the Engineer, conduct field tests on all pumping equipment. All preparations for such tests shall be made by the Contractor. The Contractor shall furnish all materials, electric meters, taps, gauges, etc., including the water. The Contractor shall submit a detailed description of the test procedure he proposes to use to the Engineer for approval.

The average head during the test should be calculated from measured elevations of the water surface in the wet well both before and after each test. The discharge elevation should be taken to be the invert of the discharge elbow.

The tests shall be conducted in order to determine if the equipment meets the warranties and guarantees as specified.

If on official field tests, the guaranteed deliveries and heads are guaranteed overall efficiencies are not obtained, the equipment shall be subject to rejection.

The term "efficiency" is hereby defined as the ratio of the useful work performed by the unit to the electrical energy input to the meters, said work being computed in like units.

The useful work performed by the units shall be based on the weight of water pumped against the total head. Total head is defined as the difference in elevation between water in the wet well and the invert of the discharge elbow.

Cost incurred for water trucked to the site as necessary and pumped into the wet pit to facilitate testing shall not be paid for separately but shall be included in the cost of SUBMERSIBLE PUMP.

KNOWN SUPPLIERS OF SUBMERSIBLE PUMPS AND RELATED EQUIPMENT.

Flygt, Xylem
Mailing Address
P.O. Box 6620
Aurora, IL 60595

Street Address
9661 194th Street
Mokena, IL 60448
Phone: 1-708 889-1560

Method of Measurement. This work will be measured for payment per each. The term "Each" shall include all furnishing and installing pumping equipment with all accessories including piping, fittings, brackets, and fasteners for two complete pumping systems and all related systems, installing the autodialer and required field testing at the Reading Pump Station.

Basis of Payment. This work will be paid for at the contract unit price per each for SUBMERSIBLE PUMP which price shall be payment in full to furnish all labor, materials and equipment to complete all permanent and temporary work and associated testing required to complete this work.

MISCELLANEOUS ELECTRICAL WORK

Description. This work shall consist of the removal and replacement of the existing lighting fixtures in the pump station electrical room and in the dry pit of the "Reading Pump Station".

CONSTRUCTION REQUIREMENTS

General. Existing lighting fixtures located in the electrical room and dry pit shall be removed and disposed of off the right of way. Existing lighting fixtures shall have no salvage value.

- a) Existing lighting fixtures shall be removed, when applicable existing wiring and conduit shall be removed and replaced.
- b) Installation of new lighting fixtures shall be according to applicable portions of Section 873 and as directed by the Engineer.

The new lighting fixtures, when practicable shall be installed as shown on the Drawings and shall be according to the following.

- Light fixtures as indicated on Drawings.

Method of Measurement. This work will be measured for payment as lump sum.

Basis of Payment. This work will be paid for at the contract lump sum for MISCELLANEOUS ELECTRICAL WORK, which price shall be payment in full to furnish all labor, materials and equipment to this work.

PUMP STATION ELECTRICAL WORK

Description. This work shall consist of installing or relocating, electrical components including, motor controls, electrical panels, safety switches, transformers, surge protection, conduit, wiring, switches, outlets, and related items located in the Electrical House and Dry Pit Area.

Refer to Section– General Electrical Requirements and Section– Pump Control Panel for further information.

Method of Measurement. This work will be measured for payment as lump sum.

Basis of Payment. This work will be paid for at the contract unit price per lump sum for PUMP STATION ELECTRICAL WORK, which price shall be payment in full to furnish all labor, materials and equipment to complete all permanent and temporary work and associated testing required to complete this work.

GENERAL ELECTRICAL REQUIREMENTS

Description.

- A. This work shall include Lift Station utility service, controls, power distribution, accessories and coordination and connection to electric utility wiring required for a complete and operational system.

- B. Work included in this section shall apply to installation and testing of all materials and equipment necessary to completely install electrical system as shown on drawings and as described herein in these specifications, or as may be necessary for a complete and operational electrical system.
- C. Drawings pertaining to this installation indicate general location of conduits, wiring, and other details necessary for installation of system.
- D. Electrical installation as shown on drawings and as specified herein is based upon best available information.
- E. Any minor changes in location of equipment, to include conduits, outlets, etc., from those shown on drawings, shall be made without extra charge if so directed by Engineer.
- F. All electrical equipment shall be installed in conformance with respective equipment manufacturer's directions, as detailed on drawings and as specified herein. Any installations which void U.L. listing (or other third-party listing) and/or manufacturer's warranty of a device or equipment shall NOT be permitted.

Laws and Ordinances

- A. In installation of this work, Contractor shall comply in every respect with requirements of, National Board of Fire Underwriters, and any state and local requirements, laws and ordinances as may be applicable.
- B. If, in opinion of the Contractor, there is anything in drawings or specifications that will not strictly comply with above laws, ordinances and rules, the matter shall be referred to the attention of the Engineer for a decision before proceeding with that part of the work. No changes on drawings or in specifications shall be made without the full consent of Engineer.
- C. Contractor shall obtain and pay for all licenses, permits and inspections required by above laws, ordinances and rules for entire electric wiring job called for in these specifications and accompanying drawings.

Drawings

- A. Drawings and specifications are intended to be descriptive only, and any error or omissions of detail in either shall not relieve Contractor from obligations thereunder to install in correct detail any and all materials necessary for complete and operating electrical systems to extent shown on drawings and described in this specification.
- B. Contractor shall, during progress of job, record any and all changes or deviations from original drawings, and, at completion of project, shall deliver to Engineer a single marked-up set of "as-built" drawings.

Service Entrance

- A. The existing service entrance to the facility shall be removed and replaced with a new service entrance at Reading and Milford Pump Stations.
- B. Contractor shall note that all "new service" or "one-time charges" that may be billed by the serving utility shall be paid for by the Contractor and included with the base bid price under this item. They will not be paid for separately.
- C. Contractor shall furnish and install the new service entrance per serving utility requirements.

TEST REPORTS. Submit test reports of entire electrical system as noted herein. Submit to the Engineer in triplicate.

ENCLOSURES.

A. NEMA 1 – Electrical Room

Enclosures shall be flat rolled, code gauge, galvanized, sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of box and front of 1 piece frame and hinged door. Arrange door to close against rabbet placed around inside edge of frame, with uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inch apart, to hold fronts to cabinets boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inch apart and not over 6 inch from top and bottom of door. For flush cabinets, make front approximately $\frac{3}{4}$ inch larger in each dimension. For surface mounted cabinets make front same height and width as box.

B. NEMA 12 – As indicated on Drawings.

Enclosures shall be NEMA 12 rated, continuous hinge, gasketed, single or double door, with white interior mounting panel. Materials of construction shall be 16 or 14-gauge steel, depending on enclosure size, with polyester powder coating. Small enclosures shall be similar to Hoffman “CHQR” Series, or equivalent. Medium size enclosures shall include 1-point latch kits or quarter turn slotted latch kits replacing conventional external screw clamps. Large size enclosures shall include 3-point latch kits. Where noted, large enclosures shall include door operated light kits. Enclosure shall include grounding device kit or other means of positively grounding door to enclosure body.

C. NEMA 4X – Outdoor and Dry Pit Locations

Enclosures shall be NEMA 4X rated, hinged, gasketed, single or double door, with easily released fast-operating clamp assemblies or quarter turn slotted latch kits replacing conventional screw clamps, white interior mounting panel and stainless-steel hinge pin. Materials of construction shall be 16 or 14-gauge (depending on size) Type 316 stainless steel. Interior mounting panel shall be steel, finish shall be white enamel. Where noted, enclosures shall include door operated light kits. Metallic enclosures shall include grounding device kit or other means of positively grounding door to enclosure body.

D. NEMA 7 – Wet Pit Locations

Enclosures shall be NEMA 7 rated suitable for Class 1, Division 2, Group D hazardous locations. Materials of construction shall be copper-free aluminum and shall be either U.L. or F.M. listed and labeled for the application. Covers for small enclosures shall be threaded construction with minimum of 5 threads fully engaged after installation. Larger enclosures shall utilize bolted covers with all bolts torqued per manufacturer’s requirements after

Conduit and Fittings

- A. Exterior above grade conduit and fittings and duct bank elbows shall be PVC Coated galvanized rigid steel and conform to Section 1088 of the Standard Specifications.

- B. Underground Power and Control, single run conduit shall be rigid nonmetallic Schedule 40 PVC conduit and conform to Section 1088 of the Standard Specifications.
- C. Interior conduit and fittings shall be galvanized rigid steel and conform to Section 1088 of the Standard Specifications

Wire

A. XHHW-2 WIRE

Unless otherwise noted on the drawings or specifications, all feeders, service conductors, motor feeders and duct bank conduit shall be type XHHW-2. Contractor should note that this applies to both direct buried cable and cable in conduit or duct.

Cable shall be 600 Volt rated, sized as indicated on the drawings. Cable shall comply with Underwriters Laboratories Standard U.L. 44 and shall pass the IEEE 383, 70,000 BTU/hr and VW-1 Flame Tests. Cables shall be rated for use at 90°C in both wet and dry locations and be suitable for use in applications listed above.

B. THHN/THWN

Unless otherwise noted on the plans or specifications, all interior power wiring installed under this project shall be dual rated type THHN/THWN.

Cable shall be 600 Volt rated, sized as indicated on the drawings. Cable shall comply with Underwriters Laboratories Standard U.L. 83. Cables shall be rated 90°C in dry locations 75°C in wet locations.

Wire Markings

- A. All wire markers installed on electrical equipment above grade shall be weatherproof and water resistant. Wire identification labeling, whether factory applied or written in the field, shall utilize an adhesive that does not soften or weaken over time. Sleeve or tubing type labels may be utilized as an alternate. Paper adhesive-backed wire markers will be rejected and replaced at the Contractor's expense. Wire marker labels shall be as manufactured by Brady, or equivalent.

Grounding

- A. Ground rods shall be UL listed, 3/4" diameter by 10' long copper-clad steel with minimum 10 mil copper coating.
- B. All buried connections of ground components shall be via exothermic weld., Erico – Cadweld, Continental Industries – Therm-O-Weld, Hagar – Ultraweld. Clamp or compression grounding connectors below grade are not acceptable.
- C. Equipment grounding conductors shall be installed. Insulation shall be 600-volt, same type as phase conductors, green in color. Use yellow tracer stripes to distinguish different grounding systems.

- D. Ground electrode conductors in contact to earth shall be bare stranded annealed copper, sized as detailed on the drawings.

Floats (Mercury Free)

- A. Float shall be capable of tripping internal switch within two inches of specified elevation. Float housings shall be stainless steel "ball" approximately 5 inches in diameter.
- B. Floats shall be U.S. Filter (Consolidated Electric Company), Model 9G-EF; Anchor Scientific, RotoFloat-SST/NM Type P; or equivalent. Unless specified or indicated otherwise on the drawings, all floats shall be normally open, with contact closing on rising water level.
- C. Where floats are noted to be installed in a Class 1, Division 2, Group D environment wet-well, each float shall additionally be furnished with an intrinsically-safe barrier to provide the necessary interface between the classified and non-classified environments. Intrinsically safe barrier shall be F.M. or another third-party listed device.

Wiring Devices

- A. Duplex receptacles with ground fault circuit interrupters (GFCI) shall be provided and installed where noted on drawings. Devices shall comply with U.L. Standard 498 and meet or exceed 2003 requirements for U.L. Standard 943 for Class A Ground Fault Circuit Interrupters. All receptacles shall be rated 20 amps with NEMA 5-20R receptacle configuration. To simplify locating the proper "reset" button after tripping, unless specifically noted on project drawings, DO NOT utilize "feed-thru" feature to protect downstream GFCI outlets. Provide self-protected GFCI receptacles at each required location. Receptacles shall be back and side wire compatible, feed-thru type (whether or not feed-thru feature is utilized on project): Leviton "SmartLock" 8899 or approved equal.
- B. Toggle switches shall be 20A, 120/277 VAC rated, back and side wired type, industrial specification grade. Switches shall be duty rated for 1 HP at 120 VAC., Leviton 1221-2, or approved equal.

Electrical Identification

- A. Nameplates and legend plates shall be engraved three-layer laminated plastic, black letters on white background. Legends (wording) shall be as detailed on drawings or as directed by Engineer.
- B. All wire markers installed on electrical equipment above grade shall be weatherproof and water resistant. Wire identification labeling, whether factory applied or written in the field, shall utilize an adhesive that does not soften or weaken over time. Sleeve or tubing type labels may be utilized as an alternate. Paper adhesive-backed wire markers will be rejected and replaced at the Contractor's expense. Wire marker labels shall be as manufactured by Brady, or equivalent.
- C. All wire markers installed below grade in manholes, handholes or vaults shall be waterproof. Markers shall be non-corroding plastic clip-on sleeve type construction. Markers shall be permanently factory-printing such that label identification will not deteriorate due to time or contact with water. Wire markers used below grade shall be Brady Clip-Sleeve, or equivalent.

Panelboards

- A. Manufacturers: Eaton/Cutler Hammer, Square-D Co., General Electric, no substitutions allowed.
- B. Panelboard Fabrication
 - a. Enclosures: Flush or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
 - b. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.
 - c. Directory Frame: Metal, mounted inside each panelboard door.
 - d. Bus: Hard drawn copper of 98% conductivity.
 - e. Main and Neutral Lugs: Compression type.
 - f. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
 - g. Service Equipment Approval: Listed for use as service equipment for panelboard with main disconnect.
 - h. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for overcurrent protective device ampere ratings indicated for future installation of devices.
 - i. Special Features: Include the following features for panelboards as indicated:
 - i. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - j. Extra Gutter Space: Dimensions and arrangement as indicated.
 - i. Subfeed: Overcurrent protective device or lug provision as indicated.
- C. Lighting and Appliance Branch Circuit Panelboards
 - a. Branch Overcurrent Protection Devices: Bolt-On circuit breakers, replaceable without disturbing adjacent units.
 - b. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, keyed alike.
- D. Distribution Panelboards
 - a. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

E. Overcurrent Protective Device

- a. Molded-Case Circuit Breakers: NEMA AB 1, handle lockable.
 - i. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
 - ii. Application Listing: Appropriate for application, including Type HACR for heating, air-conditioning, and refrigerating equipment and Class B GFCI for pipeline vessel fixed electrical heating equipment unless otherwise indicated.
 - iii. Circuit Breakers, 200A and Larger: Trip units interchangeable within frame size.
 - iv. Circuit Breakers, 400A and Larger: Field-adjustable short-time and continuous current settings.
 - v. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

Transformers

A. Manufacturers: Eaton/Cutler-Hammer, Square-D Co, General Electric, no substitutions allowed.

B. Transformers, General.

- a. Factory-assembled and –tested, air-cooled units of types specified, designed for 60Hz service.
- b. Cores: Grain-oriented, nonaging silicon steel.
- c. Coils: Continuous copper windings without splices, except for taps.
- d. Internal Coil Connections: Brazed or pressure type.
- e. Enclosure: Class complies with NEMA 250 for environment in which installed.

C. General-Purpose Distribution and Power Transformers

- a. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- b. Efficiency: Efficiency equal to or greater than that stated in NEMA TP 1, for that type and rating of transformer.
- c. Cores: 1 leg per phase.
- d. Windings: One coil per phase in primary and secondary.
- e. Enclosure: Indoor, ventilated.
- f. Insulation Class: 220°C class 115°C maximum rise above 40°C for transformers 15 kVA or smaller; 220°C class 80°C maximum rise above 40°C for transformers larger than 15 kVA.
- g. Taps: 220°C class 115°C maximum rise above 40°C for transformers 15kVA or smaller; 220°C class 80°C maximum rise above 40°C for transformers larger than 15kVA.
 - i. Taps, 3 through 15 kVA: Two 5% taps below rated high voltage.
 - ii. Taps, 15 through 500 kVA: Six 2.5% taps, 2 above and 4 below rated high voltage.

D. Finishes

- a. Indoor Units: Separate; marked "Shield" for grounding connection.

E. Source Quality Control

- a. Factory Tests: Design and routine tests comply with reference standards.

Electric Motors

- A. Manufacturers: Siemens, General Electric, Nidec – U.S. Motors, Toshiba, no substitutions allowed.

B. General:

- a. Requirements below apply to motors covered by this Section except as otherwise indicated.
- b. Motors 1/2hp and larger: polyphaser.
- c. Motors Smaller Than 1/2hp: Single-Phase.
- d. Frequency Rating: 60Hz.
- e. Voltage Rating: Determined by voltage of circuit to which motor is connected for following motor voltage ratings (utilization voltages):
 - i. 120V Circuit: 115V – motor rating.
 - ii. 208V Circuit: 200V – motor rating.
 - iii. 240V Circuit: 230V – motor rating.
 - iv. 480V Circuit: 460V – motor rating.
- f. Service factors indicated for motors are minimum values and apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10% of motor voltage rating.
- g. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100% of rated capacity.
- h. Temperature Rise: Based on 40°C ambient except as otherwise indicated.
- i. Enclosure: Totally Enclosed Fan Cooled (TEFC) unless otherwise indicated in other sections and as required by NEC.
- j. Weatherproof motors designed for outdoors and in wet areas.
- k. Windings: Copper.
- l. Winding Insulation: Class "F".

C. Polyphase Motors:

- a. Squirrel-cage induction-type conforming to the following requirements except as otherwise indicated.
- b. NEMA Design Letter Designation: "B"
- c. Bearings: Double-shielded prelubricated ball bearings suitable for radial and thrust loading for application.

- d. General purpose motors (not inverter duty/vector duty or explosionproof): NEMA Premium Energy Efficient Motors with nominal efficiency equal to or greater than that stated in NEMA MG 1 for NEMA Premium Energy Efficient Motors for that type and rating of motor.
- e. Multi-Speed Motors: Separate windings for each speed.
- f. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation.
- g. Motors for Reduced Inrush Starting: Coordinate with indicated reduced inrush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.
- h. Torque:
 - i. Breakdown torque shall be 200% or more of maximum torque load placed on motor shaft.
 - ii. Provided torque shall be 200% or more of maximum torque load placed on motor shaft.
 - iii. Supply special motors where load requirements exceed standard design.
- i. Totally Enclosed Fan Cooled (TEFC) and Totally Enclosed Non Ventilated (TENV):
 - i. Energy Efficient.
 - ii. 1.15 Service Factor, Class "F" insulation.
 - iii. Cast iron construction, frame, conduit box, end shields, fan cover, inner caps for 182T frames and larger.
 - iv. Positive lubrication system.
 - v. Removable eyebolt.
 - vi. Suitable for indoor and outdoor installations
 - vii. Diagonally split, neoprene gasketed, rotatable oversized conduit box with NPT threaded lead hole.
 - viii. Conduit box mounted, UL approved clamp type grounding lug.
 - ix. Permanently numbered non-wicking loads.
 - x. Rust inhibitive non-washing lubricant.
 - xi. Stainless steel nameplate with:
 - 1. NEMA nominal efficiency.
 - 2. AFBMA bearing numbers.
 - 3. Lubrication instructions.
- j. Submersible pump and mixer motors.
 - i. As explosionproof breather drains.
 - ii. 1.10 service factor, unless otherwise indicated in equipment specification sections.

D. Single-Phase Motors

- a. One of the following types as selected to suit starting torque and other requirements of specific motor application:

- i. Permanent Split Capacitor.
 - ii. Split-Phase Start, Capacitor-Run.
 - iii. Capacitor-Start, Capacitor-Run.
- b. Shaded-Pole Motors: Use only for motors smaller than 1/20hp.
- c. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens power supply circuit to the motor, or control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to temperature rating of motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
- d. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single-phase motors.
- E. Source Quality Control
- a. Testing:
 - i. Perform on belt-connect motors and other motors with radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single-phase motors. Test shall be standard NEMA routing production test in accordance with NEMA MG 1.

External Surge Protection Device

- A. Manufacturers: Current Technology, ASCO, no substitutions allowed.
- B. Surge suppressor shall have UL 1449 listed suppression ratings for each mode of protection, as follows:
 - a. 480/277 volt, 3 phase "WYE" – 800 volts.
 - b. 120/208 volt, 3 phase "WYE" – 400 volts.
 - c. 480 volt 3 phase "Delta" – 1500 volts.
- C. Provide protection in all modes. Ten modes for "WYE" systems, L-L, L-N, L-G and N-G, and six modes for "Delta" systems, L-L and L-G. (See NEMA 2.2.7 & IEEE Std. 1100-1992).
- D. Include a predetermined number of Selenium cells in parallel with arrays of non-linear voltage dependent metal oxide varistors to protect against system voltage swells.
- E. The Catastrophic Protection System shall provide temporary over voltage and voltage swell protection to the following:
 - a. TOV - should be capable of surviving and continue to protect critical loads against multiple TOV events (described as 200% nominal voltage by 8 mS).
 - b. Swell- should be capable of protection against swells up to 180% nominal for 0.7 ohms load >18,000 cycles.
- F. MOV's tested per ANSI/IEEE C62.33-1982.

- G. Minimum Single Pulse Surge Current Capacity per ANSI/IEEE C62041-1991's standard 8 X 20 microsecond current waveform, shall not be less than as follows:
- a. Power Panel – without disconnect
 - i. 125,000 amps, L-N
 - ii. 125,000 amps, L-G min. amps per phase 250,000 (L-N plus L-G)
 - iii. 125,000 amps, N-G
 - iv. 125,000 amps, L-L
 - b. Lighting Panel - without disconnect
 - i. 50,000 amps, L-N
 - ii. 50,000 amps, L-G min. amps per phase 250,000 (L-N plus L-G)
 - iii. 50,000 amps, N-G
 - iv. 50,000 amps, L-L
- H. Test system for repetitive sequential ANSI/IEEE C62.41 Category C3 waveforms. Minimum repetitive strikes of 1.2 X 50 microsecond, 20 KV open circuit voltage and 8 X 20 microsecond, 10 KA short circuit current with no more than 10% degradation of clamping voltage at the specified surge current.
- I. Provide an extended range noise tracking filter system between 50kHz and 100MHz with a minimum insertion loss ratio of 50:1 or 34 db over the entire range per NEMA LS-1, 1992, Section 2.2.11. UL 1283 Listed as an Electromagnetic Interference Filter. (Standard insertion loss data obtained utilizing MIL-STD-E220A 50-ohm insertion loss methodology).
- J. Minimum continuous operating voltage of any component shall not be less than 115% of nominal operating voltage.
- K. The primary suppression path shall be Line to Neutral.
- L. All surge current devices shall incorporate low impedance plated busbars. No small gauge round wire, printed circuit boards, silicon avalanche diodes or plug-in connections are acceptable.
- M. Each individual Selenium cell, MOV and capacitor shall be fused so that the failure of any component does not affect the operation or protection of the entire unit.
- N. Provide in PVC/Fiberglass or metal enclosure NEMA rated suitable for installed location.
- O. Accessories
- a. Monitoring. One set of status monitoring lights that will provide visual indication of voltage present to the SPD. The lights shall also indicate when any value of less than 50% suppression protection is available from the SPD.
 - i. An audible alarm with battery backup, indicating lights showing loss of power or with any value less than 50% suppression protection is available, a surge counter, and two sets of Form C contacts for remote monitoring.
 - ii. Visual status of suppression protection available, shown in a percentage from 0% to 100%, indication of the number of swells (voltage > 110% of nominal), surges (voltage > 130% of peak voltage), sags (voltage < 90% of nominal), and outages (power interruptions > 1 cycle) the device has encountered.

- b. High Performance Interconnect. Dual shielded, triple insulated multi-core power conductor, UL approved.
- c. System shall be capable of communicating remotely via Modbus TCP over Ethernet and a web interface via Ethernet.

Equipment Demolition

- A. The drawings are intended to indicate the scope of work required and not to indicate every box, conduit, or wire that must be removed.
- B. Where walls, ceilings, etc., are indicated as being removed on general plans, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, wiring, systems, etc., from the removed area.
- C. Coordinate scope of work and utility service with the Engineer and all other Contractors. Schedule removal of equipment and electrical service to avoid conflicts.
- D. Prior to beginning any work, the Contractor shall field determine all existing circuits and equipment powered by these circuits in the areas of demolition.
- E. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- F. Where possible, remove abandoned wiring and raceway to source of supply. Abandoned conduits which extend to below grade shall be removed to minimum of 1'-0" below grade and capped to prevent entry of water.
- G. Remove exposed abandoned raceway. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal and patch surfaces.
- H. Disconnect abandoned outlets and toggle switches and remove devices. Remove abandoned outlets and toggle switches if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlet boxes which are not removed.
- I. Disconnect and remove abandoned panelboards and distribution equipment.
- J. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- K. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Place existing fluorescent ballasts in E.P.A. approved containers for P.C.B.'s and dispose of them in an E.P.A. approved landfill. Provide documentation that P.C.B. disposal requirements have been met.
- L. Repair adjacent construction and finishes damaged during demolition and extension work.
- M. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

Equipment Mounting

- A. Electrical Contractor shall be responsible for furnishing and setting all anchor bolts required to install Contractor's equipment.
- B. Where concrete mounting pads are required for equipment mounting or where concrete repair work is required, Electrical Contractor shall furnish all concrete and form work necessary to complete the installation.

- C. Enclosures for panelboards, switches or overcurrent devices shall not be used as junction boxes, auxiliary gutters or raceways for conductors feeding through or tapping-off to other switches or overcurrent devices, unless adequate space for this purpose is provided and the equipment is listed for this use.
- D. In order to maintain NEC ratings and classifications of cables, do not combine conduit contents or modify conduit materials of construction unless specifically directed or shown otherwise on project documents.
- E. Install Receptacles at 18" above finished floor and switches 48" above finished floor.

Installation

- A. Where metal conduit is embedded in concrete, it shall receive one coat, 8 dry mils, Coal Tar Epoxy, or equal. Include any primer coats as may be required. Apply coatings in conformance with manufacturer's directions and recommendations. At the Contractor's option, PVC coated galvanized rigid steel conduit may be used in lieu of tar coating.
- B. Conduit size and fill requirements shall comply with appropriate conduit fill tables in Annex C of NEC. It should be noted these are minimum requirements and larger conduit sizes or smaller fill requirements shall be used whenever specified or detailed on drawings.
- C. Make all joints in underground conduit watertight with approved joint compound. Temporarily plug conduit openings to exclude water, concrete or any foreign materials during construction. Clean conduit runs before pulling in conductors.
- D. Wire and cable shall be installed using accepted industry methods to prevent damage to conductors and insulation.
- E. No splices shall be permitted in conduit bodies. All splices shall be made in junction boxes, control panels and cabinets provided for that purpose as detailed or required by need.
- F. All 120V circuits shall have individual neutral conductors. 120V circuits with "shared" neutral conductor shall not be permitted.
- G. Minimum wire size shall be #12 unless otherwise noted. Where protected by 15A fuses, control wiring may be #14 AWG.
- H. All conductors shall be continuous without splices except at locations approved for the purposes of splicing.
- I. All wire sizes shall be stranded copper except where specifically approved otherwise.
- J. Inspect wiring for physical damage and proper connection.
- K. All wire and cable shall be tested for continuity and short circuits prior to energizing circuits. Verify proper phasing, adjust as required.
- L. Provide wire markers for all wires and terminations. Wire identification shall be unique to wire that is marked or to terminal that wire lands upon. Identification of a run of wire from termination to termination shall be same throughout run.
- M. Install explosion-proof conduit sealing fittings in conformance with the manufacturer's instructions. Per Article 501 Paragraph 501-5(c)(6) of the NEC, cross-sectional area for conductors installed in a conduit sealing fitting shall not exceed 25%, unless conduit sealing fitting has been specifically approved for a higher percentage of fill.
- N. Secure nameplates and legend plates to equipment using screws or adhesive.
- O. Nameplates or legend plates shall be provided for all disconnects, enclosed starters, control panels.

- P. Provide wire markers for all wires and terminations. By “all”, this is intended to include, but not be limited to, all terminations at motors, instrumentation & controls, terminal blocks and strips, etc. Wire identification shall be unique to wire that is marked or to terminal that wire lands upon. Identification of a run of wire from termination to termination shall be same throughout run.

Inspection

- A. All hardware shall be inspected for physical damage and corrected as required prior to installation. Gasketing shall be inspected for proper fit and sealing. Any defective or broken lamps, poles and hardware shall be replaced at no cost to contract.

Testing.

- A. After wires and cables are in place and connected to devices and equipment, the system shall be tested for short circuits, improper grounds, and other faults. When fault condition is present, the trouble shall be rectified, and then re-tested. Where cable is found defective or damaged, it shall be removed and replaced in entirety, do not field repair. Cost for correction shall be considered incidental to the project.
- B. Unless otherwise recommended by the manufacturer, insulation resistance testing shall meet or exceed the following on 600 Volt equipment utilizing 500 Volt resistance test instruments:

Conductors.....	50 Meg-Ohms
Motors	5 Meg-Ohms
Power Transformers	5 Meg-Ohms

- C. Contractor shall furnish all tests and shall provide all test equipment, meters, instruments, cable connections or apparatus necessary for performing tests as specified herein. All costs for testing shall be considered incidental to this item and will not be paid for separately.
- D. Examine connections to equipment for proper phase relationships. Rotate phase conductors as necessary in order to correct.
- E. All motors shall be tested for correct direction of rotation. Run tests on all motors and verify that proper overload devices have been installed. Coordinate this task with motorsupplier.
- F. All grounding electrode conductors brought in from the ground field shall be tested for satisfactory continuity and by resistance measurement between the electrical equipment ground bus and the ground field. The grounding path shall not exceed 0.010 ohms.

Panelboards Installation.

- A. Installation
 - a. Install panelboards and accessory items according to NEMA PB 1.1.
 - b. Mounting Heights: Top of trim 74 in. (1880 mm) above finished floor, unless otherwise indicated.
 - c. Mounting: Plumb and rigid without distortion box. Mount flush panelboards uniformly flush with wall finish.

- d. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installed.
- e. Install filler plates in unused spaces.
- f. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

B. Identification

- a. Identify field-installed wiring and components and provide warning signs as required.
- b. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

C. Grounding

- a. Make equipment grounding connections for panelboards.
- b. Provide ground continuity to main electrical ground bus.

D. Connections

- a. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque value is not indicated, use those specified in UL 486A.

E. Field Quality Control

- a. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder and control circuits.
- b. Make continuity tests of each circuit.
- c. Visual and Mechanical Inspection.
 - i. Check circuit breaker for proper mounting and compare nameplate data to drawings and specifications.
 - ii. Operate circuit breaker to ensure smooth operations.
 - iii. Inspect case for cracks or other defects.
- d. Balancing Loads: After substantial completion, conduct load-balancing measurements and make circuit changes as follows:
 - i. Perform measurements during period of normal working load as advised by Engineer.
 - ii. Perform load-balancing circuit changes outside normal occupancy/working schedule of facility. Make special arrangements with OWNER to avoid disrupting critical 24 hr services such as fax machines and on-line data processing, computing, transmitting and receiving equipment.
 - iii. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.

- iv. Tolerance: Difference exceeding 20% between phase loads, within panelboard, in not acceptable. Rebalance and recheck as required to meet this minimum requirement.
- e. Adjusting
 - i. Set field-adjustable pick-up and time-sensitivity ranges in accordance with Section – Electrical Power System Studies.
- f. Cleaning
 - i. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt and debris. Touch up scratches and mars of finish to match original finish.

Transformers Installation. Comply with safety requirements of IEEE C2. Arrange equipment to provide adequate spacing for access and for circulation of cooling air. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

A. Grounding

- a. Comply with NFPA 70 requirements separately derived systems for connecting to grounding electrodes and for bonding to metallic piping near transformer.

B. Field Quality Control

- a. On completion of installation, inspect components. Remove paint splatters and other spots, dirt and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

C. Adjusting

- a. After installing and cleaning, touch up scratches and mars on finish to match original finish.
- b. Adjust transformer taps and connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages, tap settings or connections, and submit with test results.

Electric Motors Installation.

- a. Field install motors in accordance with manufacturer's instructions and the following:
 - i. Direct Connected Motors: Mount securely in accurate alignment.
 - ii. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts furnished by manufacturer and tension belts in accordance with manufacturer recommendations.

b. Commissioning

- i. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with commissioning of equipment for which is part.
- ii. Report unusual conditions.
- iii. Correct deficiencies of field-installed units.

c. Alignment

- i. Installer of motor is responsible for alignment.
- ii. Check alignment of motors prior to startup.

d. Field Quality Control

- i. Inspect wire and connections for physical damage and proper connection.
- ii. Conduct insulation resistance (megger) test on each motor 25 hp and larger before energizing. Conduct test with 500 or 1,000 vdc megger. Test each phase separately and follow procedures listed below.
 1. Disconnect voltage sources, lightning arrestors, capacitors, and other potential low insulation sources from motor before connecting megger to motor.
 2. When testing phase, connect phases not under test to ground.
 3. Apply test voltage, phase to ground on each phase being tested. Record resistance reading at 30 sec and at 1 min after test voltage is applied. Divide 1 min reading by 30 sec reading to obtain dielectric absorption ratio (DAR). DAR shall be 1.25 or greater for phase to pass test.
 4. If phases have DAR of 1.25 or greater, attach tag to motor and mark tag "Insulation Resistance Test OK" and sign.
 5. If phases have DAR of less than 1.25, attach tag to motor and mark tag "Insulation Resistance Test Failed" and sign. Provide new motor and retest. Notify ENGINEER of failure and actions taken to correct.
 6. Connect equipment removed in Item 1 above.
- iii. Before energizing motor, record motor's nameplate current on record drawing line diagrams. Size motor starter overload heaters with starter manufacturer's recommendations for given motor nameplate current, service factor, and power factor correcting capacitors, is provided.
- iv. Check rotation of motor before connecting to driven equipment; before couplings are bolted or belts installed. Before motor is started to check rotation, determine that motor is lubricated. When rotation is correct, mark insulation resistance test tag "Rotation OK". Sign or initial test tag by person who checked motor rotation.
- v. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process.
- vi. In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration.

External Surge Protection Testing.

- a. Factory test before shipment:
 - i. Testing shall include, but not be limited to production-line tests, quality assurance checks, MCOV, and benchmark clamping voltage tests.
 - ii. A copy of the benchmark clamping tests for each individual SPD shall be included with each unit.

- b. Manufacturer's Field Services:
 - i. Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by the Department for minimum mandays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of the Department's personnel for plant operation. Include:
 - 1. ½ man-day for Installation and Testing Services.
 - 2. ½ man-day for Instructional Services.
 - ii. Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system-related areas other than wastewater treatment process.
 - iii. Obtain the services of a factory-authorized local service representative to provide the following tests:
 - 1. Voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line, and Neutral-to-Ground (as applicable).
 - 2. Impulse injection to verify the system suppression voltage tolerances for all suppression paths. (Note: This testing is separate from any switchgear or other systems tests. Completely disconnect the TVSS from the switchgear prior to any switchgear or other system tests including any hi pot testing.)
 - 3. Record and compare test results to factory benchmark test parameters supplied with each individual unit.
 - 4. Submit a copy of the start-up test results and the factory benchmark testing results to the Engineer and the owner for confirmation of proper system function.

External Surge Protection Installation.

- a. SPDs shall be installed on the load side of the main disconnects.
- b. SPDs shall have a dedicated circuit breaker disconnect at the connection point in the electrical distribution equipment. Low impedance (HPI) cable shall be used to connect the SPD to the electrical distribution equipment. The total cable length between the electrical distribution equipment and the SPD shall be less than 10 feet.

System Warranty

- a. The SPD system manufacturer shall warranty the entire system against defective materials and workmanship for a period of fifteen years following delivery from the manufacturer.

Method of Measurement. This work shall be measured for payment as lump sum.

Basis of Payment. This work shall be paid for at the contract lump sum price for PUMP STATION ELECTRICAL WORK which will be payment in full to furnish all labor, materials and equipment to complete this work.

PUMP STATION GENERAL WORK

Description. This work shall consist of the cleaning, preparation and painting of all existing exterior walls, interior walls and ceiling in the electrical room and dry pit. This work shall consist of the cleaning, preparation and painting of all exterior and interior equipment, pumps, valves, motors, etc. and all appurtenances. This work shall consist of the cleaning, preparation and painting of all exposed interior and exterior ferrous metal, ductile iron, or cast iron piping, regardless of factory-applied finish. The contractor shall furnish all materials, equipment, labor, and other essentials necessary to accomplish this work and all other work described herein and as directed by the Engineer.

Materials. Materials shall be according to the following:

- Paint (existing exterior walls, interior walls and ceiling in the electrical room and dry pit): This material shall be according to the Manufacturer's specifications for commercial grade exterior waterproof paint. This material shall be white in color. Material testing shall not be required for this work.
- Sand: This material shall be according to applicable portions of Article 1003 of the Standard Specifications.
- Paint (interior equipment, pumps, valves, motors, etc. and all appurtenances and exposed interior and exterior ferrous metal, ductile iron, or cast iron piping). Scheduled thickness or coverage rate is minimum as recommended by manufacturer. Manufacturer's recommendations shall be followed, but in no case shall the thickness or coverage rate be less than scheduled. Coatings shall conform to the following Schedule and coating manufacturer's recommendations.

COATING SCHEDULE

Generic Type	Application	Tnemec	Sherwin-Williams
Modified Aromatic Polyurethane - Polyamidoamine Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Submerged NP / Satin	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series 66HS @ 5 mils DFT Third Coat – Series 66HS @ 5 mils DFT	First Coat – Corothane I Mio-Zinc @ 3 mils DFT, touch-up primer prior to second coat Second Coat – DuraPlate 235 @ 5 mils DFT Third Coat – DuraPlate 235 @ 5 mils DFT
Modified Aromatic Polyurethane - Polyamidoamine Epoxy	Ferrous Metal, Cast Iron, Ductile Iron / Interior Non-Submerged / Satin	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series 66HS @ 5 mils DFT Third Coat – Series 66HS @ 5 mils DFT	First Coat – Corothane I Mio-Zinc @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Macropoxy 646 @ 5 mils DFT Third Coat – Macropoxy 646 @ 5 mils DFT
Modified Aromatic Polyurethane - Polyamidoamine Epoxy – Aliphatic Acrylic Polyurethane	Ferrous Metal, Cast Iron, Ductile Iron / Exterior Non-Submerged / Gloss	First Coat – Series 1 @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Series 66HS @ 5 mils DFT Third Coat – Series 1074 @ 3 mils DFT	First Coat – Corothane I Mio-Zinc @ 3 mils DFT, touch-up primer prior to second coat Second Coat – Macropoxy 646 @ 5 mils DFT Third Coat – Hi-Solids Polyurethane Gloss @ 3 mils DFT

CONSTRUCTION REQUIREMENTS

General. The Contractor shall be responsible for any damage caused to persons, vehicles or property. The Contractor shall provide and require all employees and authorized persons to wear personal protective equipment required for the environment to which workers and authorized persons are subjected.

Cleaning. Cleaning shall be accomplished by sand blasting all exterior/interior walls and ceiling surfaces of the concrete building. The surface preparation shall remove all rust, mill scale, foreign materials, and old paint down to bare concrete. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting or moderate scraping with a dull putty knife. After sandblasting operations, the surfaces shall be air-blasted to remove blasting residue, dust and any other foreign material prior to the application of a protective surface treatment.

After all cleaning operations have been completed, all loose abrasives, paint, and residue shall be contained, collected and removed from the jobsite and properly disposed of off the right-of-way.

Preparation. Preparation shall consist of minor concrete repairs including filling/repairing cracks, spalls and deteriorated concrete.

Method of repairs shall be approved by the Engineer prior to the Contractor beginning this work.

Ferrous metal primed in the shop shall have all rust, dust, scale, and other foreign substances removed by abrasive cleaning conforming to SSPC SP-10. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Ferrous metal not primed in the shop shall be abrasive blast cleaned in the field prior to application of primer, pretreatment, or coating. Blast cleaning shall conform to SSPC SP-10 for submerged service. Blast cleaning shall conform to SSPC SP-6 for non-submerged service. Prior to finish coating, primed areas that are damaged shall be cleaned and spot primed.

Painting: After all exterior/interior walls and ceiling surfaces have been cleaned and prepared, two (2) coats of an approved commercial grade exterior waterproof paint shall be applied to all exterior/interior walls and ceiling surfaces of the building and dry pit. The paint coatings shall be applied according to the manufacturer's specifications and as directed by the Engineer.

Paint (interior equipment, pumps, valves, motors, etc. and all appurtenances and exposed interior and exterior ferrous metal, ductile iron, or cast iron piping) per Coating Schedule and coating manufacturer's recommendations.

Basis of Payment: This work will be paid for at the contract lump sum price for PUMP STATION GENERAL WORK.

HEATING AND VENTILATION WORK

Description. This work shall consist of the removal of existing louvers when required, heaters and the installation of heating and ventilation equipment as shown on the plans for the Reading Pump Station unless otherwise noted.

Provide submittals in accordance with the SUBMITTAL REQUIREMENTS subsection.

- a) Existing heaters at the Reading Pump Station shall be removed and replaced, "No Salvage".
- b) Existing heaters at the Milford Pump Station, shall be carefully removed and delivered to the departments "Watseka Maintenance Facility located at 109 Yount Ave., Watseka IL 60970. Contact person is Duane Harwood. (815) 432-2350.

Ductwork Construction:

All ductwork shall be constructed on 304 stainless sheet metal ASTM A480. Fabricate ductwork of gauges and reinforcement complying with SMACNA Duct Construction Standards and ASHRAE handbooks for 2-In. W.C. Pressure Class. Pittsburgh lock seams and slip joints or ductmate shall be used for all rectangular ducts. Coordinate ductwork layout with lighting, suspended ceilings, piping, and structural components. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details, and notations. Ensure ductwork does not obstruct usable space or block access for servicing building and its equipment. Pitch outside air intake ductwork toward intake to allow drainage to building exterior. Coordinate duct installations with installation of accessories, dampers, equipment, controls and other associated work of ductwork system. All ductwork shall be airtight before concealment and/or before insulation is applied.

Ductwork Support Materials:

Provide 304 stainless steel fasteners, anchors, rods, straps, trim and angles for support of ductwork. Support in accordance with SMACNA. A rigid ductwork support or form of lateral bracing shall be provided at each change in ductwork directions, each end or run and elsewhere as noted on Plans to minimize ductwork sway to no more than 1/2-inch of total travel.

Rectangular Manual Balancing Dampers:

Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA Standards. Dampers greater than 10-in height shall be multi-blade type. 16-gage 304 stainless steel frame and damper blade with 20-gage blade stop. 1/2-in hex axle with molded synthetic bearings. All dampers shall be furnished with locking hand quadrant. Subject to compliance with requirements, provide dampers from one of the following manufacturers: Ruskin model MD35, or equal.

Rectangular Gravity Backdraft Dampers:

Parallel blade, counterbalanced, adjustable backdraft damper. Provide in vertical or horizontal configuration as required by installation location. 304 stainless steel frame and blade construction with vinyl blade seals. Units installed in electrical rooms shall be set for 0.05 beginning pressure relief. Subject to compliance with requirements, provide dampers from one of the following manufacturers: Greenheck model BR, or equal.

Turning Vanes:

Provide turning vanes constructed of curved blades supported with bars perpendicular to blades and set into side strips suitable for mounting in ductwork. Turning vanes installed in aluminum ductwork shall be of 304 stainless steel construction. Subject to compliance with requirements, provide turning vanes from one of the following manufacturers: Cain Mfg Co., or equal.

Flexible Connections:

Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make air tight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Subject to compliance with requirements, provide flexible connections from one of the following manufacturers: Ventfabrics, or equal.

Louvers and Blank-Off Panels:

Outdoor air intake and exhaust louvers are specified under other sections. Where ductwork indicated to be connected to louver, provide 1-1/2" x 1-1/2" x 1/4" 304 stainless steel angle frames all around the louver openings securely bolted to construction with mastic caulking compound between angle and construction. Ductwork, casings, etc., shall be riveted to the outstanding leg of angle frames.

Blank-off panels where required shall be provided under this Section of the Specifications. Panels shall be of double wall 304 stainless steel construction with interior layer of 2-in thickness of polyisocyanurate board insulation.

Duct Insulation

Insulate all supply ductwork from intake louver to electric duct heater. Insulate exhaust air as shown on Plan.

Provide rigid fiberglass external ductwork insulation meeting the requirements of ASTM C612, Type IB; HH-I-558C, Form A, Class 2, average density 6.0 pcf, maximum $k = 0.22 \text{ Btu in./hr sq ft } ^\circ\text{F}$ at 75°F. Suitable for operating temperatures to 400°F. The product shall be a rigid fibrous glass board. Subject to compliance with requirements, provide ductwork insulation from one of the following manufacturers: Knauf insulation board or equal.

Jacketing shall be aluminum foil faced vapor barrier material. An all service type aluminum foil and fiberglass yarn reinforced kraft paper. FSK type conforming to ASTM C1136 Type II. Maximum water vapor permeability, ASTM E96, 0.02 perms.

Centrifugal Inline Fans: (EF-1, SF-1)

Provide inline centrifugal ventilator in capacities scheduled. Fan housing shall be constructed of aluminum. Fasteners shall be of stainless steel construction. Fan wheel shall be backward inclined, non-overloading of aluminum construction. Drives shall be sized for a minimum of 150% of driven horsepower. Provide electronic commutation (EC) type motors to match scheduled fan load. Motors shall be permanently lubricated with heavy-duty ball bearings. Internal circuitry shall convert AC power to DC power to operate the motor. Motor shall be minimum 85% efficient at all speeds. Motor speed control shall be provided as scheduled. Provide fans with the following accessories: Inlet and discharge collars, vibration isolation kit for horizontal hanging installation, aluminum belt and motor cover. Provide insulated inline filter housing with 2-inch washable aluminum filters as scheduled. Provide side discharge as scheduled and in orientation shown on Plans. Subject to compliance with requirements, provide centrifugal inline fans from one of the following manufacturers: Greenheck, Carnes, Cook or equal.

Electric Duct Heaters: (EDH-1)

Provide coils with automatic reset thermal cutouts for primary over temperature protection and with load carrying manual reset thermal cutouts, factory wired in series with each heater stage for secondary protection. Include overcurrent cutouts and subcircuit fusing in assembly and construct with following additional construction features. Provide coils with airflow switch, SCR controller, temperature contactors, snap acting, door interlocked disconnect switch, temperature sensor, and control circuit transformer. Heat shall vary to meet discharge air temperature setpoint. Discharge setpoint shall be adjustable at panel. Coils shall be finned tubular type. Construct coils with resistance wire of 80% nickel and 20% chromium, Grade A resistance wire, precisely centered in a stainless steel tube filled with granular magnesium oxide. Stainless steel fin is to be helically wound onto the tube. Elements shall be furnished with mounting flanges, making them individually removable through the terminal box. Heater frames and terminal boxes shall be corrosion resistant steel. Terminal box shall be NEMA 1 construction and shall be provided with a hinged, latching cover. Provide coils that meet the requirements of NEC and are UL listed. Provide coils of scheduled sizes, capacities, configuration, and electrical characteristics. Subject to compliance with requirements, provide electric duct heaters from one of the following manufacturers: Indeco model TZUZ, Greenheck, or equal.

Electric Unit Heaters: (EUH-1)

Provide washdown corrosion resistant electric unit heater Unit casing shall be constructed heavy 16 gauge 304 stainless steel. Assembled with stainless steel fasteners. Provide with louvered air outlet and inlet grille to act as fan guard. Heating element shall corrosion resistant 300 stainless steel sheathed with 316 stainless steel fins. Provide units of voltages, phase, and capacities as scheduled. Fan shall be of aluminum construction with corrosion resistant coating. The fan and motor assembly shall include a totally enclosed permanently lubricated, ball bearing motor, dynamically balanced. Provide the following control devices prewired to unit: Power contactor, fan delay relay, automatic overtemperature cutout, transformer for 24-volt control circuit, integral thermostat. Provide factory wired integral NEMA 4X disconnect switch. Subject to compliance with requirements, provide electric unit heaters of one from the following manufacturers: Qmark model QWD, Ruffneck, Indeco, or Equal.

Gas Fired Unit Heaters: (GUH-1, GUH-2) – Milford Pump Station

Provide propeller type, separated combustion, low profile, gas-fired unit heater designed for 82% thermal efficiency suitable for use with natural gas. Unit casing shall be constructed of heavy gauge galvanized steel with powder coat paint finish. Unit shall be designed for suspended installation from four 3/8" threaded rod. Burner / Heat Exchanger: Burner and heat exchanger shall be constructed of 409 stainless steel. Units shall be designed to draw combustion air from outdoors completely separating the combustion process from the supply airstream. Fan shall be of aluminum construction, direct drive for propeller type units and belt driven for blower type units, dynamically and statically at factory, and provided with heavy duty fan guard. Provide the following control devices AGA listed, factory piped and prewired to unit: Spark-ignited intermittent safety pilot with electronic flame supervision, single gas valves, fan and limit safety controls, temperature high-limit switch, differential air pressure switch to verify power vent airflow, 24-volt control transformer, manual shut-off valve. Provide single point power connection by means of a terminal strip. Install gas and vent piping in accordance with this section. Provide manufacturer's standard concentric vent adapter and vent terminations for separated combustion units. Subject to compliance with requirements, provide gas unit heaters from one of the following manufacturers: Reznor, Modine, or equal.

Air Grilles

Provide grilles constructed of stainless steel as scheduled. Provide grilles that do not exceed scheduled maximum pressure drop and noise criteria ratings at scheduled airflow rate or airflow rate as shown on drawings. Provide grilles with border styles that are compatible with adjacent substrate and specifically manufactured to fit into construction openings with accurate fit and adequate support. Refer to Drawings and Specifications for types of substrate which will contain each type of grille. Provide grilles of the following face / pattern type as scheduled. Blade width and spacing shall be dictated by the model number shown in the schedules. Provide grilles with anodized, matte or white baked enamel, satin finish as scheduled. Subject to compliance with requirements, provide air grilles from one of the following manufacturers: Carnes, A-J Manufacturing Company, Titus, or equal.

Provide balancing dampers on duct take-off to diffusers, and grilles and registers.

Line-Voltage/Low Voltage On-Off Thermostats

Bi-metal actuated open contact, or bellows actuated enclosed snap-switch type. UL-listed at electrical rating comparable with application. Heat anticipation. NEMA 4X enclosure.

Gas Fired Equipment Vent Piping – Milford Pump Station:

Provide vent piping in accordance with local fuel code and local mechanical code manufacturers installation instructions. All vent piping shall be Class B type with sealed joints. Double wall construction Type B vent with aluminum liner, galvanized steel outer jacket and 1/2 in. air space. Use 20 gauge galvanized steel miscellaneous connections for unit heater to double wall vent pipe. Provide UL 441 approved components. Fabricate double wall gas vents and components with interlocking double overlay type, gas-tight joints. Joints and seams shall be sealed with 2 full turns, around pipe, of aluminum or teflon tape suitable for 550°F.

Natural Gas Piping Systems – Milford Pump Station:

Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in natural gas piping systems.

Provide above grade and building distribution piping for pressures less than 5 psi in black steel pipe ASTM A53. Pipe weight shall be schedule 40 and fittings shall be malleable iron threaded.

Provide below grade distribution piping in thermoplastic polyethylene gas pressure pipe ASTM D2513. Fittings shall be butt-weld or socket-type polyethylene fusion joints and fittings.

Provide non-lubricated, resilient seated eccentric plug valve for natural gas shutoff. Valves shall be UL listed for natural gas service. Valves shall have drip-tight shut-off up to full pressure rating of valve with pressure in either direction. Valves shall be a pressure rating of 175-psig. Valve shall have a cast iron body and plug, wrench nut operator, Buna-N plug and stem seals with secondary seal of plug metal to metal seat interface. Valves shall have a corrosion resistant bearings. Subject to compliance with requirements, provide gas valves from one of the following manufacturers: Milliken model 625 series, Key Port Figure 425, or equal. Provide gas shutoff valves at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated. Locate gas shutoff valves where easily accessible, and where they will be protected from possible injury.

Installation of gas piping shall be in accordance with applicable codes and local utility company requirements. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints. Remove cutting and threading burrs before assembling piping. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection. Install drip-legs in gas piping where indicated, and where required by code or regulation. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers. Install piping with 1" drop in 60' pipe run (0.14%) in direction of flow. Install piping parallel to other piping. All gas piping in concealed locations such as ceiling plenums shall have welded joints. All joints in underground polyethylene gas pipe must be made by qualified personnel proficient in the joining methods of ASTM D2513 thermoplastic gas pressure pipe and polyethylene fittings. Do not install polyethylene gas pipe inside buildings. Vent all interior regulators to the building exterior. Vent termination shall be located a minimum of 10'-0" away from any outside air intake and 5'-0" from any combustion exhaust outlet. Paint gas piping orange with black bands in accordance with Section - Painting after all testing is complete. Label piping all piping with plastic pipe markers. Schedule any interruptions of gas service with Owner. Install supports, anchors, and seals in accordance with Pipe Hangers, Supports, and Anchors. Connect gas piping to each gas-fired equipment item, with drip leg, pressure regulating valve (where required), and shutoff gas cock. Comply with equipment manufacturer's instructions. Test natural gas piping in accordance with ANSI B31.2 or other recognized testing procedure.

Building natural gas regulator shall be a direct sensing pressure reducing valve with internal relief valve. Valve manufacturer shall recommend valve size based on scheduled flow rates and pressures. Valve shall be suitable for inlet pressures up to 25-psig with adjustable outlet pressure range from 7 to 14-inch W.C. Valve internal relief shall be capable of preventing outlet pressure of the valve from rising greater than 7-in. w.c. above outlet pressure setpoint. Construction shall be cast iron body with threaded end connections and die cast aluminum alloy diaphragm case. The diaphragm shall be of Buna-N construction with nylon fabric insert or Nitrile (NBR). The orifice and stem shall be stainless steel or aluminum. Subject to compliance with requirements, provide building natural gas regulator valves from one of the following manufacturers: Sensus model 143 series, or equal.

Generator natural gas regulator shall be a direct acting natural gas service regulator. Provide in Manufacturer's recommended sizes for the flows and pressures indicated on drawings. Construction shall be cast iron body with threaded end connections and die cast aluminum alloy diaphragm case. The diaphragm, o-rings, and seals shall be of Buna-N construction. The orifice and stem shall be brass. Subject to compliance with requirements, provide generator natural gas regulator valves from one of the following manufacturers: Sensus model 243 series, or equal.

Install pressure regulators where indicated in accordance with manufacturer's instructions. Regulators installed indoors shall be vented to outdoors.

Liquefied petroleum (LP) Piping Systems – Reading Pump Station:

Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in LP piping systems.

Provide above grade and below grade piping in copper tubing type K ASTM B88. Piping and fittings shall have a design pressure of at least 350 psi. Provide brazed joint with brazing filler material having a melting point that exceeds 1000F. All welding and brazing of metallic piping shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX. All metallic LP-Gas piping shall be installed in accordance with ASME B31.3, Process Piping, for normal fluid service or in accordance with Section 6.11 of NFPA 58.

Paint LP piping orange with black bands in accordance with Section - Painting after all testing is complete. Label piping all piping with plastic pipe markers. Schedule any interruptions of LP service with Owner. Install supports, anchors, and seals in accordance with Pipe Hangers, Supports, and Anchors and NFPA 58. Comply with equipment manufacturer's instructions. Test LP Gas piping in accordance with ANSI B31.2 or other recognized testing procedure.

Isolation valves shall be globe valve style. Construction shall be heavy duty ductile iron with a spring loaded PTFE chevron packing. Valves shall be rated for 400 psig and a standard temperature rating of -20F to 160F. Valve shall have threaded FNPT end connections. Subject to compliance with requirements, provide LP isolation valves from one of the following manufacturers: Fishers model N301-06, or equal.

Insulated Control Dampers: (ICD)

Provide insulated control dampers in sizes shown on Plans. Dampers shall have a 0.125-in aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin gaps. Aluminum airfoil blades internally insulated with polyurethane foam and thermally broken. Plated steel axle with dual bearings. Bearings shall have acetal inner sleeve and flanged outer bearing with no metal-to-metal or metal-to-plastic contact. External (out of the airstream) blade to blade linkage. Suitable for pressures to 8-in. w.c. and velocities to 4,000-fpm with maximum AMCA leakage rate of 8 cfm/sq. ft at 4-in w.c. Subject to compliance with requirements, provide insulated control dampers from one of the following manufacturers: Greenheck model ICD-45, or equal.

Damper Actuators

Actuators shall be adequately sized for the damper size and air pressures anticipated in the system with a safety factor of two. Actuators shall have ISO9001 quality certification and be UL listed under standard 60730-1 or UL listed under standard 873. Actuators used on dampers shall be designed to directly couple and mount to a stem, shaft or ISO style-mounting pad. Actuator mounting clamps shall be a V-bolt with a toothed V-clamp creating a cold weld, positive grip effect. Single point, bolt, or single screw actuator type fastening techniques or direct-coupled actuators requiring field assembly of the universal clamp is not acceptable. Actuators shall be floating/tristate position as indicated in the sequence of operation and schedule. Actuators shall have visual position indicators and shall operate in sequence with other devices if required. Provide actuators with end switches or position feedback as indicated in the schedule. Actuators shall have an operating range of -22° to 122° F. Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation. End switches to deactivate the actuator at the end rotation or magnetic clutches are not acceptable. Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required. Dampers requiring greater torque or higher close off may be assembled with multiple low torque actuators. Dual mounted actuators using additional anti-rotation strap mechanical linkages, or special factory wiring to function are not acceptable. Actuators in a tandem pair must be "off the shelf," standard actuators ready for field wiring. All damper operators shall be oil submerged, geartrain type, inherently positive positioning. The actuators shall be mounted externally of ducts or air handling equipment wherever possible for ease of service and isolated from internal temperatures. Actuator enclosure shall be NEMA 2.

Testing, Adjusting, and Balancing for HVAC:

Submit certified test reports signed by Test and Balance Supervisor who performed TAB work. Reports shall be on NEBB forms unless other forms have been approved by the Engineer prior to the start of testing. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

Air side system balancing shall include but not be limited to the following procedures:

1. Test and adjust fan RPM to design requirements. For fans operating with pressure controlled VFDs, fan speed shall first be set to lowest output that allows design flow to most remote terminal served. Measured minimum required supply air pressure shall be identified to the Temperature Controls Contractor for establishing setpoint in the FMS.
2. Test and record motor full load amperage.
3. Check all fans for correct rotation.
4. Test and record system static pressures, suction, discharge and external at all air handling equipment.
5. Test and adjust system for design outside air and recirculated air quantities.
6. Adjust and record all main supply and return air ducts and zones to proper design CFM.
7. Test and adjust each diffuser, grille and register to within 5% of design requirements. Record data and location. Use manufacturer's rating and calculations.
8. Adjust all grilles to minimize drafts in all areas.
9. Test and record all air temperatures - supply, return, mixed, and outside air

The contractor shall include the cost of new sheaves and belts if it becomes necessary to change the drives during balancing of system. Contractor shall patch holes in ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer. Contractor shall mark equipment settings, including damper control positions, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

Basis of Payment. This work will be paid for at the lump sum price for HEATING AND VENTILATION WORK.

DRAINAGE STRUCTURE TO BE CLEANED

Description. This work shall consist of cleaning the Wet Pit of any and all debris and water at each Pump Station and disposal of removed material, debris and water off the right of way.

- a) The contractor shall provide all required equipment necessary for the cleaning. Cleaning methods and equipment shall be approved by the Engineer prior to beginning this work.

Basis of Payment. This work shall be paid for at the contract unit bid price per each for DRAINAGE STRUCTURE TO BE CLEANED which will be payment in full to furnish all labor and equipment to complete this work.

GAS UTILITY SERVICE CONNECTION- MILFORD PUMP STATION

Description. This work shall consist of connecting the natural gas service (utility meter) to the emergency generator at the Milford Pump Station.

The Contractor shall furnish and install necessary piping, connectors and fittings to connect the new generator system to the utility service.

Basis of Payment. This work will be paid for at the contract lump sum price for GAS UTILITY SERVICE CONNECTION.

ELECTRIC SERVICE CONNECTION

Description. This work will consist of furnishing and installing all materials including electrical wiring, aerial wiring, fittings, connections, conduit to connect new emergency generators to the appropriate control panel(s) in the pump stations, install new utility service at Reading Pump Station, and modify utility service at Milford Pump Station.

CONSTRUCTION REQUIREMENTS

Milford Pump Station. The contractor shall furnish all labor and materials to install necessary components to connect the new emergency generator to the appropriate transfer switch located outside of the electrical room of the pump station. This work shall also include modifying the existing utility service to accommodate the new generator (e.g. adjust guy wire location).

Reading Pump Station. The contractor shall furnish all labor and materials to install necessary components including areal wiring to connect the utility service to the meter cabinet. This work shall also include connecting the new emergency generator to the appropriate transfer switch located outside of the pump station.

Basis of Payment. This work will be paid for at the contract lump sum price for ELECTRICAL SERVICE CONNECTION.

REPLACEMENT OF SUMP PUMPS

Description. This work will consist of the removal and replacement of existing sump pumps, discharge pipe and other related items including plumbing equipment, fixtures, insulation and piping systems, including sump pumps, sump pump control panel, and associated discharge piping.

Removal. This work consists of the complete removal and disposal of existing sump pump systems and related control center, discharge piping and related equipment.

Quality Assurance.

- A. Manufacturer's Qualifications: Provide plumbing equipment, fixtures, insulation and piping from firms regularly engaged in manufacture of same types and sizes of equipment required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Plumbing Code Compliance: Comply with all applicable portions of building codes pertaining to plumbing materials, construction and installation of products.
 - 1. Illinois Department of Public Health:
 - a. Part 890: Illinois Plumbing Code.
 - 1. All local plumbing codes.
- C. Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.

Delivery, Handling, and Storage. Deliver equipment and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is made safe from such hazards. Store equipment in clean, dry location.

General

- A. Size system drain piping as shown or, if not shown, as required to properly drain piping systems, including valves and equipment.
- B. Manufacturer's equipment used as basis of design for project is name indicated in Specifications for particular type of equipment or application contained in these contract documents. If no manufacturer listed, basis of design is industry standard indicated.

Sump Pump Piping

- A. Size 3 inch or smaller.
 - 1. Polyvinyl Chloride (PVC) Pipe:
 - a. Pipe Weight: Schedule 40, ASTM D1785.
 - b. Fittings: PVC Plastic, Schedule 40, socket type, ASTM 2466.
 - c. Joints: Solvent cement joints in accordance with ASTM D2855.

Valves

- A. Ball Valves 3 inch and smaller on PVC sump pump discharge piping systems.
 - 1. Manufacturers:
 - a. Spears.
 - b. Nibco.
 - c. Or equal.
 - 2. Provide sizes as indicated on Drawings.
 - 3. PVC construction, ASTM D1784.
 - 4. Valve shall be true union type.
 - 5. Provide with socket weld joints.
 - 6. PTFE ball seats.
 - 7. O-rings shall be EPDM.
 - 8. All valve unions and nuts shall have Buttress threads.
 - 9. Rated for 150 psi at 73°F.
 - 10. Unless indicated otherwise, provide with double-stop polypropylene handle operator.
- B. Swing Check on PVC sump pump discharge piping systems.
 - 1. Manufacturers:
 - a. Spears, Quiet Check Valve
 - b. Or equal.

2. 2-inch and smaller.
3. PVC construction.
4. Spring controlled rate of close to prevent slamming.
5. True Union Socket Connection.
6. Pressure rating 150 psi when open and 75 psi when closed at 73F.

Equipment

A. Sump Pump: (SP-1, SP-2)

1. Manufacturer:
 - a. Zoeller, Model 153.
 - b. Or equal.
2. Submersible sump pump.
3. Performance: 25 gpm at 35 feet of water column head.
4. Maximum operating head of 44 feet.
5. Motor: 1/2 hp, 120 Volt/1-phase hardwire, 3450 RPM.
6. Class B motor insulation.
7. Cast iron case.
8. Stainless steel hardware.
9. Provide wiring with adequate length to reach control panel (approximately 50ft).
10. Engineered thermoplastic impeller.
11. Steel shaft.
12. Sump pump control panel: (SPCP-1)
 - a. NEMA 1 Control Panel with:
 - 1) Hand-Off-Auto toggle switch for each pump.
 - 2) Running pilot light for each pump.
 - 3) Circuit breaker and starter for each pump
 - 4) Lead pump alternation.
 - 5) High level alarm light
 - b. Off, lead on, lag on, high level float switches shipped loose to be installed in sump. Provide floats with adequate length wire to reach control panel without splice (approximately 50ft). Install at heights recommended by manufacturer.

General

- A. Install pipe hangers, supports and anchors in accordance with local plumbing code and Pipe Hangers, Supports, and Anchors.
- B. Install valves in accordance with Valve Section.
- C. Install in accordance with manufacturer's written installation instructions and with local plumbing codes. Piping installations shall achieve permanently leakproof piping systems capable of performing each indicated service without piping failure.

- D. Install each pipe run with minimum joints and couplings.
- E. Provide unions at each valve and equipment connection.
- F. Reduce sizes, where indicated, by use of reducing fittings.
- G. Align piping accurately at connections, within 1/16 inch misalignment tolerance.
- H. Plastic Pipe/Tube Joints - Comply with manufacturer's instructions and recommendations, and with applicable industry standards, ANSI/ASTM D 2235, and ANSI/ASTM F 402.
- I. Locate piping runs, except otherwise indicated, vertically and horizontally (pitched to drain), and avoid diagonal runs wherever possible.
- J. Orient horizontal runs parallel with walls, building column lines and other piping.
- K. Locate runs, as shown or described by diagrams, plans, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and equipment.
- L. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building; limit clearance to 1/2 inch where furring is shown for enclosure for concealment of piping, but allow for insulation thickness, if any
- M. Sump Pumps:
 - 1. Install in accordance with manufacturer's written installation instructions and local plumbing code.
 - 2. Provide union, check valve and isolation valve on sump pump discharge piping.
 - 3. Provide offsets and transitions as required to connect to existing discharge piping.
 - 4. After piping complete, startup shall be by Plumber.
- N. Install valves in accordance with manufacturer's written installation instructions and local plumbing code.

Basis of Payment. This work will be paid for at the contract unit bid price per each for replacement of REPLACEMENT OF SUMP PUMPS.

ELECTRICAL POWER SYSTEM STUDIES

Description.

- A. Section Includes:
 - 1. Short circuit study, protective device evaluation study, protective device coordination study, and arc flash study on entire electrical power distribution system for Reading and Milford Pump Stations.
 - 2. Portions of electrical distribution system from normal and alternate sources of power throughout distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions and maximum incident energy shall be covered in study.
- B. Contractor shall engage services of independent engineering firm for purpose of performing electric power system studies as specified.

- C. The Electrical Power System Studies shall be performed and the shop drawing shall be submitted and approved prior to submitting the shop drawings for the electrical equipment.

Quality Assurance.

A. Regulatory Requirements:

1. National Electric Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.
2. National Electric Safety Code (NESC): Components and installation shall comply with American National Standards Institute (ANSI) C2.
3. Standard for Electrical Safety in the Work Place: National Fire Protection Association (NFPA) 70E.

B. Qualifications of engineering firm.

1. Corporately and financially independent engineering organization which can function as unbiased engineering authority, professionally independent of manufacturers, suppliers and installers of equipment or systems studied as specified.
2. Study report shall be signed and sealed by Professional Engineer registered in same State as project location.
3. Engineering organization may be same as testing organization.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications. Additionally provide:

- a. Description, purpose, basis, and scope of study and single line diagram of power system.
- b. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties and commentary regarding same.
- c. Protective device time versus current color coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
- d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
- e. Tabulation of appropriate tap settings for relay units.
- f. Arc flash calculations and tabulation of incident energy level calories /square centimeter (cal/cm^2) for each equipment location and recommended personal protective equipment (PPE).

Studies.

A. Studies include following.

1. Utility Company incoming service lines.
2. Service Entrance Automatic Transfer Switch.
3. Generator
4. Power and lighting distribution panels.
5. Cable, wire, and conduit systems.

B. Studies do not include equipment as shown on Drawings indicated as future.

- C. Contractor and company performing the power system studies are responsible for gathering information on the equipment and conductors required to perform the power system studies.

Short Circuit Study.

- A. Provide complete report with printout data sheets using digital computer type program as part of study.
- B. Include utilities' short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected, and other source impedances.
- C. Calculate short circuit momentary duty values and interrupting duty values based on assumed 3-phase bolted short circuit at switch gear base medium voltage controller, switchboard, low voltage Motor Control Center (MCC), distribution panelboard, pertinent branch circuit panel, and other significant locations through system. Include short circuit tabulation of symmetrical fault currents and X/R ratios. List with respective X/R ratio each fault location, total duty on bus, and individual contribution from each connected branch.

Equipment Device Evaluation Study.

- A. Provide protective device evaluation study to determine adequacy of circuit breakers, molded case switches, automatic transfer switches, knife switches, controllers, surge arresters, busways, and fuses by tabulating and comparing short circuit ratings of these devices with calculated fault currents. Apply appropriate multiplying factors based on system X/R ratios and protective device rating standards. Notify Engineer of problem areas or inadequacies in equipment due to short circuit currents and provide suggested alternate equipment.

Equipment Device Coordination Study.

- A. Provide protective device coordination study with necessary calculations and logic decisions required to select or check selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. Objective of study to obtain optimum protective and coordination performance from these devices.
- B. Include as part of coordination study, medium and low voltage classes of equipment from utility's incoming line protective device down to and including largest rated device in 480-volt MCCs and panelboards. Include phase and ground overcurrent protection as well as settings of other adjustable protective devices.
- C. Draw time-current characteristics of specified protective devices in color on log-log paper or computer printout. Include with plots complete titles, representative one-line diagram and legends, associated Power Company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. Indicate types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing in-rush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits, and significant symmetrical and asymmetrical fault currents. Provide coordination plots for phase and ground protective devices on system basis. Provide sufficient number of separate curves to indicate coordination achieved.

- D. Provide separate selection and settings of protective devices in tabulated form listing circuit identification, Institute of Electrical and Electronics Engineers (IEEE) device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings. Tabulate recommended power fuse selection for medium voltage fuses where applied in system. Notify Engineer of discrepancies, problem areas or inadequacies and provide suggested alternate equipment ratings and/or settings.

Arc Flash Study.

- A. Provide Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70E, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE).
- B. Adjust system design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 cal/cm^2 . Provide suggested alternate equipment and settings to minimize incident energy levels.
- C. Provide incident energy level (cal/cm^2) for each equipment location and recommended PPE.
- D. Based on the results of the incident energy study provide and install a warning label (orange $<40 \text{ cal/cm}^2$) or danger label (red $> 40 \text{ cal/cm}^2$) for each piece of equipment. The label must be readable in both indoor and outdoor environments and contain the following information:
1. Arc hazard boundary (feet and inches)
 2. Working distance (feet and inches)
 3. Arc flash incident energy at the working distance (cal/cm^2)
 4. PPE category and description including the glove rating
 5. Voltage rating of the equipment
 6. Limited approach distance (feet and inches)
 7. Restricted approach distance (feet and inches)
 8. Prohibited approach distance (feet and inches)
 9. Equipment/bus name
 10. Date prepared
- E. Provide one day of arc flash safety training, travel time excluded and at jobsite or classroom designated by Owner, that contains the requirements referenced in Occupational Safety and Health Administration (OSHA) 1910.269, OSHA 1910 Subpart S and NFPA 70E. Training shall include but not be limited to the following:
1. Proper use of the system analysis data
 2. Interpretation of hazard labels
 3. Selection and utilization of personal protective equipment
 4. Safe work practices and procedures

PUMP STATION CONTROL EQUIPMENT

Description. This section covers all pump station control panels, control components and indicators. This includes Main Pump control panel, Ventilation control panel, Floats, Flood Switch, Gas detection and remote indicators.

- A. The work included in this section is the supply and installation of a pump control panel as detailed herein and as required to provide a complete and operational electrical and control system.
- B. Pump control panel is to be furnished by the pump manufacturer's representative in order to ensure single-source responsibility.
- C. Ventilation control panel is to be furnished by the ventilation contractor representative in order to ensure single-source responsibility.

Reference to Standards.

- A. ANSI/NFPA 70 - National Electrical Code.
- B. NECA - National Electrical Contractors Association.
- C. NEMA ICS 1 - General Standards for Industrial Control Systems.
- D. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
- E. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- F. U.L. 508 - Industrial Control Equipment.
- G. Illinois EPA Title 35; Subtitle C; Chapter II; Part 370 - Illinois Recommended Standards for Sewage Works.
- H. Recommended Standards for Wastewater Facilities; Great Lakes Upper Mississippi River - 10 State Standards
- I. ANSI/ISA - RP12.6 Recommended Practice - Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
- J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- K. ANSI/NEMA 250 - Enclosures for Electrical Equipment.

Delivery, Storage, and Handling. Items shall be stored in original containers, protected from the weather and construction in a warm, dry, indoor area.

Provide submittals under provisions of SUBMITTAL REQUIREMENTS subsection and Standard Specifications.

Qualifications. Pumping Control Panel shall be manufactured by a current U.L. 508 listed industrial control panel builder. If required by the Owner's representative, manufacturer shall submit a certification to a minimum experience of five (5) years in manufacture of equipment similar to that specified. Control panel does require an individualized U.L. label.

Warranty. Supplied equipment shall be warranted to be free from defects in material and workmanship for a period of one year from date of substantial completion established by the Owner.

Spare parts. Provide one box, five (5) minimum quantity, of each type and size of fuse used in the control panel for spares. Provide two (2) control relays and two (2) timer relays.

Operation of System.

A. Station Main Pumping Control Description.

Operation of the pumps will be controlled by an HOA (Hand-Off-Auto) switch located on the door of the Main Pump Control Panel (MPCP-1). With the switch, the automatic mode pump operation will be based on the activation of the four sets of float switches mounted in the wet well. The float switches shall be activated at the different water levels as shown on the drawings. Verify levels with Engineer at the time of installation. Wet well float switches are numbered 1 to 8 from lowest level to highest level. There are 2 floats for each level for control redundancy.

When the water level is rising, and float switch #1/2 (pumps stop) is activated it shall enable the pumps to run in the automatic mode of operation. When float switch #3/4 (lead pump start) is activated, it shall turn on the lead pump. If the water level falls while the pump is operating, the pump shall turn off when the water level falls below float switch #1/2.

If the water level still continues to rise and activates float switch #5/6 (lag pump start), it shall turn on the lag pump. If the water level falls while both pumps are operating, the pump both shall turn off when the water level falls below float switch #1/2.

If the water level still continues to rise and reaches and activates float switch #7/8 (high water level alarm) the high-water level alarm circuit shall be activated.

An alternating relay shall alternate Lead/Lag operation of the two pumps each time the water level drops below float switch #1 and the pumps shut off. If one pump fails for any reason, the second pump shall start automatically in its place without waiting for the next pump cycle, and an alarm circuit shall be activated

When in the "Hand" position the pump will run continuously as long as the water level is high enough to activate the pump stop float switches.

The motor protection relays "Motor High Temp" will inhibit pump operation until the motor temperature returns to safe operating temperature. Each pump motor shall have overload protection with a mechanical reset operator installed on the door.

Door mounted operators shall include; Pump Main Breakers (MP-1-CB, MP-2-CB), Pump Hand-Off-Auto Switch (MP-1-SS, MP-2-SS), Pump Overload Reset Pushbuttons (mechanical devices, not shown on schematic).

Door mounted indicators shall include; Power On Light (LT1), Pump No. 1 Running Light (LT2), Pump No. 2 Running Light (LT3), Pump No. 1 High Temp Light (LT4), Pump No. 1 Seal Fail Light (LT5), Pump No. 2 High Temp Light (LT6), Pump No. 2 Seal Fail Light (LT7), Pump Stop Float Activated Light (LT8), Lead Pump Start Float Activated Light (LT9), Lag Pump Start Float Activated Light (LT10), High Level Alarm Float Activated Light (LT11), Pump No. 1 Overload Trip Light (LT12), Pump No. 2 Overload Light (LT13), Pump No. 1 Total Run Time Meter (ETM-1), Pump No. 2 Total Run Time Meter (ETM-2).

Pump control fault signals that will prompt Auto Dialer activation; Pump No. 1 High Temp, Pump No. 2 High Temp, Pump No. 1 Seal Fail, Pump No. 2 Seal Fail, High-Level Alarm (wet pit), Dry Pit Flooded Control Power Fail, Pump Failed to Stop.

External equipment which signals will prompt Auto Dialer activation using terminal connections in the Main Pump Control Panel; Emergency Generator(EG-1):Running and Common Alarm, Automatic Transfer Switch (ATS-1): Loss of Utility Power, Surge Protection Device (SPD-1): SPD Common Alarm.

B. Station Ventilation Control Description.

The Supply Fan (SF-1) and Exhaust Fan (EF-1) will be controlled by an HOA (Hand-Off-Auto) switch located on the door of the ventilation control panel. In auto mode, both fans will be set up to run continuously at a constant speed once the IDC opens to the minimum open position. The Insulated Control Damper (IDC-1) will be set up to operate in of two positions and is set at the damper control module. Position 1 will have the damper open to a minimal point to allow some outside air to circulate into the building during periods of time when outside air is below a specified temperature. This is for the purpose of minimizing energy used for heating. The second position will have the damper open to 100% and allow maximum outside air flow into the structure. There are three conditions that will call for maximum outside air flow.

1. The Electrical Duct Heater (EDH-1) is set to maintain a temperature of 45° F. When the outside temperature is above 50°F a contact closes in Outside Thermostat (T2) signaling EDH-1 there is no need for heating.
2. The structure is occupied by maintenance personnel; when the light switch in the structure is turned on, a signal is passed the control panel to open the IDC fully.
3. An elevated level of combustible gas is detected in the structure; there is be a gas monitor installed in the structure. It will look for elevated levels of hydrocarbons and methane. When a specified level is reached a signal is passed the control panel to open the IDC fully.

When the HOA for SF-1 is in the hand position, the fan will run and the damper will receive a signal to open to position 2. However the fan will start and run regardless of damper position.

When the HOA for EF-1 is in the hand position, the fan will run at high speed regardless of damper position.

In the off position, both fans will turn off and the IDC will fully close the damper.

The thermostat (T1) will monitor temperature in dry well. When temperature drops below 35°F power will be cut to supply fan and a signal will be set to auto-dailer as a “Low Temperature-Heat Fail” alarm.

The Gas Detector (GM-1) will go through the ventilation control panel. Signal outputs for the auto dialer and outdoor beacon will be provided.

Door mounted operators shall include; Supply Fan Hand-Off-Auto Switch (SF-1-SS), Exhaust Fan Hand-Off-Auto Switch (EF-1-SS).

Door mounted indicators shall include; Supply Fan Running Light (LT1), Ventilation Fault Light (LT2), Damper Open Light (LT3), Damper Max Open Light (LT4), Exhaust Fan Running Light (L5), Gas Warning Light(L6), Gas Alarm Light (L7), Gas Monitor Failure Light(L8).

Remote indicator shall be mounted outside of the pump station structure near point of entry that will signal personnel when elevated levels of combustible gas are present. It will consist of 2 separate status lights. Safe to Enter (LT9 – Green) and Elevated Gas Level (LT10 – Red). The elevated gas level light will illuminate on gas detector warning and alarm signals.

Ventilation fault signals that will prompt Auto Dialer activation; Ventilation Fault, Low Temperature Heat Fail and Gas Alarm.

MANUFACTURERS. Pumping Control Panel shall be manufactured by a current U.L. listed U.L. 698A industrial control panel manufacturer such as Indquip Engineering, Inc or equivalent.

EQUIPMENT SPECIFICATION

A. Main Pump Control Panel:

The pump control panel enclosure shall be wall mounted, NEMA 12. Enclosure shall have 3-point latching mechanism and handle for easy release. Enclosure shall be manufactured by Hoffman, APX Enclosures, Hammond or Rittal, and shall be adequately sized to accommodate equipment furnished. Bond all panels and panel doors to ground. Hinges shall not be considered as an adequate grounding path. All hardware shall be corrosion resistant.

The proposed pump control panel shall be supplied by the pump manufacturer's representative in order to ensure single-source responsibility. The panel manufacturer shall be a current Underwriters Laboratories listed UL 698A industrial control panel builder and shall show its follow-up service procedure file number on submittals. All devices within the panel shall be UL listed and/or recognized where applicable and shall be mounted and wired in accordance with the most current edition of UL 698A and the NEC. All conduit runs entering or leaving the pump station wet well shall have explosion proof conduit seals suitable for Class I, Division 2, Group D environment. All conduits for intrinsically safe wiring shall enter the panel enclosure at the intrinsically safe section of the panel.

All conduit entries into the Pump Control Panel shall have watertight threaded hubs, U.L. listed for the respective NEMA 12 enclosure.

Include a label placed on the inside of the panel door with the name, address, phone number and emergency phone number of the service representative for the pumps and control panel.

A waterproof copy of the master "As Built" wiring diagram shall be laminated in clear plastic and permanently fasted to the inside of the panel door. Provide three hardcopies of as built drawings for every panel.

The pump control panel enclosure shall be located as shown on the drawings. Include legend plates on inner and outer door labeled "CAUTION DISCONNECT SERVICE BREAKER BEFORE SERVICING". Lettering shall be black or silver on a red background.

The power feeding the pump control panel will be:

480 Volts
3-Phase
3-Wire

B. Temperature Control Panel:

The temperature control panel enclosure shall be wall mounted, NEMA 12. Enclosure shall have 3-point latching mechanism and handle for easy release. Enclosure shall be manufactured by Hoffman, APX Enclosures, Hammond or Rittal, and shall be adequately sized to accommodate equipment furnished. Bond all panels and panel doors to ground. Hinges shall not be considered as an adequate grounding path. All hardware shall be corrosion resistant.

The proposed temperature control panel shall be supplied by the ventilation contractor representative in order to ensure single-source responsibility. The panel manufacturer shall be a current Underwriters Laboratories listed UL 508 industrial control panel builder and shall show its follow-up service procedure file number on submittals. All devices within the panel shall be UL listed and/or recognized where applicable and shall be mounted and wired in accordance with the most current edition of UL 508. All conduit runs entering or leaving the pump station wet well shall have explosion proof conduit seals suitable for Class I, Division 2, Group D environment. All conduits for intrinsically safe wiring shall enter the panel enclosure at the intrinsically safe section of the panel.

All conduit entries into the Temperature Control Panel shall have watertight threaded hubs, U.L. listed for the respective NEMA 12 enclosure.

Include a label placed on the inside of the panel door with the name, address, phone number and emergency phone number of the service representative for the pumps and control panel.

A waterproof copy of the master "As Built" wiring diagram shall be laminated in clear plastic and permanently fasted to the inside of the panel door. Provide three hardcopies of as built drawings for every panel.

The temperature control panel enclosure shall be located as shown on the drawings. Include legend plates on inner and outer door labeled "CAUTION DISCONNECT SERVICE BREAKERS BEFORE SERVICING" and "CAUTION THIS EQUIPMNENT IS POWERED BY MULTIPLE POWER SOURCES" Lettering shall be black or silver on a red background.

The external power feeding (multiple circuits) the temperature control panel will be:

120 Volts x3
1-Phase x3
3-Wire x3

Contractor shall furnish all equipment, labor, services, submittals, tools and work required to provide a complete and operational Pump Control Panel and Temperature Control Panel as shown on the drawings and specified herein.

The pump control panel and temperature control panel shall include the following described equipment (installed complete and operational) as well as that shown on the drawings and specified herein.

1. Power Distribution Blocks: Each terminal block shall be provided with a clear plexiglass cover. Terminal block shall be insulated multi-cable connector block as manufactured by NSI Polaris, Square D class 9080, Type LB, Gould-Shawmut 68000-69000 Series, or Allen-Bradley Bulletin 1492 Power Blocks sized as required for the respective conductors.

All terminal blocks shall be rated 600 volts with amperage ratings in conformance with NEC Table 310-16 using 75°C wire for the respective lug wire range.

2. Intrinsically Safe Barriers (ISB): Provide an intrinsically safe isolation barrier for each float or any instrumentation device which extends into wet well. ISB, wiring, and conduit shall be in accordance with Article 504 of the NEC.

Barriers shall be Factory Mutual Listed or U.L. listed for Class I, Division 2, Group D environment. Barriers shall be so located in control panel as to physically isolate intrinsically safe wiring from other power control cables per Instrument Society of America ISA-RP12.6. All intrinsically safe wiring shall be conductors with "intrinsically safe blue colored" insulation only. Conduit entries into the pump control panel for intrinsically safe systems shall be located at the intrinsically safe section of the panel enclosure.

Intrinsically safe barriers (switching amplifiers) shall be Pepperl & Fuchs Model WE77/EX2, or WE77/EX1, Gems Sensors Division Imo Industries Style SAFE-PAK or Diversified Electronics Model Number ISO-120-AFA.

3. Control Relays: Relays with socket shall be 4PDT with 115 VAC coil and 10 Amp contacts. The control relays shall be as manufactured by Allen-Bradley, IDEC, Omron, Potter & Brumfield, or Square D. Include matching plug-in sockets.

4. Alternating Relay: A SPDT alternating relay shall alternate each pump on each successive start command and be complete with a load selector toggle switch which will allow the alternation to be canceled and omit a disabled pump. Alternating relay shall be rated for 120VAC with 10 Amp contacts and shall be Timemark Corp. Model No. 261ST-120V, Diversified Electronics Model ARB-120-ABA, or Solid State Advanced Controls Part No. ARP41S. Include socket.
5. Time Delay Relays: Adjustable time delay relay shall be used as/if required. Time Delay Relays shall be Timemark Corp. Signaline Model 310, 330, 331, 332, or 339 as applicable, or Potter & Brumfield programmable multi-function time delay relay part number CNS-35-76, 120 VAC, 11 pin, or equivalent by Solid State Advanced Controls or Diversified Electronics. Include sockets for each relay. Provide additional time delay relays as required for alarm circuits or other sequencing functions.
6. Terminal blocks for control wiring shall be Heavy Duty 600-volt, tubular clamp style, with accessories as required, as manufactured by Buchanan, Allen-Bradley, or Cutler-Hammer, or Square D. Control panel interior wiring shall be MTW or THW sized as required per NEC minimum #14 AWG. All connections shall be checked for tightness and secured as required.
7. Pilot Lights: All pilot lights shall be "push-to-test" transformer type with LED lamps, complete with one (1) normally open and one (1) normally closed contact block. Pilot lights shall be oil tight and be "full size" (no less than 30 mm in diameter). Pilot lights shall be Allen/Bradley 800T Series, Square D Class 9001, Type K Series, or Cutler-Hammer Cat. No. 10250T221N Series. Pilot light indication shall include, but not be limited to, the following where "X" designates each pump #:
 - A. Power On; white - indicating panel is energized.
 - B. Pump # "X" Thermal Trip; amber - indicating that pump # "X" has failed as a result of a thermal trip.
 - C. Pump # "X" Seal Leak; amber - indicating that pump # "X" has a seal leak failure, (where applicable).
 - D. Pumps Stop Float; green - indicating the off-level float has been activated and the water level in the wet well has reached the "Off" setpoint elevation.
 - E. Lead Float; green - indicating the lead pump float has been activated and the water level in the wet well is at the "Lead Pump Start" setpoint elevation.
 - F. Lag Float; green - indicating the lag pump float has been activated and the water level in the wet well is at the "Lag Pump Start" setpoint elevation.
 - G. High Water Level; amber - indicating the high-water level float has been activated and the water level in the wet well is at the "High Water Level" setpoint elevation.
 - H. Legend plates shall be provided for all pilot lights. Pilot lights shall be arranged on the panel such that the user shall be able to clearly distinguish between different operation and failure modes.
8. Legend Plates: Legend plates shall be required for all Starters, circuit breakers, control panels, and disconnects. Legend plates shall be provided to identify the equipment controlled and the function of each pushbutton, indicating light, pilot light, selector switch and device. Legend plates shall be weatherproof and abrasion resistant phenolic material. Lettering shall be black on white background, unless otherwise noted.

9. Verify availability of thermal trip option and seal leak option with the respective pump manufacturer. Coordinate and furnish all additional pump protection components required by pump manufacturer for warranty purposes.
10. Pump Thermal Trip: (For motors equipped with motor winding thermostats). A thermal trip on the motor will cause immediate shutdown and activate the respective thermal trip condition pilot light and alarm light. Pump and motor thermal trip shall be wired to provide automatic reset and restarting of the pump motor. Pilot light and alarm light shall employ manual reset. Provide interposing relays as required.
11. Fusing: Provide fuse protection as indicated on the drawings and specified herein for control circuitry. Fuses shall be rated 600VAC and shall be Bussman Class J or FNQ-R series fuses, Gould-Shawmut Class J or Class R fuses, or Littlefuse Class J or Class R fuses, sized as required and/or as indicated on the drawings with fuse blocks, with box lug terminals, sized as required. Include hardware for mounting. Provide one box (5 minimum quantity) of each type and size of fuse, upon completion of the job, for use as spares.
12. Circuit breakers for 120 VAC power supplies: Single pole din rail circuit breaker shall be Allen Bradley Cat Nu.: 1492-CB1G, or equal. Amps shall be as required per load.
13. Magnetic Motor Controller:
 - A. Description: NEMA ICS 2, Class A, full voltage, non-reversing, across-the-line, unless otherwise indicated.
 - B. Control Circuit: 120 Volts; obtained from integral control power transformer, unless otherwise indicated. Include control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100% spare capacity.
 - C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
 - a. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.
 - D. Overload Relay:
 - a. Electronic solid-state type with inverse-time-current characteristic, phase loss and phase unbalance protection.
 - b. Enhanced Protection Overload Relay: Provide overload relays with NEMA Class 10 or better tripping characteristics for submersible equipment or where indicated. Select to protect motor against voltage unbalance and single phasing.
14. Pushbuttons: Pushbuttons shall be rated NEMA 4/13, watertight/oil tight, 30 mm, momentary contact normally open type or normally closed (where applicable) type with 10-amp minimum contact rating at 120VAC, Allen-Bradley 800T Series, Square D Class 9001, Type K, or Cutler-Hammer Cat. No. 10250 Series.
 - A. Manual overload reset button for all motor starters on front of control panel enclosure.

15. Selector Switch: Selector switched shall be rated NEMA 4/13, watertight/oil tight, 30 mm, 2 or 3 position maintained (as shown in schematics) contacts, normally open type or normally closed (where applicable) type with 10-amp minimum contact rating at 120VAC, Allen-Bradley 800T Series, Square D Class 9001, Type K, or Cutler-Hammer Cat. No. 10250 Series.
16. Alarm System: Provide output dry contacts to be sent to new autodialer for the following alarm conditions as listed in Operation of System – Station Main Pumping Control Description and Station Ventilation Control Description. Include all necessary control relays, terminal blocks, wiring, etc. to provide the alarms functions noted above with a spare normally open contact output for each alarm function. One general alarm contact shall go to the Alarm Dialer.
17. Grounding Bar: Provide a copper grounding bar mounted and bonded inside the panel enclosure, adequately sized to accommodate all ground conductors to or from the pump control panel.
18. Mounted Alarm Light (exterior): Alarm light shall be NEMA 4X. Stackable, surface-mounted, provide mounting lugs. Body to include mounting lugs. Aluminum mounting hood, glass globe with guard, color and style per schematic. 3/4 in. conduit hubs. 120VAC. Manufacturers: Federal Signal, RAB, Crouse Hinds or Appleton Electric Company only.
19. Alarm Dialer: The dialer shall be a solid state component capable of dialing up to 16 telephone numbers, each up to 60 digits in length. Phone numbers and Standard pulse dialing or Touch Tone® DTMF dialing are user programmable via the system's keyboard or remotely via Touch Tone telephone. Group Alarm Calls - On alarm, system shall selectively call the correct phone number according to the specific alarm(s). Detect Telephone Line Fault and indicate condition with Front Panel LED.

Physical Inputs; Digital - 32 Minimum, 4 Minimum Analog (future). Remote Channel Up to 96 Channels. Control Outputs; 4 or 8 Optional, 1 Local Alarm Relay. Destination Types; Landline Phone, Cellular Phone, Numeric Pager, Computer, Voice Mail System, Responder and Verbatim. Number of Destination Locations; 16. Programming Availability (Local / Remote); Local and Remote. Reports Alarm Conditions via Digitally Recorded Voice Messages. Battery Backup. UL 1459, 1950 compliant. Manufacturers: RACO Verbatim - No Substitute Permitted.

20. Main Breaker & Disconnect Mechanism: Main circuit breaker shall be 480 VAC rated, three pole, 150 Amps thermal-magnetic circuit breaker.
21. Control circuit shall be connected so that a power outage does not necessitate manual restart of the system.
22. Elapsed Time Meter: Factory installed on front of control panel; heavy duty with 6 – digit readout, 0.125 inch (3.2mm) 99999.9 Hours, non-resettable, UL/CSA Recognized, CE Compliant. Redington Model 722 or equal.
23. Level Switch (Flood Detect): Level switch shall be Nema 4X FM approved (remote housing) when sensing element located in classified area based RF Admittance technology, High and low level operation, repeatability: 2 mm (0.08 inch) conductive liquids, response Time: Less than one second, rated temperature: -40 to 70°C (-40 to 158°F) FM, CSA, indicating LEDs (power, sensing), Time Delay: 0-60 seconds, forward or reverse-acting, Voltage: 19-250 VAC, relay Contacts: DPDT dry contacts at 5A, 120Vac, Powder-Coated aluminum housing. Manufacturers: Drexelbrook - Point Line, Endress+Hauser minicap FTC260 or equal.

24. Current Sensing Switch; Solid-state current operated switches. Contact will close when the current level through the sensing aperture goes below the adjustable setpoint. Internal circuits are totally powered by induction from the line being monitored. Input Range: 0-6, 6-40, 40-175 Amp (Jumper selectable). Output: Normally open relay (1A @ 240Vac). Panel mount, UL Listed. Manufacturer: AcuAMP ACS200, Eaton, Veris Industries, or Approved Equal.
25. Gas Monitoring System: The gas detection system shall measure and display gas concentration. The system shall alarm when preset limits are exceeded. Relays and timers for different alarm set-point levels shall be provided as additional contacts for alarms and temperature control panel.
Combustible Sensor Requirements: Infrared (IR) Combustible Sensor shall detect 0-100% LEL of combustible gas. Sensor module shall store all calibration data so that module may be calibrated off-site and field-installed without necessity of recalibration. Complex Hydrocarbon combustible gasses to be detected include: Octane, Ethane, Ethanol, Propane and Butane.
Gas Monitor: Wall mount, 316 stainless steel enclosure suitable for location in Class I, Division 1 & 2, Groups A, B, C & D, Class II, Division 1, Groups E & F, Class III classified areas Each module shall have two (SPDT) relays with change-over contacts for verification of Warning and Alarm conditions 2 input analog sensor channels minimum per installed module (for future use). Operating Temperature range: -10° to +50°C (14° to 122°F), 115 / 230 VAC ± 15% 50/60 Hz, Shall be a large 4-digit 7-segment back lit Liquid Crystal Display and bright LED's to provide ease of reading and alarm notification. Ability to choose from LEL, LELm, PPM, % Vol, g/m³ or blank. Warning and Alarm Relay Set Points shall be customer selectable between 1-100% of the measuring range. Provide same manufacturer calibration kit for use at start-up and maintenance.
Manufacturer: MSA, General Monitors "Smart Sensor" Series, Honeywell - No Substitutes Allowed.

INSTALLATION

A. Pump Control Panel

1. Control panel shall be installed per manufacturer's recommendations as detailed on the drawings and as specified herein.
2. Conduits with intrinsically safe wiring, including float switch cables, shall terminate in the control panel at the intrinsically safe wiring section. Non-intrinsically wiring including, but not limited to, power feeder conductors from the service entrance circuit breaker, branch circuit conductors, and pump motor cables shall not enter the control panel at the intrinsically safe wiring section and shall maintain a minimum separation distance inside the control panel from the intrinsically safe conductors as required by NEC 504 and ANSI/ISA RP12.6.
3. Install explosion proof conduit seals as detailed on the drawings and in conformance with Manufacturer's requirements. Contact the respective conduit seal off manufacturer if assistance is required for direction of installing the packing fiber to form a dam and pouring the sealing compound.

TESTING

A. Pump Control Panel

Supplier shall provide services of the pump control panel manufacturer's representative for the purpose of inspection, check-out, testing, start-up, instruction of user personnel, and any other required services to provide a complete and operational system. All tests shall be conducted in the presence of the Engineer. Contractor shall provide water as/if required to test pumps under load. Contractor shall furnish 3 copies of test results to Engineer. Supplier shall also furnish 3 copies of Operation and Maintenance Manuals, for operator personnel use, to the Engineer.

Provide comprehensive start-up test plan to engineer one month prior to start-up.

Start-up procedure and tests shall include, but not be limited to, the following as well as other tests and requirements specified herein.

- a. Check float switches and corresponding circuitry for proper operation.
- b. Inspect control panel for correct terminal connections and tightness, correct and tighten as required.
- c. Operation of pumps in all modes.
- c. Verify a label is provided on the pump control panel with the name, address, phone number, and emergency phone number of the service representative.
- d. Verify proper operation of all pilot lights and alarm lights.
- e. Instruct user personnel about the operation of the control panel and components; indicating items for routine maintenance check, operation modes, failure modes, alarm conditions, etc.
- f. Conduct any additional tests as required by the manufacturer.
- g. Verify tests and requirements are met as specified in General Electrical Requirements.
- h. Verify operation of existing remote annunciator (Auto dialer) for various failure modes and that the appropriate individuals are contacted.

Basis of Payment. This work will be paid for at the contract lump sum price for PUMP STATION SCADA EQUIPMENT.

AUTOMATIC TRANSFER SWITCH

Description.

Contractor shall provide all material, equipment and labor to install an electrically operated, automatic transfer switch (ATS) at two (2) separate locations as directed by the Engineer, and in accordance with the Standard Specifications, except as herein specified. All transfer switches, control panels, and accessories shall be of the same manufacturer. Manufacturer shall have experience in manufacturing equipment of the types and capacities indicated.

An ATS shall be installed at each pump station location as a complete installation and shall include but not be limited to the following components;

- a) An outdoor mounted ATS, automatically operated with integral service entrance breaker. The ATS shall include: the number of poles, amperage, voltage, and withstand current ratings as specified herein. The ATS shall consist of an inherently double throw power transfer unit.
- b) A microprocessor controller, interconnected to provide push-button load transfer from one power source to another.
- c) An enclosure for the ATS that is suitable for service entrance. It shall provide all of the proper disconnecting, overcurrent protection, grounding and bonding required for service entrance equipment.
- d) All building penetrations and raceways necessary to complete the installation and seal around all penetrations; raceway systems shall be grouted in. Relocate and reconnect existing conduit, cabling and equipment as necessary to complete the installation.
- e) Restore the appearance of the building to the satisfaction of the Engineer and remove and properly dispose of all excess material and debris.

In addition, the complete installation at each location shall include all testing and start-up necessary to insure a fully functional system. Warranty, service and technical support shall be furnished as specified herein.

Codes and Standards.

- a) The manufacturer shall provide a completely factory assembled, wired, tested and labeled ATS.
- b) Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 1. Term "NRTL" shall be defined in OSHA Regulation 1910.7.
 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code (NEC) Article 100.
- c) The ATS and accessories shall conform to the following requirements as applicable:
 1. NFPA 70 – NEC
 2. NEC Article 702
 3. NFPA 110 Emergency and Standby Power Systems
 4. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 5. NEMA Standard ICS10 - 1993 (formerly ICS2-447) - AC Transfer Switch Equipment
 6. International Standards Organization ISO 9001
 7. UL 508 Industrial Control Equipment

8. UL 891 Suitable for use only as service equipment
9. UL 1008 Standard for Non-Automatic Transfer Switches

Submittal Requirements.

a) Product Data:

1. Submit for each ATS, connection cabinet and transformer; dimensioned plans, sections and elevations showing minimum clearances, conductor entry provisions, gutter space, installed features and devices; and a materials list.
2. Wiring diagrams (elementary or schematic) differentiating between manufacturer-installed and field-installed wiring.
3. Single-line diagrams of ATS showing connection between switch and connection cabinet.
4. Records of successful in-service performance.

b) Certified test reports of laboratory tests, field tests and observations.

c) Manufacturer's certificate of compliance to referenced standards and tested short-circuit closing and withstand ratings applicable to protective devices and current ratings used in this project, as indicated and specified herein.

d) Operation and Maintenance (O&M) Data:

1. Include features and operating sequences, automatic and manual.
2. List factory settings of breaker and relays and provide relay setting and calibration instructions.

Service and Technical Support.

a) Emergency service shall be provided from a manufacturer-maintained service center capable of providing emergency maintenance and repairs to Reading and Milford with a 4-hour maximum response time.

b) In addition, technical assistance shall be available by phone on a 24/7 basis with a knowledgeable, factory trained service technician. Technical support shall be provided as needed and at no cost during the warranty period.

c) The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years. Replacement parts shall be maintained for a minimum of 10 years.

d) For ease of maintenance and parts replacement, the switch nameplate shall include drawing numbers and part numbers for the main coil and control.

e) The ATS manufacturer shall provide the Department with three (3) copies of an operations manual for the switch with accessories as defined herein.

Warranty.

a) All equipment shall be unconditionally warranted for a minimum period of (1) one year after installation.

b) Any defects in materials or workmanship during the warranty period shall be immediately replaced in kind at no cost to the Department with new equipment of the same make and model number.

Material.

a) ATS

1. Approved ATS manufacturers: ASCO, G.E. Zenith, RussElectric or approved equal.
2. The ATS voltage system for Reading shall be as stated 277/480V, 3 phase, 4 wire, 230A. ATS shall be configured as 3 pole, solid neutral with delayed midpoint.
3. The ATS voltage system for Milford shall be as stated 277/480V, 3 phase, 4 wire, 260A. ATS shall be configured as 3 pole, solid neutral with delayed midpoint.
4. The ATS shall be electrically operated and mechanically held in both directions. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
5. The ATS shall be capable of transferring load in either direction with either or both sources energized.
6. The ATS shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
 - a. All main contacts shall be silver to silver type unless noted otherwise.
 - b. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
7. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable. Interlocked molded case circuit breakers or interlocked contactors are not acceptable.
8. The ATS normal power connection shall be provided with a thermal magnetic rated molded case circuit breaker disconnect according to Art 1068.01(e) of the Standard Specifications.
 - a. Breaker shall be by Eaton, Square-D, General Electric or Siemens.
 - b. Breaker shall be integral to ATS and service entrance rated.
 - c. Breaker shall be equipped with a through door operator that is padlock able.
9. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. WCR ATS ratings shall be as follows when used with specific circuit breakers (units - Amperes):

ATS Size	Withstand & Closing Rating MCCB*	W/CLF*
30 – 200	22,000	200,000
225 – 400	42,000	200,000
600 – 1200	65,000	200,000
1600 – 2000	85,000	200,000
2600 – 3000	100,000	200,000

*MCCB = Molded Case Circuit Breaker & *W/CLF = With current limiting fuse.

10. The ATS shall have pilot lights to indicate the source to which load is connected and which source is available, green for normal and red for emergency. The pilot lights shall be the push-to-test LED type: NEMA ICS 2, heavy-duty type.
11. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided. The minimum temperature rating of the connectors shall be 75 degrees C.

b) Microprocessor Controller with Control Interface Panel

1. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent Ethernet communications capability. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
2. The controller shall be a fully automatic transfer switch controller setup for manual operation that can be easily converted to fully automatic operation in the future.
3. The controller shall have the following features at a minimum:
 - a. Voltage sensing for each phase of normal service. Pick-up voltage adjustable from 85% to 100% nominal and drop-out voltage adjustable from 75% to 98% pick-up value. Factory set for pick-up at 90% and drop-out at 85%.
 - b. Time-delay override of normal source voltage sensing delays in transfer and engine start signals. Adjustable from 0 to 6 seconds and factory set at 1 second.
 - c. Voltage/Frequency Lockout Relay to prevent premature transfer. Voltage pick-up adjustable from 85% to 100% nominal and factory set at 90%. Pick-up frequency adjustable from 90% to 100% nominal and factory set to pick-up at 95%.
 - d. Retransfer time delay adjustable from 0 to 30 minutes and factory set at 10 minutes. Provides automatic defeat of delay upon loss of voltage or sustained undervoltage of emergency source when normal source has been restored.
 - e. Test switch to simulate normal source failure.
 - f. Transfer override switch which keeps switch connected to the emergency source regardless of condition of normal source. Pilot light indicates status.
 - g. Unassigned auxiliary contacts, 2 normally open single pole double throw contacts for each switch position rated 10 amps at 240 VAC.

Tests and Certification.

- a) The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- b) The manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- c) The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.
- d) ATS shall be tested following installation. Perform electrical tests as recommended by the manufacturer and as follows:
 - 1. Measure phase-to-phase and phase-to-ground insulation resistance levels with insulation resistance tester, including control circuits. Use test voltages and procedure recommended by manufacturer. Meet manufacturer's specified minimum resistance.
 - 2. Check for electrical continuity of circuits and for short circuits.
 - 3. Coordinate with the Department so that the ATS can be tested with new generator. Operate pump station under load for a minimum of 30 minutes.
- e) Correct deficiencies identified by tests and prepare for retest. Verify equipment meets specified requirements.
- f) Maintain written records of observations and tests. Report defective materials and workmanship, and retest corrected items.

Installation and Start-Up.

- a) Prior to installation of ATS, the Contractor shall examine the areas and conditions under which the ATS are to be installed and notify the Engineer in writing if unsatisfactory conditions exist.
- b) Tighten factory-made and field connections, including connectors and terminals, screw and bolts, according to equipment manufacturer's published torque tightening values. If said values do not exist UL 486A shall be used as a guideline.
- c) Install switch on 4" thick concrete housekeeping pad for freestanding equipment arrangements. Otherwise anchor to wall for smaller equipment arrangements. Install equipment such that no operating devices, pilot lights, switches, etc. are installed above 6'- 7" including the thickness of the concrete housekeeping pad.
- d) The ATS shall be installed as per manufacturer's written instructions. In addition, the installation shall meet the requirements of local codes, the NEC and National Electrical Contractors Association's "Standard of Installation".

- e) Once installation of the ATS is complete, the Contractor shall transfer load from its normal power source to emergency in order to verify smooth and proper operation is achieved. Contractor shall verify full load can be maintained from the emergency power source for a minimum of 30 minutes. When approved by the Engineer, the system shall be transferred back to its normal condition. Switching shall continue as needed and until the installation is approved by the Engineer.
- f) Contractor shall furnish water at no cost to the Department for the wet pit in order to test the ATS installation under full load, as required above. Instead of hauling water, testing could be scheduled to coincide with a rainfall event, if approved by the Engineer.

Basis of Payment This work will be paid for at the contract unit price each for AUTOMATIC TRANSFER SWITCH.

PACKAGED ENGINE GENERATOR SYSTEMS

Description. Manufacturer shall provide two (2) engine-driven generators as directed by the Engineer, and in accordance with the Standard Specifications, except as herein specified.

a) Design Requirements:

- 1. System Includes: Standby-rated, automatically started LP (Reading) and NG (Milford) engine coupled to ac generator unit. Engine and generator are factory-mounted and factory-aligned on structural steel skid and mounted on trailer. Subsystems and auxiliary components and equipment are as indicated.
- 2. Environmental Conditions: Engine generator system withstands following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - a. Ambient Temperature: -30 to +50 degrees Celsius.
 - b. Altitude: Sea level to 1,000 feet (300 meters).

b) Performance Requirements:

- 1. Functional Description: Switching "On-Off" switch on generator control panel to "On" position starts generator set. "Off" position of same switch initiates shutdown of unit. When unit is running, specified system or equipment failures or derangements automatically shut down unit and initiate alarms.
- 2. System Performance
 - a. Steady-State Voltage Operational Bandwidth: 1% of rated output voltage from no load to full load.
 - b. Steady-State Voltage Modulation: Less than 0.25 Hertz.
 - c. Transient Voltage Performance: Not more than 10% variation for 50% step-load increase or decrease. Voltage recovers to remain within steady-state operating band within 2 seconds.

- d. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
- e. Steady-State Frequency Stability: When system is operating at constant load within rated load, there are no random speed variations outside steady-state operational band and no regular or cyclical hunting or surging of speed.
- f. Transient Frequency Performance: Less than 3 Hz variation for 50% step-load increase or decrease. Frequency recovers to remain within steady-state operating band within 3 seconds.
- g. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5% total and 3% for single harmonics. Telephone influence factor determined according to NEMA MG1 does not exceed 50.
- h. Sustained Short-Circuit Current: For 3-phase bolted short circuit at system output terminals, system will supply minimum of 300% of rated full-load current for not less than 10 seconds and then clear fault automatically, without damage to any generator system component.
- i. Temperature Rise of Generator: Within acceptable limits for insulation systems used according to NEMA MG 1 when operating continuously at standby rating conditions. Temperature rise shall not exceed 125 degrees Celsius.
- j. Nonlinear Load Performance: System performance is not degraded from that specified in this Article by continuous operation, with load current having minimum total harmonic content of 15% root mean square (rms), and minimum single harmonic content of 10% rms.
- k. Starting Time: Maximum total time period for cold start, with ambient temperature at low end of specified range, is 10 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

Material.

- a) Approved Engine Generator Sets Manufacturer's: Cummins, MTU, Kohler Co., and Caterpillar.
- b) Ratings (Reading Pump Station):
 - 1. 3-phase, 4-wire, 277/480-volt, 60 Hz, 150 kW, 187.5 kVA.
 - 2. Motor starting kilovoltamp (KVA) of 791.0 minimum required to start and operate following load steps without exceeding 25% maximum voltage dip, 10% maximum frequency dip, and with return to steady state in less than 2 seconds. Manufacturer shall coordinate to verify nameplate data.
 - i. Step No. 1 - 30 kVA lighting load.
 - ii. Step No. 1 - 10kW Heater.
 - iii. Step No. 1 - 10kW Heater.
 - iv. Step No. 2 - 25 HP, 31 FLA loaded motor operating across-the-line at 480 volts.
 - v. Step No. 3 - 25 HP, 31 FLA loaded motor operating across-the-line at 480 volts.

c) Ratings (Milford Pump Station):

1. 3-phase, 4-wire, 277/480-volt, 60 Hz, 100 kW, 125 kVA.
2. Motor starting kilovoltamp (KVA) of 423.0 minimum required to start and operate following load steps without exceeding 30% maximum voltage dip, 15% maximum frequency dip, and with return to steady state in less than 2 seconds. Manufacturer shall coordinate to verify nameplate data.
 - i. Step No. 1 - 30 kVA lighting load.
 - iv. Step No. 2 - 25 HP, 34 FLA loaded motor operating across-the-line at 480 volts.
 - v. Step No. 3 - 25 HP, 34 FLA loaded motor operating across-the-line at 480 volts.

d) Safety Standard: Comply with American Society of Mechanical Engineers (ASME) B15.1.

e) Nameplates: Equip each major system component with conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.

f) Engine Generator Set

1. Power Output Rating: Nominal ratings as indicated, with capacity as evidenced by records of prototype testing.
2. Skid: Welded steel base securely mounted with anchored mounting bolts. Adequate strength and rigidity to maintain alignment of mounted components without dependence on concrete foundation. Free from sharp edges and corners. Lifting attachments arranged to facilitate lifting with slings without damaging components.
3. Vibration Isolation: In accordance with manufacturer's recommendations. Integral vibration isolators may be provided. When integral vibration isolators are not provided, provide 95% efficient spring type vibration isolators as manufactured by Vibration Eliminator, Mason Company, or equal. Mount isolators between steel base and floor or concrete pad.
4. Rigging Diagram: Inscribed on metal plate permanently attached to skid. Diagram indicates location and lifting capacity of each lifting attachment and location of center of gravity.

g) Engine

1. Comply with NFPA 37.
2. Fuel:
 - a. Reading - Liquefied Petroleum Gas (Propane)
 - b. Milford – Natural Gas having a heating value of approximately 1000 BTU/ft³.
3. Maximum Speeds:
 - a. Engine: 1,800 rpm.
 - b. Piston speed for 4-cycle engines: 2,250 feet per minute.

4. Lubrication System: Pressurized by positive displacement pump driven from engine crankshaft. Mount following items on engine or skid:
 - a. Filter and Strainer: Rated to remove 90% of particles 5 microns and larger while passing full flow.
 - b. Oil Cooler: Maintains lubricating oil at manufacturer's recommended optimum temperature.
 - c. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
 - d. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.

 5. Engine Fuel System: Comply with NFPA 58 – Reading
 - a. Fuel mixer
 - b. Secondary gas regulator
 - c. Gas solenoid valve
 - d. LP liquid withdrawal with integral vaporizer
 - e. Secondary gas solenoid valve
 - f. Gas filter

 6. Engine Fuel System: Comply with NFPA 54 – Milford
 - a. Natural gas carburetion.
 - b. Fuel solenoid with UL approved flexible lines; installation of this work to be provided under Section – Process-Mechanical Piping Systems
 - c. Fuel regulator.

 7. Jacket Coolant Heater: Electric immersion type, factory-installed in jacket coolant system. Unit is rated and thermostatically controlled to maintain an engine temperature of 25 degrees Celsius at low end of specified ambient temperature range.
 - a. Voltage: 120.
 - b. Watts: 1,500.

 8. Speed Governor: Adjustable isochronous type, with speed sensing.
- h) Engine Cooling System
1. Closed-loop, liquid-cooled, with radiator factory-mounted on engine generator set skid and integral engine-driven coolant pumping.
 - a. Factory-piped and -rated for specified coolant.
 - b. Fan: Driven by multiple belts from engine shaft.
 - c. Overflow fill bottle on radiator to maintain proper coolant level in radiator.

2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 100% load condition.
 3. Coolant: Solution of 50% ethylene glycol and 50% water.
 4. Temperature Control: Self-contained thermostatic control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer. Features include:
 - a. Thermostatic Elements: Interchangeable and nonadjustable.
 - b. Actuator Design: Normally-open valves to return to open position when actuator fails.
 5. Coolant Hose: Flexible assembly with nonporous rubber inside surface and aging, ultraviolet, and abrasion-resistant fabric outer covering.
 - a. Rating: 50 Pounds per Square Inch (PSI) (345 kiloPascals (kPa)) maximum working pressure with 180 degrees Fahrenheit (82 degrees Celsius) coolant, and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- i) Fuel Supply System - Reading
1. Comply with NFPA 58
 2. Liquid Withdrawal System: Furnish liquid withdrawal system with generator set.
- j) Fuel Supply System - Milford
1. Comply with NFPA 37 and NFPA 54.
 2. Fuel Piping: Furnish flexible fuel connections with generator set; installation of this work to be provided under Section – Process-Mechanical Piping Systems.
- k) Engine Exhaust System
1. Muffler: Residential-type, sized as recommended by engine manufacturer. Measured sound level, according to “DEMA Test Code for Measurement of Sound from Heavy- Duty Reciprocating Engines” at distance of 23 feet (7 meter) from exhaust discharge, is 70 dB "A" or less.
 2. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- l) Starting System
1. Description: 12-volt electric with negative ground and including following items:
 - a. Components: Size so they will not be damaged during full engine-cranking cycle with specified maximum ambient temperature.
 - b. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

- c. Battery complies with Society of Automotive Engineers (SAE) J537 and has adequate capacity within ambient temperature range specified in Part 1 to provide specified cranking cycle series at least twice without recharging.
 - d. Battery Cable: Size as recommended by generator set manufacturer for cable length required for connection to battery. Include required interconnecting conductors and connection accessories.
 - e. Battery Rack: Factory fabricated of metal with acid-resistant finish.
 - f. Battery-Charging Alternator: Factory-mounted on engine with solid-state voltage-regulation and 35-amp minimum continuous rating.
 - g. Battery Heater: Factory fabricated, thermostatically controlled, 120V, single phase.
2. Battery Charger: Current limiting, automatic equalizing and float charging-type designed for operation from 120-volt 60 Hertz supply source. Unit complies with UL 508 and includes following features:
- a. Operation: Equalizing charging rate of 10 amps is initiated automatically after battery has lost charge until adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to lower float-charging mode, and continues operating in that mode until battery is discharged again
 - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from -40 to +60 degrees Celsius to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to +10%.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
 - e. Enclosure: NEMA Class 1 cabinet.
- m) Control and Monitoring
- 1. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on common control and monitoring panel mounted on generator set. Mounting method isolates control panel from generator set vibration. The contractor shall supply all wiring between the control panel and load devices.
 - a. Generator Circuit Breaker: Low-voltage, insulated case-type. Short circuit rating shall match existing motor control center rating. Trip rating based on generator full load current. Circuit breaker shall be in accordance with Article 1068.01(e) of the Standard Specifications.
 - i. Breaker shall be by Eaton, Square-D, General Electric, or Siemens.
 - b. Current and Potential Transformers: Instrument accuracy class.
 - c. Emergency Stop Switch: Switch shall be a red "mushroom head" pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.

2. Indicating and Protective Devices, and Controls: Include following:

- a. ac Voltmeter.
- b. ac Ammeter.
- c. ac Frequency Meter.
- d. dc Voltmeter (Alternator Battery Charging).
- e. Engine Coolant Temperature Gage.
- f. Engine-Lubricating Oil Pressure Gage.
- g. Running Time Meter.
- h. Ammeter/Voltmeter Phase Selector Switch or Switches.
- i. Generator Voltage-Adjusting Rheostat.
- j. Frequency Adjusting Rheostat.
- k. Start-Stop Switch.
- l. Over speed Shutdown Device.
- m. High Coolant-Temperature Shutdown Device.
- n. Low Coolant-Level Shutdown Device.
- o. Low Oil Pressure Shutdown Device.

3. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
4. Remote Emergency Stop Switches: Flush-mounted on enclosure (quantity: 2); protect pushbutton from accidental operation.

n) Generator, Exciter, and Voltage Regulator

1. Comply with NEMA MG 1 and specified performance requirements. Temperature rise shall not exceed 125 degrees Celsius.
2. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
3. Electrical Insulation: Class H or Class F.
4. Stator Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
5. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125% of rating, and heat during operation at 100% of rated capacity.
6. Excitation uses no-slip or collector rings, or brushes, and is arranged to sustain generator output under short circuit conditions as specified.
7. Enclosure: Dripproof.
8. Instrument Transformers: Mounted within generator enclosure.
9. Voltage Regulator: Solid-state-type, separate from exciter, providing performance as specified.
 - a. Adjusting rheostat on control and monitoring panel provides +5% adjustment of output voltage operating band.

o) Outdoor Generator Set Enclosure

1. Description: Weatherproof steel housing suitable for operating temperatures as low as negative 30 degrees Celsius and shall be rated for 150 mph winds. Multiple panels are lockable and provide adequate access to components requiring maintenance. Panels are removable by one person without tools. Instruments, control, and battery system shall be mounted within enclosure.
2. Fixed Louvers: At air inlet and discharge. Louvers prevent entry of rain and snow.
3. Air Flow Through Housing: Adequate to maintain temperature rise of system components within required limits.
4. Muffler/Silencer mounted inside enclosure.
5. A minimum of two (2) GFCI receptacles mounted near access panel within enclosure.
6. Width of enclosure to be no larger than 42" and width of access doors to be no larger than 30".

p) Finishes

1. Enclosures: Polyurethane enamel over corrosion-resistant pretreatment and manufacturer's compatible standard primer.

Codes and Standards.

- a) The generator set and accessories shall conform to the following requirements as applicable:
 1. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 2. NFPA70 – National Electrical Code.
 3. NFPA110 – Emergency and Standby Power Systems.
 4. NEMA MG1 – 1998 Part 32.
 5. UL2201 – Portable Engine-Generator Assemblies.
 6. UL508A – Industrial Control Equipment
 7. International Standards Organization ISO 9001

Tests and Certifications.

- a) Include prototype testing and Project-specific equipment tests (equipment manufactured specifically for this Project).
- b) Prototype Testing: Performed on separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 1. Tests: Conform to those required for Level 1 energy converters in paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2 of NFPA 110.
 2. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been acceptably tested to demonstrate compatibility and reliability.

- c) Project-Specific Equipment Tests: Test engine generator set and other system components and accessories prior to shipment. Test items individually and assembled and connected as complete system at factory in manner equivalent to that required at Project site. Record and report test data.
1. Mechanical operation test.
 2. Ground tests.
 3. Control wiring tests.
 4. Operation test.
 5. Report test results within 10 days of completion of test.
- d) Tests: Provide services of qualified testing agency to perform tests listed below according to manufacturer's recommendations upon completion of installation of system. Use instruments bearing records of calibration within last 12 months, traceable to NIST standards, and adequate for making positive observation of test results.
1. Conduct following tests before Site Testing/Demonstration:
 - a. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of connectors.
 - b. Battery Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - c. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - d. Simulation of malfunctions to verify proper operation of local and remote protective, alarm, and monitoring devices.
 - e. Load Test: Use variable load bank capable of simulating kVA, kW and power factor of load for which unit is rated. Run unit at 25, 50 and 75% of rated capacity for 30 min each and at 100% for 1 hour. Record voltage, frequency, load current, battery-charging current, power output, oil pressure and coolant temperature during test.
 - f. Exhaust Emissions Test: Conform to applicable government test criteria.
 2. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
 3. Report test results within 10 days of completion of tests. Results shall be certified that the equipment installed meets requirements otherwise highlight area where equipment falls short or fails to meet specified requirements.
 4. Site Testing/Demonstration:
 - a. Electrically connect generator to site equipment, test, and demonstrate operation of generator. During test check phase relationship to connection, rotation of motors, and operation of site equipment. Correct deficiencies before performing demonstration.

- b. Manufacturer's representative shall inspect connection of automatic transfer switch installation prior to making electrical connections to preclude any installation and startup problems.
 - c. Demonstrate to DEPARTMENT connection of generator to site equipment and operation of generator.
- e) After completing testing and demonstration deliver to DEPARTMENT'S storage area.
- 1. Cleaning
 - a. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.
 - f) Manufacturer Qualifications: Firms experienced in manufacturing equipment of types and capacities indicated that have record of successful in-service performance.
 - 1. Emergency Service: System manufacturer maintains service center capable of providing training, parts, and emergency maintenance and repairs at Project site with 4 hours maximum response time.
 - g) Engine Exhaust Emissions and Fuel System: Comply with applicable Federal, State, and local government requirements.
 - h) Permits: Provide required air permitting and fuel system permitting required in accordance with applicable Federal, State, and local government requirements.
 - i) Single-Source Responsibility: Obtain engine generator system components from single manufacturer with responsibility for entire system. Unit shall be representative product built from components that have proven compatibility and reliability and are coordinated to operate as unit as evidenced by records of prototype testing.
 - j) Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL), where such listing or labeling is available.

Submittal Requirements.

- a) Product Data:
 - 1. Include data on features, components, ratings, and performance.
 - 2. Include dimensioned outline plan and elevation drawings of engine generator set, trailer and other system components.
- b) Test Results:
 - 1. Certified Summary of Prototype Unit Test Report: Submit certified copies of actual prototype unit test report if requested by Engineer.
 - 2. Certified Test Reports of Components and Accessories: Submit for devices that are equivalent, but not identical, to those tested on prototype unit if requested by Engineer.

3. Exhaust Emissions Test Report. Include proof of compliance with applicable requirements.
4. Certification of Torsional Vibration Compatibility: Conform to Nation Fire Protection Association (NFPA) 110.
5. Field Test Report.
6. Retest: Correct deficiencies identified by tests and observations and retest until spec

c) Operation and Maintenance Data (O&M):

1. Wiring Diagrams for System: Show power and control connections.
2. Detailed Operating Instructions: Describe operation under both normal and abnormal conditions.
3. Lists: Tools, test equipment, spare parts, and replacement items recommended to be stored at site for ready access. Include part and drawing numbers, current unit prices, and source of supply.

d) Permits:

1. Provide required air permitting and fuel system permitting required in accordance with applicable Federal, State, and local government requirements.

Service and Technical Support.

a) The manufacturer shall provide the Department of 3 copies of an operations manual for the generator with accessories as defined herein.

b) Definitions:

1. Emergency or Standby Rating: Power output rating equal to power that generator set delivers continuously under normally varying load factors for duration of power outage with capability of 24 continuous operating hours.
2. Operational Bandwidth: Total variation from lowest to highest value of parameter over range of conditions indicated, expressed as percentage of nominal value of parameter.
3. Power Output Rating: Gross electrical power output of generator set minus total power requirements of electric motor-driven accessories normally constituting part of engine assembly.
4. Steady-State Voltage Modulation: Uniform cyclical variation of voltage within operational bandwidth, expressed in Hertz or cycles per second.

Warranty

a) All equipment shall be unconditionally warranted for a minimum period of (1) one year after installation.

b) Any defects in materials or workmanship during the warranty period shall be immediately replaced in kind at no cost to the Department with new equipment of the same make and model number.

Basis of Payment. This work will be paid for at the contract lump sum price for PUMP STATION PACKAGED ENGINE GENERATOR SYSTEM.

FINAL CLEANUP

Upon completion of the work, all surplus material, excavated and useless materials, etc., shall be removed from within the limits of the right of way.

COMPENSABLE DELAY COSTS (BDE)

Effective: June 2, 2017

Revised: April 1, 2019

Revise Article 107.40(b) of the Standard Specifications to read:

“(b) Compensation. Compensation will not be allowed for delays, inconveniences, or damages sustained by the Contractor from conflicts with facilities not meeting the above definition; or if a conflict with a utility in an unanticipated location does not cause a shutdown of the work or a documentable reduction in the rate of progress exceeding the limits set herein. The provisions of Article 104.03 notwithstanding, compensation for delays caused by a utility in an unanticipated location will be paid according to the provisions of this Article governing minor and major delays or reduced rate of production which are defined as follows.

- (1) Minor Delay. A minor delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two hours, but not to exceed two weeks.
- (2) Major Delay. A major delay occurs when the work in conflict with the utility in an unanticipated location is completely stopped for more than two weeks.
- (3) Reduced Rate of Production Delay. A reduced rate of production delay occurs when the rate of production on the work in conflict with the utility in an unanticipated location decreases by more than 25 percent and lasts longer than seven calendar days.”

Revise Article 107.40(c) of the Standard Specifications to read:

“(c) Payment. Payment for Minor, Major, and Reduced Rate of Production Delays will be made as follows.

- (1) Minor Delay. Labor idled which cannot be used on other work will be paid for according to Article 109.04(b)(1) and (2) for the time between start of the delay and the minimum remaining hours in the work shift required by the prevailing practice in the area.

Equipment idled which cannot be used on other work, and which is authorized to standby on the project site by the Engineer, will be paid for according to Article 109.04(b)(4).

- (2) Major Delay. Labor will be the same as for a minor delay.

Equipment will be the same as for a minor delay, except Contractor-owned equipment will be limited to two weeks plus the cost of move-out to either the Contractor's yard or another job and the cost to re-mobilize, whichever is less. Rental equipment may be paid for longer than two weeks provided the Contractor presents adequate support to the Department (including lease agreement) to show retaining equipment on the job is the most economical course to follow and in the public interest.

- (3) Reduced Rate of Production Delay. The Contractor will be compensated for the reduced productivity for labor and equipment time in excess of the 25 percent threshold for that portion of the delay in excess of seven calendar days. Determination of compensation will be in accordance with Article 104.02, except labor and material additives will not be permitted.

Payment for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be determined according to Article 109.13."

Revise Article 108.04(b) of the Standard Specifications to read:

"(b) No working day will be charged under the following conditions.

- (1) When adverse weather prevents work on the controlling item.
- (2) When job conditions due to recent weather prevent work on the controlling item.
- (3) When conduct or lack of conduct by the Department or its consultants, representatives, officers, agents, or employees; delay by the Department in making the site available; or delay in furnishing any items required to be furnished to the Contractor by the Department prevents work on the controlling item.
- (4) When delays caused by utility or railroad adjustments prevent work on the controlling item.
- (5) When strikes, lock-outs, extraordinary delays in transportation, or inability to procure critical materials prevent work on the controlling item, as long as these delays are not due to any fault of the Contractor.
- (6) When any condition over which the Contractor has no control prevents work on the controlling item."

Revise Article 109.09(f) of the Standard Specifications to read:

“(f) Basis of Payment. After resolution of a claim in favor of the Contractor, any adjustment in time required for the work will be made according to Section 108. Any adjustment in the costs to be paid will be made for direct labor, direct materials, direct equipment, direct jobsite overhead, direct offsite overhead, and other direct costs allowed by the resolution. Adjustments in costs will not be made for interest charges, loss of anticipated profit, undocumented loss of efficiency, home office overhead and unabsorbed overhead other than as allowed by Article 109.13, lost opportunity, preparation of claim expenses and other consequential indirect costs regardless of method of calculation.

The above Basis of Payment is an essential element of the contract and the claim cost recovery of the Contractor shall be so limited.”

Add the following to Section 109 of the Standard Specifications.

“**109.13 Payment for Contract Delay.** Compensation for escalated material costs, escalated labor costs, extended project overhead, and extended traffic control will be allowed when such costs result from a delay meeting the criteria in the following table.

Contract Type	Cause of Delay	Length of Delay
Working Days	Article 108.04(b)(3) or Article 108.04(b)(4)	No working days have been charged for two consecutive weeks.
Completion Date	Article 108.08(b)(1) or Article 108.08(b)(7)	The Contractor has been granted a minimum two week extension of contract time, according to Article 108.08.

Payment for each of the various costs will be according to the following.

- (a) Escalated Material and/or Labor Costs. When the delay causes work, which would have otherwise been completed, to be done after material and/or labor costs have increased, such increases will be paid. Payment for escalated material costs will be limited to the increased costs substantiated by documentation furnished by the Contractor. Payment for escalated labor costs will be limited to those items in Article 109.04(b)(1) and (2), except the 35 percent and 10 percent additives will not be permitted.
- (b) Extended Project Overhead. For the duration of the delay, payment for extended project overhead will be paid as follows.
 - (1) Direct Jobsite and Offsite Overhead. Payment for documented direct jobsite overhead and documented direct offsite overhead, including onsite supervisory and administrative personnel, will be allowed according to the following table.

Original Contract Amount	Supervisory and Administrative Personnel
Up to \$5,000,000	One Project Superintendent
Over \$ 5,000,000 - up to \$25,000,000	One Project Manager, One Project Superintendent or Engineer, and One Clerk
Over \$25,000,000 - up to \$50,000,000	One Project Manager, One Project Superintendent, One Engineer, and One Clerk
Over \$50,000,000	One Project Manager, Two Project Superintendents, One Engineer, and One Clerk

(2) Home Office and Unabsorbed Overhead. Payment for home office and unabsorbed overhead will be calculated as 8 percent of the total delay cost.

(c) Extended Traffic Control. Traffic control required for an extended period of time due to the delay will be paid for according to Article 109.04.

When an extended traffic control adjustment is paid under this provision, an adjusted unit price as provided for in Article 701.20(a) for increase or decrease in the value of work by more than ten percent will not be paid.

Upon payment for a contract delay under this provision, the Contractor shall assign subrogation rights to the Department for the Department's efforts of recovery from any other party for monies paid by the Department as a result of any claim under this provision. The Contractor shall fully cooperate with the Department in its efforts to recover from another party any money paid to the Contractor for delay damages under this provision."

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (DBE)

Effective: September 1, 2000

Revised: March 2, 2019

FEDERAL OBLIGATION. The Department of Transportation, as a recipient of federal financial assistance, is required to take all necessary and reasonable steps to ensure nondiscrimination in the award and administration of contracts. Consequently, the federal regulatory provisions of 49 CFR Part 26 apply to this contract concerning the utilization of disadvantaged business enterprises. For the purposes of this Special Provision, a disadvantaged business enterprise (DBE) means a business certified by the Department in accordance with the requirements of 49 CFR Part 26 and listed in the Illinois Unified Certification Program (IL UCP) DBE Directory.

STATE OBLIGATION. This Special Provision will also be used by the Department to satisfy the requirements of the Business Enterprise for Minorities, Females, and Persons with Disabilities Act, 30 ILCS 575. When this Special Provision is used to satisfy state law requirements on 100 percent state-funded contracts, the federal government has no involvement in such contracts (not a federal-aid contract) and no responsibility to oversee the implementation of this Special Provision by the Department on those contracts. DBE participation on 100 percent state-funded contracts will not be credited toward fulfilling the Department's annual overall DBE goal required by the US Department of Transportation to comply with the federal DBE program requirements.

CONTRACTOR ASSURANCE. The Contractor makes the following assurance and agrees to include the assurance in each subcontract the Contractor signs with a subcontractor.

The Contractor, subrecipient, or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of contracts funded in whole or in part with federal or state funds. Failure by the Contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate, which may include, but is not limited to:

- (a) Withholding progress payments;
- (b) Assessing sanctions;
- (c) Liquidated damages; and/or
- (d) Disqualifying the Contractor from future bidding as non-responsible.

OVERALL GOAL SET FOR THE DEPARTMENT. As a requirement of compliance with 49 CFR Part 26, the Department has set an overall goal for DBE participation in its federally assisted contracts. That goal applies to all federal-aid funds the Department will expend in its federally assisted contracts for the subject reporting fiscal year. The Department is required to make a good faith effort to achieve the overall goal. The dollar amount paid to all approved DBE companies performing work called for in this contract is eligible to be credited toward fulfillment of the Department's overall goal.

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. The determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates, in the absence of unlawful discrimination and in an arena of fair and open competition, DBE companies can be expected to perform **0.00%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work. A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set for in this Special Provision:

- (a) The bidder documents enough DBE participation has been obtained to meet the goal or,
- (b) The bidder documents a good faith effort has been made to meet the goal, even though the effort did not succeed in obtaining enough DBE participation to meet the goal.

DBE LOCATOR REFERENCES. Bidders shall consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217) 785-4611, or by visiting the Department's website at:
<http://www.idot.illinois.gov/doing-business/certifications/disadvantaged-business-enterprise-certification/il-ucp-directory/index>.

BIDDING PROCEDURES. Compliance with this Special Provision is a material bidding requirement and failure of the bidder to comply will render the bid not responsive.

The bidder shall submit a DBE Utilization Plan (form SBE 2026), and a DBE Participation Statement (form SBE 2025) for each DBE company proposed for the performance of work to achieve the contract goal, with the bid. If the Utilization Plan indicates the contract goal will not be met, documentation of good faith efforts shall also be submitted. The documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor is selected over a DBE for work on the contract. The required forms and documentation must be submitted as a single .pdf file using the "Integrated Contractor Exchange (iCX)" application within the Department's "EBids System".

The Department will not accept a Utilization Plan if it does not meet the bidding procedures set forth herein and the bid will be declared not responsive. In the event the bid is declared not responsive, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty and may deny authorization to bid the project if re-advertised for bids.

GOOD FAITH EFFORT PROCEDURES. The contract will not be awarded until the Utilization Plan is approved. All information submitted by the bidder must be complete, accurate and adequately document enough DBE participation has been obtained or document the good faith efforts of the bidder, in the event enough DBE participation has not been obtained, before the Department will commit to the performance of the contract by the bidder. The Utilization Plan will be approved by the Department if the Utilization Plan documents sufficient commercially useful DBE work to meet the contract goal or the bidder submits sufficient documentation of a good faith effort to meet the contract goal pursuant to 49 CFR Part 26, Appendix A. This means the bidder must show that all necessary and reasonable steps were taken to achieve the contract goal. Necessary and reasonable steps are those which, by their scope, intensity and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if they were not successful. The Department will consider the quality, quantity, and intensity of the kinds of efforts the bidder has made. Mere *pro forma* efforts, in other words efforts done as a matter of form, are not good faith efforts; rather, the bidder is expected to have taken genuine efforts that would be reasonably expected of a bidder actively and aggressively trying to obtain DBE participation sufficient to meet the contract goal.

- (a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases and will be considered by the Department.
- (1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.
 - (2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the Contractor might otherwise prefer to perform these work items with its own forces.
 - (3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

- (4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.
 - b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable. In accordance with the above Bidding Procedures, the documentation of good faith efforts must include copies of each DBE and non-DBE subcontractor quote submitted to the bidder when a non-DBE subcontractor was selected over a DBE for work on the contract.
- (5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
 - (6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.
 - (7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.
 - (8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.

- (b) If the Department determines the bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided it is otherwise eligible for award. If the Department determines the bidder has failed to meet the requirements of this Special Provision or that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification will also include a statement of reasons for the adverse determination. If the Utilization Plan is not approved because it is deficient as a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no more than a five calendar day period to cure the deficiency.
- (c) The bidder may request administrative reconsideration of an adverse determination by emailing the Department at "DOT.DBE.UP@illinois.gov" within the five calendar days after the receipt of the notification of the determination. The determination shall become final if a request is not made on or before the fifth calendar day. A request may provide additional written documentation or argument concerning the issues raised in the determination statement of reasons, provided the documentation and arguments address efforts made prior to submitting the bid. The request will be reviewed by the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person to consider all issues of documentation and whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for reconsideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

CALCULATING DBE PARTICIPATION. The Utilization Plan values represent work anticipated to be performed and paid for upon satisfactory completion. The Department is only able to count toward the achievement of the overall goal and the contract goal the value of payments made for the work actually performed by DBE companies. In addition, a DBE must perform a commercially useful function on the contract to be counted. A commercially useful function is generally performed when the DBE is responsible for the work and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. The Department and Contractor are governed by the provisions of 49 CFR Part 26.55(c) on questions of commercially useful functions as it affects the work. Specific counting guidelines are provided in 49 CFR Part 26.55, the provisions of which govern over the summary contained herein.

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.

- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
 - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.
 - (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
 - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
 - (2) 100 percent goal credit for the cost of materials or supplies obtained from a DBE manufacturer.
 - (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a DBE regular dealer or DBE manufacturer.

CONTRACT COMPLIANCE. Compliance with this Special Provision is an essential part of the contract. The Department is prohibited by federal regulations from crediting the participation of a DBE included in the Utilization Plan toward either the contract goal or the Department's overall goal until the amount to be applied toward the goals has been paid to the DBE. The following administrative procedures and remedies govern the compliance by the Contractor with the contractual obligations established by the Utilization Plan. After approval of the Utilization Plan and award of the contract, the Utilization Plan and individual DBE Participation Statements become part of the contract. If the Contractor did not succeed in obtaining enough DBE participation to achieve the advertised contract goal, and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of DBE work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the amended contract goal. All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the DBE Participation Commitment Statement.

- (a) NO AMENDMENT. No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be emailed to the Department at DOT.DBE.UP@illinois.gov.
- (b) CHANGES TO WORK. Any deviation from the DBE condition-of-award or contract plans, specifications, or special provisions must be approved, in writing, by the Department as provided elsewhere in the Contract. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract. Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A or AER 260A, must be signed and submitted. If the commitment of work is in the form of additional tasks assigned to an existing subcontract, a new Request for Approval of Subcontractor will not be required. However, the Contractor must document efforts to assure the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.
- (c) SUBCONTRACT. The Contractor must provide copies of DBE subcontracts to the Department upon request. Subcontractors shall ensure that all lower tier subcontracts or agreements with DBEs to supply labor or materials be performed in accordance with this Special Provision.
- (d) ALTERNATIVE WORK METHODS. In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals. Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:
- (1) The replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
 - (2) The DBE is aware its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
 - (3) The DBE is not capable of performing the replacement work or has declined to perform the work at a reasonable competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.

- (e) TERMINATION AND REPLACEMENT PROCEDURES. The Contractor shall not terminate or replace a DBE listed on the approved Utilization Plan, or perform with other forces work designated for a listed DBE except as provided in this Special Provision. The Contractor shall utilize the specific DBEs listed to perform the work and supply the materials for which each is listed unless the Contractor obtains the Department's written consent as provided in subsection (a) of this part. Unless Department consent is provided for termination of a DBE subcontractor, the Contractor shall not be entitled to any payment for work or material unless it is performed or supplied by the DBE in the Utilization Plan.

As stated above, the Contractor shall not terminate or replace a DBE subcontractor listed in the approved Utilization Plan without prior written consent. This includes, but is not limited to, instances in which the Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Written consent will be granted only if the Bureau of Small Business Enterprises agrees, for reasons stated in its concurrence document, that the Contractor has good cause to terminate or replace the DBE firm. Before transmitting to the Bureau of Small Business Enterprises any request to terminate and/or substitute a DBE subcontractor, the Contractor shall give notice in writing to the DBE subcontractor, with a copy to the Bureau, of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor shall give the DBE five days to respond to the Contractor's notice. The DBE so notified shall advise the Bureau and the Contractor of the reasons, if any, why it objects to the proposed termination of its subcontract and why the Bureau should not approve the Contractor's action. If required in a particular case as a matter of public necessity, the Bureau may provide a response period shorter than five days.

For purposes of this paragraph, good cause includes the following circumstances:

- (1) The listed DBE subcontractor fails or refuses to execute a written contract;
- (2) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the Contractor;
- (3) The listed DBE subcontractor fails or refuses to meet the Contractor's reasonable, nondiscriminatory bond requirements;
- (4) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (5) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant 2 CFR Parts 180, 215 and 1200 or applicable state law.
- (6) The Contractor has determined the listed DBE subcontractor is not a responsible contractor;

- (7) The listed DBE subcontractor voluntarily withdraws from the projects and provides written notice to the Contractor of its withdrawal;
- (8) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (9) A DBE owner dies or becomes disabled with the result that the listed DBE subcontractor is unable to complete its work on the contract;
- (10) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the Contractor seeks to terminate a DBE it relied upon to obtain the contract so that the Contractor can self-perform the work for which the DBE contractor was engaged or so that the Contractor can substitute another DBE or non-DBE contractor after contract award.

When a DBE is terminated or fails to complete its work on the Contract for any reason, the Contractor shall make a good faith effort to find another DBE to substitute for the original DBE to perform at least the same amount of work under the contract as the terminated DBE to the extent needed to meet the established Contract goal. The good faith efforts shall be documented by the Contractor. If the Department requests documentation under this provision, the Contractor shall submit the documentation within seven days, which may be extended for an additional seven days if necessary at the request of the Contractor. The Department will provide a written determination to the Contractor stating whether or not good faith efforts have been demonstrated.

- (f) FINAL PAYMENT. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than 30 calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Resident Engineer. If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the DBE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (h) of this part.
- (g) ENFORCEMENT. The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.

- (h) **RECONSIDERATION**. Notwithstanding any other provision of the contract, including but not limited to Article 109.09 of the Standard Specifications, the Contractor may request administrative reconsideration of a decision to deduct the amount of the goal not achieved as liquidated damages. A request to reconsider shall be delivered to the Contract Compliance Section and shall be handled and considered in the same manner as set forth in paragraph (c) of "Good Faith Effort Procedures" of this Special Provision, except a final decision that a good faith effort was not made during contract performance to achieve the goal agreed to in the Utilization Plan shall be the final administrative decision of the Department. The result of the reconsideration process is not administratively appealable to the U.S. Department of Transportation.

DISPOSAL FEES (BDE)

Effective: November 1, 2018

Replace Articles 109.04(b)(5) – 109.04(b)(8) of the Standard Specifications with the following:

- "(5) Disposal Fees. When the extra work performed includes paying for disposal fees at a clean construction and demolition debris facility, an uncontaminated soil fill operation or a landfill, the Contractor shall receive, as administrative costs, an amount equal to five percent of the first \$10,000 and one percent of any amount over \$10,000 of the total approved costs of such fees.
- (6) Miscellaneous. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.
- (7) Statements. No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with itemized statements of the cost of such force account work. Statements shall be accompanied and supported by invoices for all materials used and transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from his/her stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

Itemized statements at the cost of force account work shall be detailed as follows.

- a. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman. Payrolls shall be submitted to substantiate actual wages paid if so requested by the Engineer.
- b. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
- c. Quantities of materials, prices and extensions.

- d. Transportation of materials.
 - e. Cost of property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions, and social security tax.
- (8) Work Performed by an Approved Subcontractor. When extra work is performed by an approved subcontractor, the Contractor shall receive, as administrative costs, an amount equal to five percent of the total approved costs of such work with the minimum payment being \$100.
- (9) All statements of the cost of force account work shall be furnished to the Engineer not later than 60 days after receipt of the Central Bureau of Construction form "Extra Work Daily Report". If the statement is not received within the specified time frame, all demands for payment for the extra work are waived and the Department is released from any and all such demands. It is the responsibility of the Contractor to ensure that all statements are received within the specified time regardless of the manner or method of delivery."

EQUIPMENT PARKING AND STORAGE (BDE)

Effective: November 1, 2017

Replace the first paragraph of Article 701.11 of the Standard Specifications with the following.

"701.11 Equipment Parking and Storage. During working hours, all vehicles and/or nonoperating equipment which are parked, two hours or less, shall be parked at least 8 ft (2.5 m) from the open traffic lane. For other periods of time during working and for all nonworking hours, all vehicles, materials, and equipment shall be parked or stored as follows.

- (a) When the project has adequate right-of-way, vehicles, materials, and equipment shall be located a minimum of 30 ft (9 m) from the pavement.
- (b) When adequate right-of-way does not exist, vehicles, materials, and equipment shall be located a minimum of 15 ft (4.5 m) from the edge of any pavement open to traffic.
- (c) Behind temporary concrete barrier, vehicles, materials, and equipment shall be located a minimum of 24 in. (600 mm) behind free standing barrier or a minimum of 6 in. (150 mm) behind barrier that is either pinned or restrained according to Article 704.04. The 24 in. or 6 in. measurement shall be from the base of the non-traffic side of the barrier.
- (d) Behind other man-made or natural barriers meeting the approval of the Engineer."

LIGHTS ON BARRICADES (BDE)

Effective: January 1, 2018

Revise Article 701.16 of the Standard Specifications to read:

“701.16 Lights. Lights shall be used on devices as required in the plans, the traffic control plan, and the following table.

Circumstance	Lights Required
Daylight operations	None
First two warning signs on each approach to the work involving a nighttime lane closure and “ROUGH GROOVED SURFACE” (W8-I107) signs	Flashing mono-directional lights
Devices delineating isolated obstacles, excavations, or hazards at night (Does not apply to patching)	Flashing bi-directional lights
Devices delineating obstacles, excavations, or hazards exceeding 100 ft (30 m) in length at night (Does not apply to widening)	Steady burn bi-directional lights
Channelizing devices for nighttime lane closures on two-lane roads	None
Channelizing devices for nighttime lane closures on multi-lane roads	None
Channelizing devices for nighttime lane closures on multi-lane roads separating opposing directions of traffic	None
Channelizing devices for nighttime along lane shifts on multilane roads	Steady burn mono-directional lights
Channelizing devices for night time along lane shifts on two lane roads	Steady burn bi-directional lights
Devices in nighttime lane closure tapers on Standards 701316 and 701321	Steady burn bi-directional lights
Devices in nighttime lane closure tapers	Steady burn mono-directional lights
Devices delineating a widening trench	None
Devices delineating patches at night on roadways with an ADT less than 25,000	None
Devices delineating patches at night on roadways with an ADT of 25,000 or more	None

Batteries for the lights shall be replaced on a group basis at such times as may be specified by the Engineer.”

Delete the fourth sentence of the first paragraph of Article 701.17(c)(2) of the Standard Specifications.

Revise the first paragraph of Article 603.07 of the Standard Specifications to read:

“603.07 Protection Under Traffic. After the casting has been adjusted and Class SI concrete has been placed, the work shall be protected by a barricade for at least 72 hours.”

PAYMENTS TO SUBCONTRACTORS (BDE)

Effective: November 2, 2017

Add the following to the end of the fourth paragraph of Article 109.11 of the Standard Specifications:

“If reasonable cause is asserted, written notice shall be provided to the applicable subcontractor and/or material supplier and the Engineer within five days of the Contractor receiving payment. The written notice shall identify the contract number, the subcontract or material purchase agreement, a detailed reason for refusal, the value of payment being withheld, and the specific remedial actions required of the subcontractor and/or material supplier so that payment can be made.”

PORTLAND CEMENT CONCRETE (BDE)

Effective: November 1, 2017

Revise the Air Content % of Class PP Concrete in Table 1 Classes of Concrete and Mix Design Criteria in Article 1020.04 of the Standard Specifications to read:

"TABLE 1. CLASSES OF CONCRETE AND MIX DESIGN CRITERIA		
Class of Conc.	Use	Air Content %
PP	Pavement Patching Bridge Deck Patching (10)	4.0 - 8.0"
	PP-1	
	PP-2	
	PP-3	
	PP-4	
	PP-5	

Revise Note (4) at the end of Table 1 Classes of Concrete and Mix Design Criteria in Article 1020.04 of the Standard Specifications to read:

“(4) For all classes of concrete, the maximum slump may be increased to 7 in (175 mm) when a high range water-reducing admixture is used. For Class SC, the maximum slump may be increased to 8 in. (200 mm). For Class PS, the maximum slump may be increased to 8 1/2 in. (215 mm) if the high range water-reducing admixture is the polycarboxylate type.”

PROGRESS PAYMENTS (BDE)

Effective: November 2, 2013

Revise Article 109.07(a) of the Standard Specifications to read:

“(a) Progress Payments. At least once each month, the Engineer will make a written estimate of the quantity of work performed in accordance with the contract, and the value thereof at the contract unit prices. The amount of the estimate approved as due for payment will be vouchered by the Department and presented to the State Comptroller for payment. No amount less than \$1000.00 will be approved for payment other than the final payment.

Progress payments may be reduced by liens filed pursuant to Section 23(c) of the Mechanics' Lien Act, 770 ILCS 60/23(c).

If a Contractor or subcontractor has defaulted on a loan issued under the Department's Disadvantaged Business Revolving Loan Program (20 ILCS 2705/2705-610), progress payments may be reduced pursuant to the terms of that loan agreement. In such cases, the amount of the estimate related to the work performed by the Contractor or subcontractor, in default of the loan agreement, will be offset, in whole or in part, and vouchered by the Department to the Working Capital Revolving Fund or designated escrow account. Payment for the work shall be considered as issued and received by the Contractor or subcontractor on the date of the offset voucher. Further, the amount of the offset voucher shall be a credit against the Department's obligation to pay the Contractor, the Contractor's obligation to pay the subcontractor, and the Contractor's or subcontractor's total loan indebtedness to the Department. The offset shall continue until such time as the entire loan indebtedness is satisfied. The Department will notify the Contractor and Fund Control Agent in a timely manner of such offset. The Contractor or subcontractor shall not be entitled to additional payment in consideration of the offset.

The failure to perform any requirement, obligation, or term of the contract by the Contractor shall be reason for withholding any progress payments until the Department determines that compliance has been achieved."

REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES (BDE)

Effective: January 1, 2019

Revise Section 669 of the Standard Specifications to read:

"SECTION 669. REMOVAL AND DISPOSAL OF REGULATED SUBSTANCES

669.01 Description. This work shall consist of the transportation and proper disposal of contaminated soil and groundwater. This work shall also consist of the removal, transportation, and proper disposal of underground storage tanks (UST), their content and associated underground piping to the point where the piping is above the ground, including determining the content types and estimated quantities.

669.02 Equipment. The Contractor shall notify the Engineer of the delivery of all excavation, storage, and transportation equipment to a work area location. The equipment shall comply with OSHA and American Petroleum Institute (API) guidelines and shall be furnished in a clean condition. Clean condition means the equipment does not contain any residual material classified as a non-special waste, non-hazardous special waste, or hazardous waste. Residual materials include, but are not limited to, petroleum products, chemical products, sludges, or any other material present in or on equipment.

Before beginning any associated soil or groundwater management activity, the Contractor shall provide the Engineer with the opportunity to visually inspect and approve the equipment. If the equipment contains any contaminated residual material, decontamination shall be performed on the equipment as appropriate to the regulated substance and degree of contamination present according to OSHA and API guidelines. All cleaning fluids used shall be treated as the contaminant unless laboratory testing proves otherwise.

669.03 Pre-construction Submittals. Prior to beginning this work, or working in areas with regulated substances, the Contractor shall submit a Regulated Substance Pre-Construction Plan (RSPCP) to the Engineer for review and approval using form BDE 2730. The form shall be signed by an Illinois licensed Professional Engineer or Professional Geologist.

As part of the RSPCP, the qualifications of Contractor(s) or firm(s) performing the following work shall be listed.

- (a) On-Site Monitoring. Qualification for on-site monitoring of regulated substance work and on-site monitoring of UST removal requires either pre-qualification in Hazardous Waste by the Department or demonstration of acceptable project experience in remediation and special waste operations for contaminated sites in accordance with applicable Federal, State, or local regulatory requirements.

Qualification for each individual performing on-site monitoring requires a minimum of one-year of experience in similar activities as those required for the project.

- (b) Underground Storage Tank. Qualification for underground storage tank (UST) work requires licensing and certification with the Office of the State Fire Marshall (OSFM) and possession of all permits required to perform the work. A copy of the permit shall be provided to the Engineer prior to tank removal.

The qualified Contractor(s) or firm(s) shall also document it does not have any current or former ties with any of the properties contained within, adjoining, or potentially affecting the work.

The Engineer will require up to 30 calendar days for review of the RSPCP. The review may involve rejection or revision and resubmittal; in which case, an additional 30 days will be required for each subsequent review. Work shall not commence until the RSPCP has been approved by the Engineer. After approval, the RSPCP shall be revised as necessary to reflect changed conditions in the field.

CONSTRUCTION REQUIREMENTS

669.04 Contaminated Soil and/or Groundwater Monitoring. Prior to beginning excavation, the Contractor shall mark the limits of removal for approval by the Engineer. Once excavation begins, the work and work area involving regulated substances shall be monitored by qualified personnel. The qualified personnel shall be on-site continuously during excavation and loading of material containing regulated substances. The qualified personnel shall be equipped with either a photoionization detector (PID) (minimum 10.6eV lamp), or a flame ionization detector (FID), and other equipment, as appropriate, to monitor for potential contaminants associated with volatile organic compounds (VOCs) or semi-volatile organic compounds (SVOCs). The PID or FID meter shall be calibrated on-site and background level readings taken and recorded daily, and as field and weather conditions change. Any field screen reading on the PID or FID in excess of background levels indicates the potential presence of contaminated material requiring handling as a non-special waste, special waste, or hazardous waste. PID or FID readings may be used as the basis of increasing the limits of removal with the approval of the Engineer but shall in no case be used to decrease the limits.

The qualified personnel shall document field activities using form BDE 2732 (Regulated Substances Monitoring Daily Record) including the name(s) of personnel conducting the monitoring, weather conditions, PID or FID calibration records, a list of equipment used on-site, a narrative of activities completed, photo log sheets, manifests and landfill tickets, monitoring results, how regulated substances were managed and other pertinent information.

Samples will be collected in accordance with the RSPCP. Samples shall be analyzed for the contaminants of concern (COCs), including pH, based on the property's land use history, the encountered abnormality and/or the parameters listed in the maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Ill. Adm. Code 1100.605. The analytical results shall serve to document the level of contamination.

Samples shall be grab samples (not combined with other locations). The samples shall be taken with decontaminated or disposable instruments. The samples shall be placed in sealed containers and transported in an insulated container to the laboratory. The container shall maintain a temperature of 39 °F (4 °C). All samples shall be clearly labeled. The labels shall indicate the sample number, date sampled, collection location and depth, and any other relevant observations.

The laboratory shall use analytical methods which are able to meet the lowest appropriate practical quantitation limits (PQL) or estimated quantitation limit (EQL) specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846; "Methods for the Determination of Organic Compounds in Drinking Water", EPA, EMSL, EPA-600/4-88/039; and "Methods for the Determination of Organic Compounds in Drinking Water, Supplement III", EPA 600/R-95/131, August 1995. For parameters where the specified cleanup objective is below the acceptable detection limit (ADL), the ADL shall serve as the cleanup objective. For other parameters the ADL shall be equal to or below the specified cleanup objective.

669.05 Contaminated Soil and/or Groundwater Management and Disposal. The management and disposal of contaminated soil and/or groundwater shall be according to the following:

- (a) Soil Analytical Results Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels exceed the most stringent maximum allowable concentration (MAC) for chemical constituents in uncontaminated soil established pursuant to Subpart F of 35 Illinois Administrative Code 1100.605, the soil shall be managed as follows:
 - (1) When analytical results indicate inorganic chemical constituents exceed the most stringent MAC but they are still considered within area background levels by the Engineer, the excavated soil can be utilized within the construction limits as fill, when suitable. If the soils cannot be utilized within the construction limits, they shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.
 - (2) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for a Metropolitan Statistical Area (MSA) County, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a clean construction and demolition debris (CCDD) facility or an uncontaminated soil fill operation (USFO) within an MSA County provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (3) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, or the MAC within the Chicago corporate limits, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an USFO within an MSA County excluding Chicago or within the Chicago corporate limits provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (4) When analytical results indicate chemical constituents exceed the most stringent MAC but do not exceed the MAC for an MSA County excluding Chicago, the excavated soil can be utilized within the construction limits as fill, when suitable, or managed and disposed of off-site as “uncontaminated soil” at a CCDD facility or an USFO within an MSA County excluding Chicago provided the pH of the soil is within the range of 6.25 - 9.0, inclusive.
 - (5) When the Engineer determines soil cannot be managed according to Articles 669.05(a)(1) through (a)(4) above, the soil shall be managed and disposed of off-site as a non-special waste, special waste, or hazardous waste as applicable.

- (b) Soil Analytical Results Do Not Exceed Most Stringent MAC. When the soil analytical results indicate that detected levels do not exceed the most stringent MAC, the excavated soil can be utilized within the construction limits or managed and disposed off-site as “uncontaminated soil” according to Article 202.03. However, the excavated soil cannot be taken to a CCDD facility or an USFO for any of the following reasons.
- (1) The pH of the soil is less than 6.25 or greater than 9.0.
 - (2) The soil exhibited PID or FID readings in excess of background levels.
- (c) Soil Analytical Results Exceed Most Stringent MAC but Do Not Exceed Tiered Approach to Corrective Action Objectives (TACO) Residential. When the soil analytical results indicate that detected levels exceed the most stringent MAC but do not exceed TACO Tier 1 Soil Remediation Objectives for Residential Properties pursuant to 35 IAC 742 Appendix B Table A, the excavated soil can be utilized within the right-of-way or managed and disposed off-site as “uncontaminated soil” according to Article 202.03. However, the excavated soil cannot be taken to a CCDD facility or an USFO.
- (d) Groundwater. When groundwater analytical results indicate the detected levels are above Appendix B, Table E of 35 Illinois Administrative Code 742, the most stringent Tier 1 Groundwater Remediation Objectives for Groundwater Component of the Groundwater Ingestion Route for Class 1 groundwater, the groundwater shall be managed off-site as a special waste. The groundwater shall be containerized and trucked to an off-site treatment facility or may be discharged to a sanitary sewer or combined sewer when permitted by the local sewer authority. Groundwater discharged to a sewer shall be pre-treated to remove particulates and measured with a calibrated flow meter to comply with applicable discharge limits. A copy of the permit shall be provided to the Engineer prior to discharging groundwater to the sewer.

All groundwater encountered within trenches may be managed within the trench and allowed to infiltrate back into the ground. If the groundwater cannot be managed within the trench it must be removed as a special or hazardous waste. The Contractor is prohibited from managing groundwater within the trench by discharging it through any existing or new storm sewer. The Contractor shall install backfill plugs within the area of groundwater contamination.

One backfill plug shall be placed down gradient to the area of groundwater contamination. Backfill plugs shall be installed at intervals not to exceed 50 ft (15 m). Backfill plugs are to be 4 ft (1.2 m) long, measured parallel to the trench, full trench width and depth. Backfill plugs shall not have any fine aggregate bedding or backfill, but shall be entirely cohesive soil or any class of concrete. The Contractor shall provide test data that the material has a permeability of less than 10^{-7} cm/sec according to ASTM D 5084, Method A or per another test method approved by the Engineer.

The Contractor shall use due care when transferring contaminated material from the area of origin to the transporter. Should releases of contaminated material to the environment occur (i.e., spillage onto the ground, etc.), the Contractor shall clean-up spilled material and place in the appropriate storage containers as previously specified. Clean-up shall include, but not be limited to, sampling beneath the material staging area to determine complete removal of the spilled material.

The Contractor shall be responsible for transporting and disposing all material classified as a non-special waste, special waste, or hazardous waste from the job site to an appropriately permitted landfill facility. The transporter and the vehicles used for transportation shall comply with all federal, state, and local rules and regulations governing the transportation of non-special waste, special waste, or hazardous waste.

All equipment used by the Contractor to haul contaminated material to the landfill facility shall be lined with a 6 mil (150 micron) polyethylene liner and securely covered during transportation. The Contractor shall obtain all documentation including any permits and/or licenses required to transport the contaminated material to the disposal facility.

The Contractor shall provide engineered barriers, when required, and shall include materials sufficient to completely line excavation surfaces, including sloped surfaces, bottoms, and sidewall faces, within the areas designated for protection.

The Engineer shall coordinate with the Contractor on the completion of all documentation. The Contractor shall make all arrangements for collection and analysis of landfill acceptance testing. The Contractor shall coordinate for waste disposal approval with the disposal facility. After the Contractor completes these activities and upon receipt of authorization from the Engineer, the Contractor shall initiate the disposal process.

The Contractor shall provide the Engineer with all transport-related documentation within two days of transport or receipt of said document(s). The Engineer shall maintain the file for all such documentation. For management of special or hazardous waste, the Contractor shall provide the Engineer with documentation the Contractor (or subcontractor, if a subcontractor is used for transportation) is operating with a valid Illinois special waste transporter permit at least two weeks before transporting the first load of contaminated material.

The Contractor shall schedule and arrange the transport and disposal of each load of contaminated material produced. The Contractor shall make all transport and disposal arrangements so no contaminated material remains within the project area at the close of business each day. Exceptions to this specification require prior approval from the Engineer within 24 hours of close of business. The Contractor shall be responsible for all other pre-disposal/transport preparations necessary daily to accomplish management activities.

Any waste generated as a special or hazardous waste from a non-fixed facility shall be manifested off-site using the Department's county generator number. An authorized representative of the Department shall sign all manifests for the disposal of the contaminated material and confirm the Contractor's transported volume. Any waste generated as a non-special waste may be managed off-site without a manifest, a special waste transporter, or a generator number.

The Contractor shall select a landfill mandated by definition of the contaminant within the State of Illinois. The Department will review and approve or reject the facility proposed by the Contractor to use as a landfill. The Contractor shall verify whether the selected disposal facility is compliant with those applicable standards as mandated by definition of the contaminant and whether the disposal facility is presently, has previously been, or has never been, on the United States Environmental Protection Agency (U.S. EPA) National Priorities List or the Resource Conservation and Recovery Act (RCRA) List of Violating Facilities. The Contractor shall be responsible for coordinating permits with the IEPA. The use of a Contractor selected landfill shall in no manner delay the construction schedule or alter the Contractor's responsibilities as set forth.

669.06 Non-Special Waste Certification. An authorized representative of the Department shall sign and date all non-special waste certifications. The Contractor shall be responsible for providing the Engineer with the required information that will allow the Engineer to certify the waste is not a special waste.

(a) Definition. A waste is considered a non-special waste as long as it is not:

- (1) a potentially infectious medical waste;
- (2) a hazardous waste as defined in 35 IAC 721;
- (3) an industrial process waste or pollution control waste that contains liquids, as determined using the paint filter test set forth in subdivision (3)(A) of subsection (m) of 35 IAC 811.107;
- (4) a regulated asbestos-containing waste material, as defined under the National Emission Standards for Hazardous Air Pollutants in 40 CFR 61.141;
- (5) a material containing polychlorinated biphenyls (PCB's) regulated pursuant to 40 CFR Part 761;
- (6) a material subject to the waste analysis and recordkeeping requirements of 35 IAC 728.107 under land disposal restrictions of 35 IAC 728;
- (7) a waste material generated by processing recyclable metals by shredding and required to be managed as a special waste under Section 22.29 of the Environmental Protection Act; or

- (8) an empty portable device or container in which a special or hazardous waste has been stored, transported, treated, disposed of, or otherwise handled.
- (b) Certification Information. All information used to determine the waste is not a special waste shall be attached to the certification. The information shall include but not be limited to:
- (1) the means by which the generator has determined the waste is not a hazardous waste;
 - (2) the means by which the generator has determined the waste is not a liquid;
 - (3) if the waste undergoes testing, the analytic results obtained from testing, signed and dated by the person responsible for completing the analysis;
 - (4) if the waste does not undergo testing, an explanation as to why no testing is needed;
 - (5) a description of the process generating the waste; and
 - (6) relevant material safety data sheets.

669.07 Temporary Staging. The Contractor shall excavate and dispose of all waste material as mandated by the contaminants without temporary staging. If circumstances require temporary staging, he/she shall request in writing, approval from the Engineer.

When approved, the Contractor shall prepare a secure location within the project area capable of housing containerized waste materials. The Contractor shall contain all waste material in leak-proof storage containers such as lined roll-off boxes or 55 gal (208 L) drums, or stored in bulk fashion on storage pads. The design and construction of such storage pad(s) for bulk materials shall be subject to approval by the Engineer. The Contractor shall place the staged storage containers on an all-weather gravel-packed, asphalt, or concrete surface. The Contractor shall maintain a clearance both above and beside the storage units to provide maneuverability during loading and unloading. The Contractor shall provide any assistance or equipment requested by the Engineer for authorized personnel to inspect and/or sample contents of each storage container. All containers and their contents shall remain intact and undisturbed by unauthorized persons until the manner of disposal is determined. The Contractor shall keep the storage containers covered, except when access is requested by authorized personnel of the Department. The Engineer shall authorize any additional material added to the contents of any storage container before being filled.

The Contractor shall ensure the staging area is enclosed (by a fence or other structure) to ensure direct access to the area is restricted, and he/she shall procure and place all required regulatory identification signs applicable to an area containing the waste material. The Contractor shall be responsible for all activities associated with the storage containers including, but not limited to, the procurement, transport, and labeling of the containers. The Contractor shall clearly mark all containers in permanent marker or paint with the date of waste generation, location and/or area of waste generation, and type of waste (e.g., decontamination water, contaminated clothing, etc.). The Contractor shall place these identifying markings on an exterior side surface of the container. The Contractor shall separately containerize each contaminated medium, i.e. contaminated clothing is placed in a separate container from decontamination water. Containers used to store liquids shall not be filled in excess of 80 percent of the rated capacity. The Contractor shall not use a storage container if visual inspection of the container reveals the presence of free liquids or other substances that could classify the material as a hazardous waste in the container.

The Department will not be responsible for any additional costs incurred, if mismanagement of the staging area, storage containers, or their contents by the Contractor results in excess cost expenditure for disposal or other material management requirements.

669.08 Underground Storage Tank Removal. For the purposes of this section, an underground storage tank (UST) includes the underground storage tank, piping, electrical controls, pump island, vent pipes and appurtenances.

Prior to removing an UST, the Engineer shall determine whether the Department is considered an "owner" or "operator" of the UST as defined by the UST regulations (41 Ill. Adm. Code Part 176). Ownership of the UST refers to the Department's owning title to the UST during storage, use or dispensing of regulated substances. The Department may be considered an "operator" of the UST if it has control of, or has responsibility for, the daily operation of the UST. The Department may however voluntarily undertake actions to remove an UST from the ground without being deemed an "operator" of the UST.

In the event the Department is deemed not to be the "owner" or "operator" of the UST, the OSFM removal permit shall reflect who was the past "owner" or "operator" of the UST. If the "owner" or "operator" cannot be determined from past UST registration documents from OSFM, then the OSFM removal permit will state the "owner" or "operator" of the UST is the Department. The Department's Office of Chief Counsel (OCC) will review all UST removal permits prior to submitting any removal permit to the OSFM. If the Department is not the "owner" or "operator" of the UST then it will not register the UST or pay any registration fee.

The Contractor shall be responsible for obtaining all permits required for removing the UST, notification to the OSFM, using an OSFM certified tank contractor, removal and disposal of the UST and its contents, and preparation and submittal of the OSFM Site Assessment Report in accordance with 41 Ill. Adm. Code Part 176.330.

The Contractor shall contact the Engineer and the OSFM's office at least 72 hours prior to removal to confirm the OSFM inspector's presence during the UST removal. Removal, transport, and disposal of the UST shall be according to the applicable portions of the latest revision of the "American Petroleum Institute (API) Recommended Practice 1604".

The Contractor shall collect and analyze tank content (sludge) for disposal purposes. The Contractor shall remove as much of the regulated substance from the UST system as necessary to prevent further release into the environment. All contents within the tank shall be removed, transported and disposed of, or recycled. The tank shall be removed and rendered empty according to IEPA definition.

The Contractor shall collect soil samples from the bottom and sidewalls of the excavated area in accordance with 35 Ill. Adm. Code Part 734.210(h) after the required backfill has been removed during the initial response action, to determine the level of contamination remaining in the ground, regardless if a release is confirmed or not by the OSFM on-site inspector.

In the event the UST is designated a leaking underground storage tank (LUST) by the OSFM's inspector, or confirmation by analytical results, the Contractor shall notify the Engineer and the DESU. Upon confirmation of a release of contaminants from the UST and notifications to the Engineer and DESU, the Contractor shall report the release to the Illinois Emergency Management Agency (IEMA) (e.g., by telephone or electronic mail) and provide them with whatever information is available ("owner" or "operator" shall be stated as the past registered "owner" or "operator", or the IDOT District in which the UST is located and the DESU Manager);

The Contractor shall perform the following initial response actions if a release is indicated by the OSFM inspector:

- (a) Take immediate action to prevent any further release of the regulated substance to the environment, which may include removing, at the Engineer's discretion, and disposing of up to 4 ft (1.2 m) of the contaminated material, as measured from the outside dimension of the tank
- (b) Identify and mitigate fire, explosion and vapor hazards;
- (c) Visually inspect any above ground releases or exposed below ground releases and prevent further migration of the released substance into surrounding soils and groundwater; and
- (d) Continue to monitor and mitigate any additional fire and safety hazards posed by vapors and free product that have migrated from the UST excavation zone and entered into subsurface structures (such as sewers or basements).

The UST excavation shall be backfilled according to applicable portions of Sections 205, 208, and 550 with a material that will compact and develop stability. The material shall be approved prior to placement. All uncontaminated concrete and soil removed during tank extraction may be used to backfill the excavation, at the discretion of the Engineer.

After backfilling the excavation, the site shall be graded and cleaned.

669.09 Regulated Substance Final Construction Report. Not later than 90 days after completing this work, the Contractor shall submit a Regulated Substance Final Construction Report (RSFCR) to the Engineer using form BDE 2733 and required attachments. The form shall be signed by an Illinois licensed Professional Engineer or Professional Geologist.

669.10 Method of Measurement. Non-special waste, special waste, and hazardous waste soil will be measured for payment according to Article 202.07(b) when performing earth excavation, Article 502.12(b) when excavating for structures, or by computing the volume of the trench using the maximum trench width permitted and the actual depth of the trench.

Groundwater containerized and transported off-site for management, storage, and disposal will be measured for payment in gallons (liters).

Backfill plugs will be measured in cubic yards (cubic meters) in place, except the quantity for which payment will be made shall not exceed the volume of the trench, as computed by using the maximum width of trench permitted by the Specifications and the actual depth of the trench, with a deduction for the volume of the pipe.

Engineered Barriers will be measured for payment in square yards (square meters).

669.11 Basis of Payment. The work of preparing, submitting and administering a Regulated Substances Pre-Construction Plan will be paid for at the contract lump sum price for REGULATED SUBSTANCES PRE-CONSTRUCTION PLAN.

On-site monitoring of regulated substances, including completion of form BDE 2732 for each day of work, will be paid for at the contract unit price per calendar day, or fraction thereof, for ON-SITE MONITORING OF REGULATED SUBSTANCES.

The installation of engineered barriers will be paid for at the contract unit price per square yard (square meter) for ENGINEERED BARRIER.

The work of removing a UST, soil excavation, soil and content sampling, and the excavated soil, UST content, and UST disposal will be paid for at the contract unit price per each for UNDERGROUND STORAGE TANK REMOVAL.

The transportation and disposal of soil and other materials from an excavation determined to be contaminated will be paid for at the contract unit price per cubic yard (cubic meter) for NON-SPECIAL WASTE DISPOSAL, SPECIAL WASTE DISPOSAL, or HAZARDOUS WASTE DISPOSAL.

The transportation and disposal of groundwater from an excavation determined to be contaminated will be paid for at the contract unit price per gallon (liter) for SPECIAL WASTE GROUNDWATER DISPOSAL or HAZARDOUS WASTE GROUNDWATER DISPOSAL. When groundwater is discharged to a sanitary or combined sewer by permit, the cost will be paid for according to Article 109.05.

Backfill plugs will be paid for at the contract unit price per cubic yard (cubic meter) for BACKFILL PLUGS.

Payment for temporary staging, if required, will be paid for according to Article 109.04.

Payment for accumulated stormwater removal and disposal will be according to Article 109.04. Payment will only be allowed if appropriate stormwater and erosion control methods were used.

Payment for decontamination, labor, material, and equipment for monitoring areas beyond the specified areas, with the Engineer's prior written approval, will be according to Article 109.04.

The sampling and testing associated with this work will be paid for as follows.

- (a) BETX Soil/Groundwater Analysis. When the contaminants of concern are gasoline only, soil or groundwater samples shall be analyzed for benzene, ethylbenzene, toluene, and xylenes (BETX). The analysis will be paid for at the contract unit price per each for BETX SOIL ANALYSIS and/or BETX GROUNDWATER ANALYSIS using EPA Method 8021B.
- (b) BETX-PNAS Soil/Groundwater Analysis. When the contaminants of concern are middle distillate and heavy ends, soil or groundwater samples shall be analyzed for BETX and polynuclear aromatics (PNAS). The analysis will be paid for at the contract unit price per each for BETX-PNAS SOIL ANALYSIS and/or BETX-PNAS GROUNDWATER ANALYSIS using EPA Method 8021B for BETX and EPA Method 8310 for PNAS.
- (c) Priority Pollutants Soil Analysis. When the contaminants of concern are used oils, soil samples shall be analyzed for priority pollutant VOCs, priority pollutants SVOCs, and priority pollutants metals. The analysis will be paid for at the contract unit price per each for PRIORITY POLLUTANTS SOIL ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCs, and using an ICP instrument and EPA Methods 6010B and 7471A for metals.
- (d) Priority Pollutant Groundwater Analysis. When the contaminants of concern are used oils, non-petroleum material, or unknowns, groundwater samples shall be analyzed for priority pollutant VOCs, priority pollutants SVOCs, and priority pollutants metals. The analysis will be paid for at the contract unit price per each for PRIORITY POLLUTANTS GROUNDWATER ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCs, and EPA Methods 6010B and 7470A for metals.
- (e) Target Compound List (TCL) Soil Analysis. When the contaminants of concern are unknowns or non-petroleum material, soil samples shall be analyzed for priority pollutant VOCs, priority pollutants SVOCs, priority pollutants metals, pesticides, and Resource Conservation and Recovery Act (RCRA) metals by the toxicity characteristic leaching procedure (TCLP). The analysis will be paid for at the contract unit price per each for TCL SOIL ANALYSIS using EPA Method 8260B for VOCs, EPA Method 8270C for SVOCs, EPA Method 8081 for pesticides, and ICP instrument and EPA Methods 6010B, 7471A, 1311 (extraction), 6010B, and 7470A for metals.

- (f) Soil Disposal Analysis. When the waste material for disposal requires sampling for disposal acceptance, the samples shall be analyzed for TCLP VOCs, SVOCs, RCRA metals, pH, ignitability, and paint filter test. The analysis will be paid for at the contract unit price per each for SOIL DISPOSAL ANALYSIS using EPA Methods 1311 (extraction), 8260B for VOCs, 8270C for SVOCs, 6010B and 7470A for RCRA metals, 9045C for pH, 1030 for ignitability, and 9095A for paint filter.

The work of preparing, submitting and administering a Regulated Substances Final Construction Report will be paid for at the contract lump sum price REGULATED SUBSTANCES FINAL CONSTRUCTION REPORT.”

SUBCONTRACTOR AND DBE PAYMENT REPORTING (BDE)

Effective: April 2, 2018

Add the following to Section 109 of the Standard Specifications.

“109.14 Subcontractor and Disadvantaged Business Enterprise Payment Reporting.
The Contractor shall report all payments made to the following parties:

- (a) first tier subcontractors;
- (b) lower tier subcontractors affecting disadvantaged business enterprise (DBE) goal credit;
- (c) material suppliers or trucking firms that are part of the Contractor’s submitted DBE utilization plan.

The report shall be made through the Department’s on-line subcontractor payment reporting system within 21 days of making the payment.”

SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)

Effective: November 2, 2017

Revised: April 1, 2019

Replace the second paragraph of Article 109.12 of the Standard Specifications with the following:

“This mobilization payment shall be made at least seven days prior to the subcontractor starting work. The amount paid shall be at the following percentage of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor’s work.

Value of Subcontract Reported on Form BC 260A	Mobilization Percentage
Less than \$10,000	25%
\$10,000 to less than \$20,000	20%
\$20,000 to less than \$40,000	18%
\$40,000 to less than \$60,000	16%
\$60,000 to less than \$80,000	14%
\$80,000 to less than \$100,000	12%
\$100,000 to less than \$250,000	10%
\$250,000 to less than \$500,000	9%
\$500,000 to \$750,000	8%
Over \$750,000	7%

TRAFFIC CONTROL DEVICES - CONES (BDE)

Effective: January 1, 2019

Revise Article 701.15(a) of the Standard Specifications to read:

“(a) Cones. Cones are used to channelize traffic. Cones used to channelize traffic at night shall be reflectorized; however, cones shall not be used in nighttime lane closure tapers or nighttime lane shifts.”

Revise Article 1106.02(b) of the Standard Specifications to read:

“(b) Cones. Cones shall be predominantly orange. Cones used at night that are 28 to 36 in. (700 to 900 mm) in height shall have two white circumferential stripes. If non-reflective spaces are left between the stripes, the spaces shall be no more than 2 in. (50mm) in width. Cones used at night that are taller than 36 in. (900 mm) shall have a minimum of two white and two fluorescent orange alternating, circumferential stripes with the top stripe being fluorescent orange. If non-reflective spaces are left between the stripes, the spaces shall be no more than 3 in. (75 mm) in width.

The minimum weights for the various cone heights shall be 4 lb for 18 in. (2 kg for 450 mm), 7 lb for 28 in. (3 kg for 700 mm), and 10 lb for 36 in. (5 kg for 900 mm) with a minimum of 60 percent of the total weight in the base. Cones taller than 36 in. shall be weighted per the manufacturer’s specifications such that they are not moved by wind or passing traffic.”

WEEKLY DBE TRUCKING REPORTS (BDE)

Effective: June 2, 2012

Revised: April 2, 2015

The Contractor shall submit a weekly report of Disadvantaged Business Enterprise (DBE) trucks hired by the Contractor or subcontractors (i.e. not owned by the Contractor or subcontractors) that are used for DBE goal credit.

The report shall be submitted to the Engineer on Department form “SBE 723” within ten business days following the reporting period. The reporting period shall be Monday through Sunday for each week reportable trucking activities occur.

FAP Route 332A (IL 1) & FAP Route 649 (IL 17)
Section (107)PS-3 & (2SB-FAGH)PS-1
Iroquois & Livingston Counties
Contract No. 66J68

Any costs associated with providing weekly DBE trucking reports shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

REVISIONS TO THE ILLINOIS PREVAILING WAGE RATES

The Prevailing rates of wages are included in the Contract proposals which are subject to Check Sheet #5 of the Supplemental Specifications and Recurring Special Provisions. The rates have been ascertained and certified by the Illinois Department of Labor for the locality in which the work is to be performed and for each craft or type of work or mechanic needed to execute the work of the Contract. As required by Prevailing Wage Act (820 ILCS 130/0.01, et seq.) and Check Sheet #5 of the Contract, not less than the rates of wages ascertained by the Illinois Department of Labor and as revised during the performance of a Contract shall be paid to all laborers, workers and mechanics performing work under the Contract. Post the scale of wages in a prominent and easily accessible place at the site of work.

If the Illinois Department of Labor revises the prevailing rates of wages to be paid as listed in the specification of rates, the contractor shall post the revised rates of wages and shall pay not less than the revised rates of wages. Current wage rate information shall be obtained by visiting the Illinois Department of Labor web site at <http://www.state.il.us/agency/idol/> or by calling 312-793-2814. It is the responsibility of the contractor to review the rates applicable to the work of the contract at regular intervals in order to insure the timely payment of current rates. Provision of this information to the contractor by means of the Illinois Department of Labor web site satisfies the notification of revisions by the Department to the contractor pursuant to the Act, and the contractor agrees that no additional notice is required. The contractor shall notify each of its subcontractors of the revised rates of wages.