PROJECT MANUAL
FOR THE

Pump Station Improvements of
3301 Fairway Drive, 3410 Fairway Drive,
& Lake Ridge Court

Bid No. 672

City of Danville, Illinois

Bid Opening: May 5, 2021 2:00 p.m.

Danville Department of Public Works
1155 E VOORHEES, SUITE A, Danville, IL 61832

SAM D. COLE, CITY ENGINEER
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADVERTISEMENT FOR BIDS</td>
<td>2</td>
</tr>
<tr>
<td>NOTICE TO BIDDERS</td>
<td>4</td>
</tr>
<tr>
<td>PROPOSAL BID BOND</td>
<td>6</td>
</tr>
<tr>
<td>PROPOSAL</td>
<td>7</td>
</tr>
<tr>
<td>VENDOR’S SWORN STATEMENT</td>
<td>8</td>
</tr>
<tr>
<td>CITY OF DANVILLE STANDARD CONTRACT CLAUSES</td>
<td>9</td>
</tr>
<tr>
<td>CITY OF DANVILLE GENERAL CONDITIONS</td>
<td>10</td>
</tr>
<tr>
<td>CITY OF DANVILLE REQUIRED CONTRACT PROVISIONS</td>
<td>11</td>
</tr>
<tr>
<td>UNIT PRICE SCHEDULE - RETURN WITH BID</td>
<td>13</td>
</tr>
<tr>
<td>SIGNATURES</td>
<td>14</td>
</tr>
<tr>
<td>CITY OF DANVILLE AFFIRMATIVE ACTION REQUIREMENTS</td>
<td>15</td>
</tr>
<tr>
<td>EMPLOYER CERTIFICATE OF COMPLIANCE REPORT FORM</td>
<td>16</td>
</tr>
<tr>
<td>SEXUAL HARASSMENT GUIDELINES</td>
<td>21</td>
</tr>
<tr>
<td>CONTRACT</td>
<td>26</td>
</tr>
<tr>
<td>CONTRACT BOND</td>
<td>27</td>
</tr>
<tr>
<td>CONTRACT DOCUMENTS &amp; SPECIFICATIONS</td>
<td>29</td>
</tr>
</tbody>
</table>
OWNER AND WORK: The City of Danville, Illinois will receive unit price sealed bids from contractors for the following project:

PUMP STATION IMPROVEMENTS OF 3301 FAIRWAY DRIVE, 3410 FAIRWAY DRIVE, & LAKE RIDGE COURT

The project consists of supplying the labor, equipment, and material necessary to furnish and install submersible replacement sewage pumps and accessories. There are three (3) pump stations: 3301 Fairway Drive, 3410 Fairway Drive, & Lake Ridge Court locations. The project also includes demolition and removal of certain structures, bypass pumping, electrical work, controls, site work, pavement, erosion control, cleanup, seeding and other items of construction.

TIME AND PLACE OF BID OPENING: Sealed bids will be received until the closing time of 2:00 P.M. prevailing local time on Wednesday, May 5, 2021 in the office of the City Clerk, Robert E. Jones Municipal Building, 17 West Main Street, Danville Illinois. Bids received after the closing time shall not be accepted and shall be returned unopened. Bids submitted via the U.S. Postal Service or private courier shall be identified on the outside of the envelope with the phrase: “BID ENCLOSED for the PUMP STATION IMPROVEMENTS”, and should be to: City Clerk, Robert E. Jones Municipal Building, 17 West Main Street, Danville, Illinois 61832. The bids will be publicly opened and read aloud thereafter.

BIDDING DOCUMENTS: The Bidding Documents can be downloaded from the City Website: http://www.cityofdanville.org/bids--rfps.html. The City’s Project Manager is Eric N. Childers, Assistant City Engineer who can be contacted at 217-431-2259, email address: echilders@cityofdanville.org.

Bids must be submitted on the Bid Form furnished and must be accompanied by a signed original of the “Vendor’s Sworn Statement” Form, plus an acceptable form of Proposal Guaranty in an amount of at least five (5) percent of the amount of the Proposal, payable to the City of Danville, Illinois. The Proposal Guaranty shall be a certified check, bank draft, or an executed Bid Bond acceptable to the Owner as a guaranty that if the Proposal is accepted, the Bidder will execute the Contract and will file an acceptable Contract Bond and Certificate of Insurance within (15) days after the award of the Contract. A Proposal Guaranty consisting of a personal check will not be accepted. The Proposal must be submitted in a sealed envelope.

ECCR FORM: Prospective Bidders must submit the Employer Certificate of Compliance Report Form (ECCR Form) with their Bids for the Bids to be accepted. The ECCR Form can be found in the Bid Documents.

WAGE RATES: The City of Danville, Illinois has established the rates for the various classifications of workers and crafters on the proposed improvements, with said rates being the prevailing State of Illinois Prevailing Wage Rate. All wages paid by the Contractor and each subcontractor shall be in compliance with The Prevailing Wage Act (820 ILCS 130), as amended, except where a prevailing wage violates a federal law, order or ruling, the rate conforming the federal law, order, or ruling shall govern. Contractor shall provide certified payroll on a monthly basis and retain said payroll records, in accordance with Chapter 820 of the Illinois Compiled Statutes, Section 130/5, as amended in 2005 by Public Act 094-0515.

BID SECURITY: Bid Security in the amount of not less than 5% of the Bid shall accompany each Bid in accordance with the Instructions to Bidders.
CONTRACT SECURITY: The Bidder to whom a Contract is awarded shall furnish a Contract Bond in an amount equal to the computed Contract Price.

BID REJECTION/ACCEPTANCE: The Owner, City of Danville, Illinois reserves the right to reject any and all Bids, waive informalities in bidding, or to accept the Bid or Bids, which best serves the interests of the Owner.

BID WITHDRAWAL: A Bidder may withdraw from the possession of the City, his or her submitted bid only to the previously stated closing time for receipt of the bids. All bids shall remain valid for a period of sixty (60) days after the closing time for receipt of bids.
CITY OF DANVILLE

Notice to Bidders

Project
Pump Station Improvements

County
Vermilion

Local Agency
City of Danville

Project No.
Bid 672

RETURN WITH BID

Time and Place of Opening of Bids

Sealed proposals for the improvement described below will be received at the office of CITY CLERK

17 W MAIN DANVILLE, IL 61832

until 2:00 o’clock P M., May 5, 2021

Proposals will be opened and read publicly at 2:00 o’clock P M., May 5, 2021 at the office of CITY CLERK

17 W MAIN DANVILLE, IL 61832

Description of Work

Name Pump Station Improvements

Location 3301 Fairway Drive, 3410 Fairway Drive, & Lake Ridge Court

Proposed Improvement Rehabilitation and upgrades to current pump stations

Bidders Instructions

1. Plans and proposal forms will be available in the office of Public Works 1155 E Voorhees Suite A and at http://www.cityofdanville.org/bids--rfps.html

2. If prequalification is required, the 2 low bidders must file within 24 hours after the letting an “Affidavit of Availability” (Form BC 57), in triplicate, showing all uncompleted contracts awarded to them and all low bids pending award for Federal, State, County, Municipal and private work. Two copies shall be filed with the Awarding Authority.

3. All proposals must be accompanied by either a proposal bid bond, proposal cashier’s check, or a proposal certified check in the amount of 5% of the total bid price.

4. The Awarding Authority reserves the right to waive technicalities and to reject any or all proposals as provided in the General Conditions.

5. Bidders need not return the entire contract proposal when bids are submitted unless otherwise required. Portions of the proposal that must be returned include the following:
   a. Contract Cover
   b. Notice to Bidders
   c. Contract Proposal
   d. Contract Schedule of Prices
   e. Acknowledgement of Addenda
   f. Signatures
   g. Proposal Bid Bond (if applicable)
   h. Vendor’s Sworn Statement Re. Delinquent Taxes
   i. ECCR Forms
6. The quantities appearing in the bid schedule are approximate and are prepared for the comparison of bids. Payment to the Contractor will be made only for the actual quantities of work performed and accepted or materials furnished according to the contract. The scheduled quantities of work to be done and materials to be furnished may be increased, decreased or omitted as hereinafter provided.

7. Submission of a bid shall be conclusive assurance and warranty the bidder has examined the plans and understands all requirements for the performance of work. The bidder will be responsible for all errors in the proposal resulting from failure or neglect to conduct an in depth examination. The Awarding Authority will, in no case be responsible for any costs, expenses, losses or changes in anticipated profits resulting from such failure or neglect of the bidder.

8. The bidder shall take no advantage of any error or omission in the proposal and advertised contract.

9. If a special envelope is supplied by the Awarding Authority, each proposal should be submitted in that envelope furnished by the Awarding Agency and the blank spaces on the envelope shall be filled in correctly to clearly indicate its contents. When an envelope other than the special one furnished by the Awarding Authority is used, it shall be marked to clearly indicate its contents. When sent by mail, the sealed proposal shall be addressed to the Awarding Authority at the address and in care of the official in whose office the bids are to be received. All proposals shall be filed prior to the time and at the place specified in the Notice to Bidders. Proposals received after the time specified will be returned to the bidder unopened.

10. Permission will be given to a bidder to withdraw a proposal if the bidder makes the request in writing or in person before the time for opening proposals.

11. **DOES NOT APPLY TO FEDERAL AID PROJECTS.** In accordance with the provisions of Section 30-22 (6) of the Illinois Procurement Code, the bidder certifies that it is a participant, either as an individual or as part of a group program, in the approved apprenticeship and training programs applicable to each type of work or craft that the bidder will perform with its own forces. The bidder further certifies for work that will be performed by subcontract that each of its subcontractors submitted for approval either (a) is, at the time of such bid, participating in an approved, applicable apprenticeship and training program; or (b) will, prior to commencement of performance of work pursuant to this contract, begin participation in an approved apprenticeship and training program applicable to the work of the subcontract. The Department, at any time before or after award, may require the production of a copy of each applicable Certificate of Registration issued by the United States Department of Labor evidencing such participation by the contractor and any or all of its subcontractors. Applicable apprenticeship and training programs are those that have been approved and registered with the United States Department of Labor. The bidder shall list in the space below, the official name of the program sponsor holding the Certificate of Registration for all of the types of work or crafts in which the bidder is a participant and that will be performed with the bidder’s forces. Types of work or craft work that will be subcontracted shall be included and listed as subcontract work. The list shall also indicate any type of work or craft job category that does not have an applicable apprenticeship or training program. The bidder is responsible for making a complete report and shall make certain that each type of work or craft job category that will be utilized on the project is accounted for and listed.

The requirements of this certification and disclosure are a material part of the contract, and the contractor shall require this certification provision to be included in all approved subcontracts. In order to fulfill this requirement, it shall not be necessary that an applicable program sponsor be currently taking or that it will take applications for apprenticeship, training or employment during the performance of the work of this contract.

By Order of

City of Danville  Lisa K Monson
(Awarding Authority)  County Engineer/County Superintendent of Highways/Municipal Clerk

**Note:** All proposal documents, including Proposal Guaranty Checks or Proposal Bid Bonds, should be stapled together to prevent loss when bids are processed.
## City of Danville

### Proposal Bid Bond

<table>
<thead>
<tr>
<th>Project</th>
<th>Pump Station Improvements</th>
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</thead>
<tbody>
<tr>
<td>County</td>
<td>Vermilion</td>
</tr>
<tr>
<td>Local Agency</td>
<td>City of Danville</td>
</tr>
<tr>
<td>Project No.</td>
<td>Bid 672</td>
</tr>
</tbody>
</table>

### PAPER BID BOND

WE as PRINCIPAL,

and

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

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

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

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

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

### Principal

(Company Name)

By: __________________________

(Signature and Title)

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

### Surety

(Company Name)

By: __________________________

(Signature and Title)

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

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

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

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

My commission expires __________

(Notary Public)

### ELECTRONIC BID

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

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

Electronic Bid Bond ID Code

(Company/Bidder Name)

(Signature and Title)

Date
CITY OF DANVILLE

Project
Pump Station Improvements
Country
Vermilion
Local Agency
City of Danville
Project No.
Bid 672

RETURN WITH BID

1. Proposal of Pump Station Improvements for 3301 Fairway Drive, 3410 Fairway Drive, & Lake Ridge Court for the improvement of the above section by the construction of

| N/A | a total distance of | N/A | feet, of which a
distance of | N/A | feet, ( N/A | miles) are to be improved.

2. The plans for the proposed work are those prepared by City of Danville - Engineering

3. The specifications referred to herein are the Standard Specifications for Water & Sewer Main Construction in Illinois prepared by the Illinois Society of Professional Engineers and those prepared by the Department of Transportation and designated as “Standard Specifications for Road and Bridge Construction” and the “Supplemental Specifications and Recurring Special Provisions” thereto, adopted and in effect on the date of invitation for bids.

4. The undersigned agrees to accept, as part of the contract, the applicable Special Provisions indicated on the “Check Sheet for Recurring Special Provisions” contained in this proposal.

5. The undersigned agrees to complete the work within ------ working days or by May 1, 2022

6. A proposal guaranty in the amount of 5% of the total bid price will be required. Bid Bonds ☒ will ☐ will not be allowed as proposal guaranties. Accompanying this proposal is either a bid bond if allowed, on form COBRLR 12230 or a proposal guaranty cashier’s or certified check made payable to: STEPHANIE WILSON Treasurer of the CITY OF DANVILLE
the amount of the check is: ______________________________ ( ____________ )

7. In the event that one proposal guaranty check is intended to cover two or more proposals, the amount must be equal to the sum of the proposal guaranties, which would be required for each individual proposal. If the proposal guaranty check is placed in another proposal, it will be found in the proposal for: Project Number N/A

8. If this proposal is accepted and the undersigned fails to execute a contract and contract bond as required, it is hereby agreed that the Bid Bond or check shall be forfeited to the City of Danville.

9. Each pay item should have a unit price and a total price. If no total price is shown or if there is a discrepancy between the product of the unit price multiplied by the quantity, the unit price shall govern. If a unit price is omitted, the total price will be divided by the quantity in order to establish a unit price.

10. A bid will be declared unacceptable if neither a unit price nor a total price is shown.

11. The undersigned firm certifies that it has not been convicted of bribery or attempting to bribe an officer or employee of the State of Illinois, nor has the firm made an admission of guilt of such conduct which is a matter of record, nor has an official, agent, or employee of the firm committed bribery or attempted bribery on behalf of the firm and pursuant to the direction or authorization of a responsible official of the firm. The undersigned firm further certifies that it is not barred from contracting with any unit of State or local government as a result of a violation of State laws prohibiting bid-rigging or bid-rotating.

12. The undersigned submits herewith the SCHEDULE OF PRICES covering the work to be performed under this contract.
VENDOR’S SWORN STATEMENT  
PURSUANT  
TO 65 IL CS 5/11-42.1-1

TO:  CITY OF DANVILLE  
17 WEST MAIN ST.  
DANVILLE, IL. 61832

With reference to bid/purchase order# ________________________, the undersigned states under oath as follows: (check only one (1) box).

☐ 1. The undersigned is not delinquent in the payment of any tax administered by the Illinois Department of Revenue; or,

☐ 2. The undersigned is delinquent in the payment of one or more taxes administered by the Illinois Department of Revenue, but is contesting its liability for the tax or the amount of tax accordance with the procedures established by the appropriate revenue Act; or,

☐ 3. The undersigned is not considered delinquent in the payment of a tax because (i) it has entered into an agreement with the Illinois Department of Revenue for the payment of all such taxes due, and (ii) it is in compliance with the agreement.

Dated: ______________________, 2021  
VENDOR:  
______________________________

Name

By:  ______________________________

Signature

SUBSCRIBED AND SWORN TO

Before me this _________day

of ______________________, 2021

______________________________
Notary Public

EXECUTE AND RETURN WITH BID
CITY OF DANVILLE STANDARD CONTRACT CLAUSES

1.) Any proposed change in this contract shall be submitted to the City of Danville for its prior approval.

2.) In connection with the execution of this contract, the contractor shall not discriminate against any employee or applicant for the employee because of race, religion, color, sex, or national origin. The contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during their employment, without regard to their race, religion, sex, color, or national origin. Such actions shall include but not be limited to the following: Employment upgrading, demotion or transfer, recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

3.) In connection with the performance of this contract, the contractor will cooperate with the City of Danville, Illinois in meeting his or her goals with regard to the City’s goal of 16% minority employment.
CITY OF DANVILLE GENERAL CONDITIONS

1.) The intent of this presentation is to specify a contract for the construction of the project as described in the Notice to Bidders, the Special Provisions, and the plan documents.

2.) The Contractor shall, upon request, submit supportive evidence that he/she has successfully engaged in this type of construction and a list of successfully completed projects may be requested.

3.) No advantage shall be taken of the purchaser by the bidder in the omission of any part or detail, which goes to make the service complete and operable, even though such part is not specifically covered in this specification.

4.) Delays in service caused by bon-fide strikes, government priority or requisition, riots, fires, sabotage, acts of God, or any other delays deemed by the City of Danville, to be clearly and unequivocally beyond the contractor’s control, will be recognized by the City, and the Contractor will be relieved of the responsibility of meeting the delivery time, as stipulated, upon Contractor’s filing with the City, a notarized, just and true statement signed by a responsible official of the contractor’s company, giving in detail all the essential circumstances which, upon verification by the City, justifies such action by the City.

5.) Each proposal shall be submitted with the understanding that the acceptance in writing by the purchaser of the offer to furnish the service described herein shall constitute a contract between the bidder and the purchaser which shall bind the bidder on his/her part to furnish and deliver at his/her bid prices in accordance with the conditions of said accepted proposal and specifications.

6.) Incomplete and/or conditional bids, or those, which take exception to the specifications, may be considered non-responsible and may be rejected.

7.) The City of Danville, Illinois, reserves the right to accept any bid or to reject any or all bids or to award the contract on such basis as it deems to be in the best interest of the City.

8.) Other Information
   A. The City of Danville, Illinois, reserves the right to postpone bid opening for its own convenience, to waive technicalities in the bidding and to reject any or all bids.
   B. Changes to the specifications will be made by addendum.
   C. Requests for information or clarification regarding the bidding documents shall be made in writing 72 hours prior to bid opening.

9.) Bids will be submitted on the forms provided. Bids submitted in any other form may be considered non-responsive and may be rejected. The bid forms must be completely filled out, by the bidder, to be considered responsive.
CITY OF DANVILLE REQUIRED CONTRACT PROVISIONS

1.) It is the intent of the City of Danville, Illinois, to make an award of contract within (30) days after receipt of bids.

2.) Based on the bid proposals received by the City of Danville with regard to this specification, the City will review proposals submitted to see if bids are responsive to the specifications, first. The City will then judge the bidders qualifications to make sure the bidder is qualified to bid.

3.) The contractor shall comply with the Illinois Prevailing Wages Act and any and all other Acts, Statutes of Laws which pertain to workers employed on a Public Works Project. This contract calls for the construction of a “public work,” within the meaning of the Illinois Prevailing Wage Act, 820 ILCS 130/.01 et seq. (“the Act”). The Act requires contractors and subcontractors to pay laborers, workers and mechanics performing services on public works projects no less than the current “prevailing rate of wages” (hourly cash wages plus amount for fringe benefits) in the county where the work is performed. The Illinois Department of Labor (“The Department”) publishes the prevailing wage rates on its website at http://labor.illinois.gov/. The Department revises the prevailing wage rates and the contractor/subcontractor has an obligation to check the Department’s web site for revisions to prevailing wage rates. For information regarding current prevailing wage rates, please refer to the Illinois Department of Labor’s website. All contractors and subcontractors rendering services under this contract must comply with all requirements of the Act, including but not limited to, all wage requirements and notice and record keeping duties.

4.) The successful bidder to whom the award of contract is made shall be given notification of such award and the aforementioned shall have ten (10) working days to execute the service contract. If the contract is not executed within ten (10) working days, the City shall rebid the contract or move to the next highest rated bidder (at the City’s own choice).

5.) In the even a single bid is received the City of Danville, Illinois, may conduct a price and/or cost analysis of the bid. The City will then make a determination as to the acceptance or rejection of the bid.

6.) The performance of work under this contract may be terminated by the procuring agency in accordance with this clause in the best interest of the City of Danville, Illinois. Any such termination shall be affected by delivery to the Contractor a Notice of Termination specifying the extent to which performance for work under the contract is terminated and the date upon which such termination subsequently becomes effective. After receipt of a Notice of Termination, the Contractor shall:
   A. Stop work under the contract on the date given in the Notice of Termination and to the extent specified in the Notice of Termination.
   B. Acknowledge in writing to the City of Danville, Illinois, the receipt of such notice.
   C. Place no further orders or subcontracts for materials, services, or facilities, except as may be necessary for completion of such portion of work as deemed necessary by the City.
   D. Terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the Notice.

7.) This contract may be terminated for cause or convenience after a thirty (30) day written notice.

8.) Any falsification of records or fraudulent activities or practices will be prosecuted and financial remedies will be sought.

9.) As security for acceptance of the contract, each bid shall be accompanied by a bid bond or bid check, drawn payable to the City of Danville, Illinois as required in the Proposal. This bid bond shall be furnished at the time of the bid submittal and shall be executed by the officer, partner or owner authorized to sign for the firm, and the secretary’s signature and seal of the firm must be affixed. The bid deposit of the successful bidder and the two (2) lowest bidders other than the successful bidder shall be held by the City of Danville, Illinois, until such time as each contract has been executed. If the bidder to whom the award of contract is made, neglects or refuses to execute the contract within ten (10) working
days after being notified by the City of Danville, Illinois of award of contract, then the bid deposit shall be forfeited to and retained by the City of Danville, Illinois, as liquidated damages for such neglect or refusal. The next lowest bidder shall then be notified that he/she has been given the award of contract in lieu of the original successful bidder’s refusal or neglect to execute a contract. The next lowest qualified bidder shall then be bound to all conditions of the original successful bidder’s contract. When the City of Danville, Illinois, has an executed contract, all bidders’ deposits relevant to that bid will be returned except those given the award of contract but refusing or neglecting to execute a contract with the City of Danville, Illinois.

10.) The bidder to whom the contract is awarded shall provide a performance bond, payable to the City of Danville, Illinois, in the amount of 100% of his/her total bid.

11.) The bidder to whom the contract is awarded shall provide a payment bond, payable to the City of Danville, Illinois, in the amount of 100% of his/her total bid.

12.) Payments to the Contractor will be made thirty (30) days after invoicing upon receipt of lien waivers with a 5% retainage payable when the project is completed and accepted.

13.) The Contractor shall permit authorized representatives of the City of Danville and the State of Illinois to inspect and audit all data and records of the Contractor relating to his/her performance under the contract.

14.) Assignment of any portion of the work by subcontract must be approved in advance by the City of Danville, Illinois.

15.) Representatives of the City of Danville shall have access to the construction site and shall have the right to inspect all project work.

16.) The Contractor and his/her subcontractors shall maintain Worker’s Compensation, Commercial General Liability Public Liability, Property Damage and Automobile Liability Insurance in amounts and on terms satisfactory to the City of Danville as called for in Section 107 of the State of Illinois Standard Specifications for Road and Bridge Construction current edition. The Contractor shall have on file with the City of Danville a Certificate of Insurance naming the City “Additional Insured” with the required amounts of coverage. Such insurance coverage is required to remain in effect until the City of Danville has accepted the construction.

17.) For a period of one (1) year from the date of completion, as evidence by the date of final acceptance of the work, the Contractor warrants that all work performed under his contract conforms to the contract requirements and is free of any defect of equipment, material or workmanship performed by the Contractor or any of his/her subcontractors or suppliers.

18.) The Contractor shall be responsible for maintaining a certified copy of each payroll for a period of three (3) years. The City shall have access to the documents upon request.
City shall pay Contractor for completion of the Work in accordance with the Contract Documents and amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the Quantity of that item as indicated within the Unit Price Schedule. The City reserves the right to strike out or remove an Item from the Unit Price Schedule.

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Bid Unit Price</th>
<th>Bid Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3301 FAIRWAY PUMP STATION</td>
<td>1</td>
<td>LS</td>
<td>$</td>
<td>$</td>
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<tr>
<td>2</td>
<td>3410 FAIRWAY PUMP STATION</td>
<td>1</td>
<td>LS</td>
<td>$</td>
<td>$</td>
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<tr>
<td>3</td>
<td>LAKE RIDGE COURT PUMP STATION</td>
<td>1</td>
<td>LS</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

TOTAL OF ALL BID PRICES (Sum of Bid Price Items) $_______________________

_______________________ Dollars
(Total in words)

LS = Lump Sum
CITY OF DANVILLE

RETURN WITH BID

Project
County
Local Agency
Project No.

Pump Station Improvements
Vermilion
City of Danville
N/A

(If an individual)

Signature of Bidder ____________________________
Business Address ____________________________

(If a partnership)

Firm Name ____________________________
Signed By ____________________________
Business Address ____________________________

Insert
Names and
Addresses of
All Partners

(If a corporation)

Corporate Name ____________________________
Signed By ____________________________ President
Business Address ____________________________

Insert
Names of
Officers

President ____________________________
Secretary ____________________________
Treasurer ____________________________

Attest: ____________________________ Secretary
CITY OF DANVILLE AFFIRMATIVE ACTION REQUIREMENTS
SECTION 95.15

Dear Contractor/Vendor:

Pursuant to the Human Relations Ordinance, being Chapter 95 of the Code of Ordinances of Danville, Illinois, any business entity contracting to do business with the City of Danville in the total amount of Ten Thousand Dollars ($10,000.00) or more must submit an Employer Certificate of Compliance Report Form (ECCR Form), as a written commitment to provide equal employment opportunity.

The completed form should be submitted to the address listed on page eight (8) of the form. Once the form has been approved, your firm will be issued a certificate of compliance which will include an EEO Certification Number. That number will identify your firm in the contract compliance monitoring system as eligible to conduct business with the City. The certificate of compliance shall be valid for one year. Therefore, prior to the expiration of that year, my office will send you a renewal form. To renew your certificate, you will be required to complete and submit the renewal form to my office.

Please be advised that your failure to properly complete, sign and notarize the ECCR Form will result in it being returned unprocessed. Also, it will result in a delay or denial of your eligibility to bid. If you currently have a valid certificate of compliance, you may submit a copy of it instead of completing and submitting the ECCR Form. However, if you are awarded the contract and you hire additional employees for the current project, you must complete and submit the enclosed Employee Utilization Form to my office.

Also, pursuant to the Human Relations Ordinance, you are required to have a sexual harassment policy as part of your company's policies. Enclosed are sexual harassment guidelines which provide the necessary elements applicable to a sexual harassment policy. If you have a company policy in existence, please review the guidelines against it to ensure that your policy contains all of the necessary elements as provided in the guidelines, paying particular attention to the internal complaint process. If you do not have a policy in existence, you may follow the guidelines in establishing your sexual harassment policy.

If your existing policy complies with the elements contained in the sexual harassment guidelines, please submit a copy along with your completed ECCR Form. If you need to establish a policy, the Ordinance provides that you have 60 days from the date you submit a bid to establish such policy. If you have questions concerning sexual harassment policies, you should consult with an attorney.

Your cooperation in this matter will be appreciated. Please call me at (217) 431-2280 if you have questions or need assistance in completing the enclosed form. Our regular office hours are 8:00 a.m. through 4:30 p.m., Monday through Friday.

Sincerely,

CITY OF DANVILLE

Sandra R. Finch, Administrator
Department of Human Relations

Enclosed: Employer Report Form CC-1
Workforce Addendum
Sexual Harassment Guidelines
Employee Utilization Form
EMPLOYER CERTIFICATE OF COMPLIANCE REPORT FORM
(ECCR Form)

Disclosure of the information requested in this form is required of those companies seeking competitive bid contracts to provide goods and/or services in the amount of $10,000.00 or more with the City of Danville. Failure to properly complete, sign and notarize this form, including the Workforce Profile form, may result in a delay or denial of eligibility to bid on City contracts.

Part I: Identification

1.) a.) Company name and address: ____________________________________________

b.) Assumed business name or other company name used: ____________________________________________

c.) County: ______________________  Telephone: (    ) _______________

d.) Name and address of registered agent: ____________________________________________

e.) Name and title of EEO director or person responsible for the information in this form and the policies hereunder: _____________

f.) If the company is a division or subsidiary, please provide the following information:

Parent Company: ____________________________________________

Location: ____________________________________________

Telephone: (    ) ____________________________________________

Name and Title of CEO: _______________________________

Name and Title of EEO Director: _______________________________

Name and Address of Registered Agent: ________________________

2.) a.) Have you ever been awarded a bid/contract by the City of Danville? 

Yes ________  No ________

If yes and you currently have a valid certificate of compliance, you may submit a copy of it instead of completing and submitting this form and you must also comply with #5 below. Otherwise, you must complete and submit this form as required.

b.) In what capacity would (or does) the Company do business with the City? 

_____ Contractor   _____ Vendor/Supplier   _____ Subcontractor

_____ Manufacturer   _____ Other: _________________________________________

c.) Will the company be providing goods or services through a joint venture?
If so, please provide contact information for the partner(s):

Name: ________________________________________________________________

Address: __________________________________________________________________

City/State/Zip: __________________________________________________________________

Telephone: __________________________________________________________________

3.) Major activity of the company (principal product or service):

________________________________________________________________________

4.) Has the company ever been disqualified to do business with the City?

Yes ________ No ________

If yes, please provide dates and the reasons for disqualification. ________________

________________________________________________________________________

5.) Will the company hire additional employees to perform work under this contract?

Yes ________ No ________

If the answer is yes, please submit a copy of the Employee Utilization form provided with this ECCR Form upon completion of the project. If the answer is no, but you later do in fact hire additional employees, please submit a copy of the form upon completion of the project.

6.) Has the company ever been disqualified from conducting business with a state and/or federal agency?

Yes ________ No ________

If so, please provide dates and the reasons for disqualification. ________________

________________________________________________________________________

7.) a.) Has the company undergone an EEO compliance review by a federal or state agency?

Yes ________ No ________

b.) If so, identify the agency and location: _____________________________

________________________________________________________________________

c.) Date of last review: ________________________________________________
Part II: Employment Information

8.) Please complete the company Workforce Profile form on the last page of this application. Use the number of employees of the most recent payroll period. Be sure to complete all applicable columns.

Part III: Company’s Agreement to Comply with the Contract Compliance Requirements of the City of Danville Human Relations Ordinance

The Company agrees that the provisions of the City of Danville Human Relations Ordinance regulating affirmative action and equal employment opportunity hereby incorporated by reference, shall be complied with the same as if said provisions or policies and procedures were set forth herein verbatim. Specifically, the Company shall:

(i) maintain specific employment practices to achieve equal employment opportunities;

(ii) examine, from time to time, any training programs or other similar opportunities available to determine the level of minorities and women involved in such programs and opportunities and take appropriate affirmative action to recruit minorities and women for such programs and opportunities if they are underutilized;

(iii) examine, from time to time, all job classifications to determine if minority persons or women are underutilized and take appropriate affirmative action to rectify any such underutilization by setting specific goals for participation by minority groups;

(iv) state in all solicitations or advertisements for employees that all applicants will be afforded equal opportunity without unlawful discrimination;

(v) distribute copies of this commitment to all employees who participate in recruitment, screening, referral and selection of job applicants and prospective job applicants;

(vi) require all subcontractors, if any, to submit a written commitment meeting the requirements of the Danville Human Relations Ordinance; and this form; and

(vii) send to each labor organization or representative of workers with which the Company has or is bound by a collective bargaining or other agreement or understanding a notice advising of the Company’s obligations herein.

The Company certifies that it has answered all of the foregoing questions truthfully to the best of its knowledge and belief. The Company further agrees to report any and all changes that would alter the status of any information provided on this form.

As evidence of certification, the Department of Human Relations will issue a “Certificate of Compliance” which shall be valid for one year. Please be sure to note the expiration date. Prior to the expiration of that year, you must complete and submit an Employer Certificate of Compliance Renewal Form (ECCR Form) in order to remain eligible to contract with the City.

If you no longer have a valid Certificate of Compliance, you will not be eligible to contract with the City. Therefore, you must complete and submit a new ECCR Form to my office.
I agree and will comply with all the provisions and requirements listed in ECCR form:

_________________________________________  
Company

_________________________________________  
Print Name and Title of Company Official

_________________________________________  
Signature and Title of Company Official

_________________________________________  
Area Code/Telephone Number

SUBSCRIBED AND SWORN TO before me this ________ day of ______________________, 20_________.

__________________________________  
Notary Public

Please submit this form to:

Sandra R. Finch, Administrator  
Human Relations Department  
City of Danville  
Municipal Building  
17 West Main Street  
Danville, IL 61832  
(217) 431-2280  
(217) 431-2237 – Fax
<table>
<thead>
<tr>
<th>Workforce Profile - Full Time Only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job Classifications</strong></td>
</tr>
<tr>
<td>Officials, Managers, Supervisors</td>
</tr>
<tr>
<td>Professionals</td>
</tr>
<tr>
<td>Technicians</td>
</tr>
<tr>
<td>Sales</td>
</tr>
<tr>
<td>Office/Clerical</td>
</tr>
<tr>
<td>White Collar Trainers</td>
</tr>
<tr>
<td>Skilled Crafts</td>
</tr>
<tr>
<td>Apprentices</td>
</tr>
<tr>
<td>On-the-Job Trainees</td>
</tr>
<tr>
<td>Semi-Skilled</td>
</tr>
<tr>
<td>Service Workers</td>
</tr>
<tr>
<td>Unskilled</td>
</tr>
<tr>
<td><strong>Caucasian</strong></td>
</tr>
<tr>
<td>M F</td>
</tr>
<tr>
<td><strong>Black</strong></td>
</tr>
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<tr>
<td><strong>Hispanic</strong></td>
</tr>
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<tr>
<td><strong>American Indian</strong></td>
</tr>
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<td><strong>Asian</strong></td>
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<td>M F</td>
</tr>
<tr>
<td><strong>Total Employees</strong></td>
</tr>
<tr>
<td>M F</td>
</tr>
<tr>
<td><strong>Employment Record</strong></td>
</tr>
<tr>
<td><strong>Visual Check</strong></td>
</tr>
<tr>
<td><strong>Above Employee Figures Obtained</strong></td>
</tr>
</tbody>
</table>

20
I. Purpose

Title VII of the Civil Rights Act of 1964 makes it an unlawful employment practice to discriminate against any individual with respect to terms and conditions of employment because of that person’s race, color, religion, sex, national origin or handicap. Any conduct in the workplace that takes place because of a person’s gender is sex discrimination prohibited by Title VII and the City of Danville’s Human Relations Ordinance which makes similar provisions. Therefore, the company has implemented the following sexual harassment policies and procedures.

It is the policy of the company that all employees have the right to work in an environment free from all forms of discrimination and conduct which can be considered harassing, coercive or destructive, including sexual harassment.

The company's position is that sexual harassment is a form of misconduct that undermines the integrity of the employment relationship. No employee, either male or female, should be subject to unsolicited and unwelcomed sexual overtures or conduct, either verbal or physical. Sexual harassment does not refer to occasional compliments of a socially acceptable nature. It refers to behavior that is not welcome, that is personally offensive, that debilitates morale, and that, therefore, interferes with work effectiveness. Such behavior may result in disciplinary action up to and including dismissal.

II. Coverage - All employees shall be covered by this policy.

III. Management Responsibility

Sexual harassment, whether committed by supervisory or non-supervisory personnel, is specifically prohibited as unlawful and against stated company policy. In addition, management shall be responsible for taking action against acts of sexual harassment by non-supervisory personnel or others, regardless of whether the specific acts complained of were sanctioned or specifically forbidden and regardless of the manner in which the company becomes aware of the conduct.

IV. Policy Implementation

1. It is the responsibility of group, division, department and operations heads to make sure that their facility is in full compliance with this policy and associated legal guidelines.

2. Employees that have complaints should report such conduct to their supervisors, if this is not appropriate, employees are urged to seek the assistance of their company personnel or EEO representative.
3. It is the responsibility of the company's ranking personnel or EEO representative to: provide guidance, investigate charges of Impropriety; and recommend appropriate action. All claims must be thoroughly investigated. The manager of EEO contract compliance and counsel for EEO affairs will provide guidance and assistance in proper handling of any allegations.

V. Legal Definition and Guidelines

Illinois law defines sexual harassment as follows: sexual harassment means any unwelcome sexual advances or requests for sexual favors or any conduct of a sexual nature when (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment, (2) submission to or rejection of such conduct by an individual is used as the basis for employment decisions affecting such individual, or (3) such conduct has the purpose or the effect of substantially interfering with an individual's work performance or creating an intimidating, hostile or offensive working environment.

**Sexual advances may be either verbal or physical.**

A term or condition of employment may include, but not be limited to, hiring, promotion, training, work assignments, overtime assignments, or pay increases.

VI. Examples of Sexual Harassment

1. **Quid pro quo harassment.** A supervisor with authority to affect an employee's working conditions makes unwelcome sexual advances. Submission to the advances is an expressed or implied condition for receiving job benefits, or refusal to submit to the demands results in the loss of a job benefit or in discharge. For example, a supervisor says: "go out to dinner with me if you want that raise or if you want to keep your job".

2. **Hostile environment.** This is a relentless and continuing sexual conduct in the work place that interferes with an employee's work performance or that creates an intimidating, hostile, abusive or offensive work environment. Hostile environment harassment can also be found from any unfavorable working conditions directed only at one sex. Pervasive animosity or extreme rudeness directed only at women, for example, can be the basis for a hostile working environment claim.

**The following are examples of this type of sexual harassment.**

Photographs, Graffiti, Comments: Throughout the shipyard in which Lois worked as a welder, pictures of nude women in sexually suggestive or submissive poses were posted. The pictures consisted of plaques on walls, magazines and photographs torn from magazines and placed on walls or affixed to vendor advertising calendars. The calendars themselves also depicted nude or partially nude women. Some sexually offensive drawings and graffiti were on the walls.
No pictures of nude or partially nude men were posted in the workplace. Coupled with the pictures were sexually demeaning comments and jokes made by male employees and supervisors to Lois (and other female employees) or in her presence.

Rude Treatment of Women: John felt women were a threat to his position of head of a military EEO office, so he constantly abused his three female subordinates. In addition to offering little guidance and refusing his staff access to needed documents and mail, he used expressions such as "okay babe" and "listen here woman" in reference to Virginia, an EEO Specialist under his supervision. He also would scream and threaten Virginia for leaving the office on occasion and once physically prevented her from leaving, while on another occasion blowing cigar smoke in her face. The two other subordinates were also subjected to shouting and insults, such as being called stupid. Furthermore, John complained to a manager that he had "dumb females working for him who couldn't read or write," and he once tried to stuff paper down the blouse of a female employee who was not in his department. John's abusive treatment of female workers was sexual harassment because it was not extended to male employees.

3. Sexual favoritism. A woman may be granted a promotion because she submits to unwelcome requests for sexual favors from a supervisor. Under those circumstances, both male and female workers can allege sexual harassment by showing that they were denied a chance at promotion because of the sexual harassment directed toward that one female employee.

4. Harassment by non-employees. Employers can be liable for the sexual harassment of employees by customers or other third parties if the employer has some degree of control to stop the improper behavior.

For example, an employer who requires female employees to dress in revealing uniforms which cause offensive comments and physical conduct to be directed at the female employees by members of the public and after notification of such comments and conduct continues to require the females to wear the uniforms will be liable for sexual harassment.

VII. Procedure for Internal Complaint.

A. Employee

1. Complaints of sexual harassment should be brought to the attention of the (1) immediate supervisor, (2) department head, (3) EEO officer (person responsible for implementing and maintaining this policy), (4) manager, personnel department (if separate from EEO officer).

2. If the alleged harasser is the employee's supervisor or employed in one of the above listed offices, the employee should feel free to bypass the supervisor or office and take the complaint to one of the other offices listed,
or through the Danville Human Relations Department or the Illinois Department of Human Rights as provided in Section VIII of this policy.

B. Company

1. The EEO Officer shall be notified of any complaint.

2. After notification of the employee's complaint, a confidential investigation will be initiated to gather all facts about the complaint.

3. After the investigation has been completed, a determination will be made by appropriate management regarding the resolution of the complaint.

4. If warranted, disciplinary action will be taken in accordance with the following penalties.

   (a) written reprimand;

   (b) an order to stay away from the complainant;

   (c) either the complainant employee or the employee who committed the harassment may be transferred to a different department, so long as it does not substantially change such employee's duties, pay or benefits; or

   (d) termination.

Such penalties may be imposed individually or in combination.


A. Employee

1. An employee may choose to raise the complaint through one of the following agencies: Danville Human Relations Department, the Illinois Department of Human Rights or the Equal Employment Opportunity Commission (EEOC).

2. Complaints should be brought to:

   (a) Sandra R. Finch, Administrator
       Human Relations Department
       City of Danville
       17 West Main Street
       Danville, IL 61832
       (217) 431-2280
(b) Illinois Department of Human Rights – (217) 785-5100
(c) Equal Employment Opportunity Commission (EEOC)
   (312) 353-8985

B. Agency

1. Once a complaint is filed, the agency will commence an investigation to
determine whether sexual harassment has occurred.

2. Upon investigation, a determination will be made as to whether a complaint
should continue forward. If it is determined that a complaint should proceed
forward, it will proceed through conciliation and, if necessary, a public
hearing.

IX. Non-Retaliation.

This policy also prohibits retaliation against any employees who bring sexual harassment
charges or assist in investigating charges. Any employee bringing a sexual harassment
complaint or assisting in the investigation of such a complaint will not be adversely
affected in terms and conditions of employment, nor discriminated against or discharged
because of the complain
EXECUTE AFTER CONTRACT AWARD

1. THIS AGREEMENT, made and concluded the ______ day of ______________________, Month and Year, between the ____________________________ of ____________________________ acting by and through its ____________________________ known as the party of the first part, and ____________________________ his/their executors, administrators, successors or assigns, known as the party of the second part.

2. Witnesseth: That for and in consideration of the payments and agreements mentioned in the Proposal hereto attached, to be made and performed by the party of the first part, and according to the terms expressed in the Bond referring to these presents, the party of the second part agrees with said party of the first part at his/their own proper cost and expense to do all the work, furnish all materials and all labor necessary to complete the work in accordance with the plans and specifications hereinafter described, and in full compliance with all of the terms of this agreement and the requirements of the Engineer under it.

3. And it is also understood and agreed that the Notice to Contractors, Special Provisions, Proposal and Contract Bond hereto attached, and the Plans for Project No. __________ Bid 672 in __________________________, approved by the Department of Engineering of the City of Danville, __________________________, are essential documents of this contract and are a part hereof.

4. IN WITNESS WHEREOF, The said parties have executed these presents on the date above mentioned.

Attest: ____________________________ Clerk By ____________________________

(Seal)

Party of the First Part

((If a Corporation)

Corporate ____________________________

By ____________________________

President Party of the Second Part

((If a Co-Partnership)

Attest: ____________________________

Secretary

Partners doing Business under the firm name of ____________________________

Party of the Second Part

((If an individual) Party of the Second Part
EXECUTE AFTER CONTRACT AWARD

We, a/an) □ Individual □ Co-partnership □ Corporation organized under , as PRINCIPAL, as SURETY,
are held and firmly bound unto the City of Danville (hereafter referred to as “COD”) in the penal sum of

United States, well and truly to be paid unto said COD, for the payment of which we bind ourselves, our heirs, executors, administrators, successors, jointly to pay to the COD this sum under the conditions of this instrument.

WHEREAS THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH that, the said Principal has entered into a written contract with the COD acting through its awarding authority for the construction of work on the above section, which contract is hereby referred to and made a part hereof, as if written herein at length, and whereby the said Principal has promised and agreed to perform said work in accordance with the terms of said contract, and has promised to pay all sums of money due for any labor, materials, apparatus, fixtures or machinery furnished to such Principal for the purpose of performing such work and has further agreed to pay all direct and indirect damages to any person, firm, company or corporation suffered or sustained on account of the performance of such work during the time thereof and until such work is completed and accepted; and has further agreed that this bond shall inure to the benefit of any person, firm, company or corporation to whom any money may be due from the Principal, subcontractor or otherwise for any such labor, materials, apparatus, fixtures or machinery so furnished and that suit may be maintained on such bond by any such person, firm, company or corporation for the recovery of any such money.

NOW THEREFORE, if the said Principal shall well and truly perform said work in accordance with the terms of said contract, and shall pay all sums of money due or to become due for any labor, materials, apparatus, fixtures or machinery furnished to him for the purpose of constructing such work, and shall commence and complete the work within the time prescribed in said contract, and shall pay and discharge all damages, direct and indirect, that may be suffered or sustained on account of such work during the time of the performance thereof and until the said work shall have been accepted, and shall hold the COD and its awarding authority harmless on account of any such damages and shall in all respects fully and faithfully comply with all the provisions, conditions and requirements of said contract, then this obligation to be void; otherwise to remain in full force and effect.
IN TESTIMONY WHEREOF, the said PRINCIPAL and the said SURETY have caused this instrument to be
signed by their respective officers this __________ day of __________ A.D. ______

PRINCIPAL

(Company Name)

By: ____________________________
(Signature & Title)

Attest: ____________________________
(Signature & Title)

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

STATE OF ILLINOIS,
COUNTY OF ________________________________
I, ________________________________, a Notary Public in and for said county, do hereby certify that

__________________________________________________________________________________

(insert names of individuals signing on behalf or PRINCIPAL)

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

Given under my hand and notarial seal this __________ day of __________ A.D. ______

My commission expires ____________________________
Notary Public ____________________________ (SEAL)

SURETY

By: ____________________________
(Signature of Attorney-in-Fact)

STATE OF ILLINOIS,

(SEAL)

COUNTY OF ________________________________
I, ________________________________, a Notary Public in and for said county, do hereby certify that

__________________________________________________________________________________

(insert names of individuals signing on behalf or SURETY)

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

Given under my hand and notarial seal this __________ day of __________ A.D. ______

My commission expires ____________________________
Notary Public ____________________________ (SEAL)

Approved this __________ day of __________ A.D. ______

Attest:

______________________________ (City of Danville)
______________________________ (Mayor)
CONTRACT DOCUMENTS & SPECIFICATIONS
City of Danville, Illinois

Pump Station Improvements

For Bidding

Project No.: 19-156

March 16, 2021

FEHR GRAHAM
ENGINEERING & ENVIRONMENTAL

1610 Broadmoor Drive
Champaign, Illinois 61821

Prepared for:
City of Danville
1155 E. Voorhees Street
Suite A
Danville, Illinois 61832
CONTRACT DOCUMENTS
AND
SPECIFICATIONS
FOR
PUMP STATION IMPROVEMENTS

PREPARED FOR:
CITY OF DANVILLE, ILLINOIS

PROJECT NO.: 19-156
DATE: March 16, 2021

SIGNATURE:  
Matthew A. Johnson, PE, SE

DATE: 3/16/21

PREPARED BY:
FEHR GRAHAM
STATE OF ILLINOIS LICENSE NO. 184-003525
## SECTION 00 00 02

### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Division</th>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIVISION 02 – EXISTING CONDITIONS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selective Structure Demolition</td>
<td>02 41 19</td>
<td>2</td>
</tr>
<tr>
<td>DIVISION 09 – FINISHES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Painting and Finishing</td>
<td>09 91 00</td>
<td>11</td>
</tr>
<tr>
<td>DIVISION 26 - ELECTRICAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Electrical Requirements</td>
<td>26 00 10</td>
<td>11</td>
</tr>
<tr>
<td>Provisions for Electric Utility Service</td>
<td>26 05 04</td>
<td>3</td>
</tr>
<tr>
<td>Low-Voltage Power Conductors and Cables</td>
<td>26 05 19</td>
<td>5</td>
</tr>
<tr>
<td>Grounding and Bonding for Electrical Systems</td>
<td>26 05 26</td>
<td>8</td>
</tr>
<tr>
<td>Hangers and Supports for Electrical Systems</td>
<td>26 05 29</td>
<td>3</td>
</tr>
<tr>
<td>Raceways and Boxes for Electrical Systems</td>
<td>26 05 33</td>
<td>9</td>
</tr>
<tr>
<td>Identification of Electrical Systems</td>
<td>26 05 53</td>
<td>7</td>
</tr>
<tr>
<td>Low-Voltage Transformers</td>
<td>26 22 00</td>
<td>6</td>
</tr>
<tr>
<td>Panelboards</td>
<td>26 24 16</td>
<td>7</td>
</tr>
<tr>
<td>Wiring Devices</td>
<td>26 27 26</td>
<td>4</td>
</tr>
<tr>
<td>DIVISION 31 – EARTHWORK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soils and Aggregates for Earthwork</td>
<td>31 05 10</td>
<td>2</td>
</tr>
<tr>
<td>Site Clearing</td>
<td>31 10 00</td>
<td>2</td>
</tr>
<tr>
<td>Grading</td>
<td>31 22 00</td>
<td>2</td>
</tr>
<tr>
<td>Excavation and Fill</td>
<td>31 23 00</td>
<td>5</td>
</tr>
<tr>
<td>Dewatering</td>
<td>31 23 19</td>
<td>1</td>
</tr>
<tr>
<td>Trenching, Backfilling, and Compacting</td>
<td>31 23 33</td>
<td>7</td>
</tr>
<tr>
<td>Erosion and Sedimentation Control</td>
<td>31 25 00</td>
<td>12</td>
</tr>
<tr>
<td>DIVISION 32 – EXTERIOR IMPROVEMENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paving and Surfacing</td>
<td>32 10 05</td>
<td>3</td>
</tr>
<tr>
<td>Chain Link Fence</td>
<td>32 31 00</td>
<td>3</td>
</tr>
<tr>
<td>Turfs and Grasses</td>
<td>32 92 00</td>
<td>3</td>
</tr>
<tr>
<td>DIVISION 33 – UTILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ductile Iron Pipe and Fittings</td>
<td>33 00 04</td>
<td>4</td>
</tr>
<tr>
<td>Poly Vinyl Chloride Plastic Pipe and Fittings</td>
<td>33 00 09</td>
<td>4</td>
</tr>
<tr>
<td>Testing and Inspection of Pipelines and Appurtenances</td>
<td>33 05 01</td>
<td>4</td>
</tr>
<tr>
<td>Utility Piping – General Provisions</td>
<td>33 05 05</td>
<td>5</td>
</tr>
</tbody>
</table>
DIVISION 40 – PROCESS INTERCONNECTIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Code</th>
<th>Page</th>
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<tr>
<td>Process Piping</td>
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<td>8</td>
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<tr>
<td>Process Valves</td>
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<td>21</td>
</tr>
<tr>
<td>Level Switches</td>
<td>40 72 76</td>
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DIVISION 43 – PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

<table>
<thead>
<tr>
<th>Item</th>
<th>Code</th>
<th>Page</th>
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<tbody>
<tr>
<td>Submersible Grinder Pumps</td>
<td>43 26 13</td>
<td>13</td>
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END SECTION.
SECTION 02 41 19
SELECTIVE STRUCTURE DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY
A. Demolition of designated structures and removal of materials from site.
B. Demolition and removal of foundations and slabs on grade.
C. Demolition and removal of site paving.
D. Disconnecting and capping or removal of identified utilities.
E. Refer to items specified for demolition shown on drawings.

1.02 RELATED SECTIONS
A. Division 1 through 46, as applicable

1.03 SUBMITTALS
A. Shop Drawings: Indicate demolition, removal sequence, and location of salvageable items; location and construction of barricades, fences, and temporary work.
B. Project Record Documents: Accurately record actual locations of capped utilities, subsurface obstructions, and etc.

1.04 REGULATORY REQUIREMENTS
A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, and disposal.
B. Obtain required permits from authorities.
C. Notify affected utility companies before starting work and comply with their requirements.
D. Do not close or obstruct roadways, sidewalks, or hydrants without permits.
E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

PART 2 – PRODUCTS

2.01 MATERIALS
A. Fill Material: Compacted Excavated Material
B. Repair Materials:
   1. Use repair materials equal to existing materials:
      a. Where equal materials are not available or cannot be provided for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
      b. Use materials which have equal or superior performance to that of existing materials.
PART 3 – EXECUTION

3.01 PREPARATION
A. Provide, erect, and maintain temporary barriers and security devices to assume safety of all persons.
B. Protect existing landscaping materials, appurtenances, structures, and all facilities that are not to be demolished.
C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
D. Mark location of utilities.

3.02 DEMOLITION REQUIREMENTS
A. Conduct demolition to minimize interference with adjacent structures or occupancies.
B. Cease operations immediately if adjacent structures appear to be in danger. Notify Engineer and Owner and authority having jurisdiction. Do not resume operations until directed.
C. Conduct operations with minimum interference to public or private accesses. Maintain protected egress and access at all times.
D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.
E. Sprinkle demolition areas with water to minimize dust. Provide hoses and water connections for this purpose.

3.03 DEMOLITION
A. Disconnect and cap designated utilities within demolition areas. Remove and Identify disconnected utilities.
B. Remove foundation walls and footings to a minimum of two feet below finished grade or within area of new construction.
C. Remove concrete slabs on grade.
D. Break up concrete slabs on grade to permit natural moisture drainage.
E. Break up site paving in areas indicated.
F. Remove materials to be retained or re-installed in a manner that will prevent damage.
G. Backfill areas excavated, open pits, and holes caused as a result of demolition, in accordance with these specifications.
H. Rough grade and compact areas affected by demolition to maintain site grades and contours.
I. Remove demolished materials from site.
J. Do not burn or bury materials on site. Leave site in clean condition.
K. Remove temporary work.

END SECTION.
SECTION 09 91 00
PAINTING AND FINISHING

PART 1 – GENERAL

1.01 SUMMARY
   A. Furnish and apply coatings and perform related work, all as necessary to complete the work shown on the drawings and specified.

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

1.03 DEFINITIONS
   A. Abbreviations
      1. ASTM – American Standard Testing Materials
      2. OSHA – Occupational Safety and Health Administration
      3. SSPC – Steel Structures Painting Council
      4. TNE – Tnemec Company, Inc.
      5. SW – The Sherwin Williams Paint Co.
      6. DFT – Dry film thickness
      7. DMT – Dry mil thickness
      8. NFPA – National Fire Protection Association
      9. NACE – National Association of Corrosion Engineers
   B. Coating
      1. The term coating includes emulsions, enamels, paints, stains, varnishes, sealers, emulsion filler, and other coating materials whether used as prime, intermediate, or finish coats.
   C. Spatter
      1. Drops and droplets of coating and spilled or splashed coatings on surfaces not specified to be coated or surfaces previously finish coated.

1.04 QUALITY ASSURANCE
   A. All coating and surface preparation shall be completed by a qualified painting contractor who shall have experience in applying protective coatings to industrial and municipal water and wastewater treatment facilities.
   B. All coating shall be done strictly in accordance with the most recent manufacturer’s printed instructions and shall be performed in a manner satisfactory to the Engineer.
C. Minimum requirements for materials are included in this Section. These requirements are intended to establish standards of quality. Products of manufactures which meet all minimum requirements as herein established shall be acceptable. Written acceptance of the materials to be used shall be obtained prior to surface preparation or application.

D. No request for substitution will be considered which decreases the film thickness designated, or which offers a change from the generic type of coating specified. Requests for substitution shall contain the full name of each product, descriptive literature, directions for use, generic type, and nonvolatile content by volume.

E. All materials shall be brought to the job site in the original sealed and labeled containers of the manufacturer and shall be subject to inspection by the Engineer’s representative.

F. All materials shall be the product of, or recommended by, the coating manufacturer.

G. All materials shall be compatible with the service intended. No products shall be used that may have ingredients which might react detrimentally with the adjacent fluids or gases.

1.05 SUBMITTALS

A. Submittals shall be as specified in the General Conditions.

B. Submit the following:
   1. Technical product data sheets for all products used.
   2. Color charts
   3. Samples of slip-resistant adhesive tape, if used.
   4. List of surfaces indicating coating system and colors.
   5. Manufacturer’s application instructions.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of the products.

B. Promptly remove damaged or deteriorated products from the job site, including products which have exceeded their shelf life. Replace damaged products with undamaged and undeteriorated products.

C. All painting materials stored on the job site shall be stored in a location consistent to the manufacturer’s storage requirements. The Contractor shall take all safety precautions in accordance with NFPA Bulletin No. 101.

1.07 JOB CONDITIONS

A. Environmental Requirements
   1. Perform coating work in strict conformance with the manufacturer’s printed recommendations as to environmental conditions under which the coating and coating systems can be applied.
   2. Do not apply the finish in areas where dust is being generated.
   3. During the course of the coating work, adequately ventilate the coated spaces to ensure there will be no concentration of noxious odors, hazardous fumes, or flammable vapors.
4. Unless otherwise noted, do not apply coating in damp weather or when the temperature is below 50ºF or above 95ºF.

5. Provide heating and enclosures when necessary to maintain the specified temperature during the application and curing of the coatings.

6. Provide forced air circulation in enclosed areas during the application and curing periods.

7. All costs associated with providing and/or maintaining the required environmental conditions shall be borne by the coating sub-contractor.

B. Protection

1. Protect all finish work of other trades and surfaces not being coated. Furnish suitable coverings as required. Remove coating spatter from all finished surfaces, and restore finishes of affected items to their original conditions at no additional cost to the Owner.

2. Post “Wet Paint” notices, as required, to protect newly coated surfaces.


4. Protection of Adjacent Surfaces
   a. Cover or otherwise protect all finished work or other trades and surfaces not being painted. Remove finish hardware, accessories, light fixtures and cover plates, factory finished work, and similar items. Replace upon completion of painting.

C. Job Site Conference

1. The Contractor shall arrange and conduct a job site conference between the coating manufacturer’s representative, the Owner’s representative, and the personnel assigned this work prior to any field surface preparation or coating application.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Except as otherwise specified, materials shall be the products of the following manufacturers, or approved equal:
   1. Tnemec Company, Inc. (TNE)
   2. The Sherwin Williams Company (SW)

B. Equivalent materials of other manufacturers may be substituted on written approval of the Engineer. Requests for substitution shall include the manufacturer’s literature for each product giving the name, generic type, and descriptive information. Submittals shall include the following performance data as certified by a qualified testing laboratory:
   1. ASTM D 4541: Adhesion
   2. ASTM B 117: Salt Spray
   3. ASTM D 1653: Permeability
   4. ASTM D 4060: Abrasion
5. ASTM D 4585: Humidity
6. Galvanic Protection: Conductivity

C. Materials selected for coating systems for each type of surface shall be the product of a single manufacturer, unless otherwise acceptable to the Engineer.

2.02 MATERIALS

A. All field applied primers and undercoats shall be provided to ensure compatibility of the total coating systems and of the same manufacturer as the finish coats for each system as specified hereafter. Provide barrier coats over incompatible primers or remove and re-prime as required. No thinner or solvents other than those approved by the Coating Manufacturer shall be used.

B. All materials shall herein be assigned a designation number for ease of reference. The minimum material requirements shall be as listed.

2.03 COATING SYSTEMS

All surfaces to be coated shall be cleaned of all dirt, oil, grease, salts, mill scale, and other foreign matter prior to the surface preparation and coating applications described below.

A. Non-Submerged Interior or Exterior Metals, Machinery, and Piping
   1. Surface Preparation
   2. Commercial blast, per SSPC-SP6; Achieve 1.0 to 2.0 mil profile
   3. Prime Coat (shop coated or field coated)
      a. Organic Zinc-Rich Urethane; One coat; 2.5 to 3.5 mils DFT
         1) TNE: Tneme-Zinc, Series 90-97
         2) SW: Corothane I Galvapa 1K Zinc Primer; B65G11
   4. Finish Coat
      a. Aliphatic Acrylic Polyurethane; Two coats, 2.0 to 5.0 mils DFT per coat
         1) TNE: Endura-Shield, Series 73U
         2) SW: Acrolon 218 HS, B65 W600 Series
   5. Minimum of three coats and a minimum total finished DMT of 6.5.

B. Submerged Metals, Piping, and Machinery
   1. Surface Preparation
   2. Near-white blast, per SSPC-SP10; Achieve 1.0 to 2.0 mil profile
   3. Prime Coat (shop coated or field coated)
      a. Potable Water Service: Organic Zinc-Rich Urethane; One coat; 2.5 to 3.5 mils DFT
         1) TNE: Tneme-Zinc, Series 90-97
         2) SW: Corothane I, B65 Series
b. Non-Potable, Wastewater, and Sludge Service: Organic Zinc-Rich Urethane; One coat; 2.5 to 3.5 mils DFT
   1) TNE: Tneme-Zinc, Series 90-97
   2) SW: DuraPlate 235, B67-235 Series

4. Finish Coat
   a. Potable Water Service: Modified Epoxy; Two coats, 6.0 to 8.0 mils DFT per coat
      1) TNE: Hi-Build Epoxoline II, Series L69F
      2) SW: Dura-Plate 235, B67-235 Series
   b. Non-Potable, Wastewater, and Sludge Service: Modified Epoxy; Two coats, 6.0 to 8.0 mils DFT per coat
      1) TNE: Hi-Build Epoxoline II, Series L69F
      2) SW: Dura-Plate 235, B67-235 Series

5. Minimum of three coats and a minimum total finished DMT of 14.5.

C. Interior or Exterior Fiberglass (FRP) and PVC Piping and Surfaces
   1. Surface Preparation
   2. Cleaner/Detergent per SSPC-SP1, Lightly abrade with sandpaper; Surface to resemble medium-grit sandpaper
   3. Prime Coat
      a. Epoxy; One coat; 2.5 to 4.0 mils DFT
         1) TNE: Hi-Build Epoxoline, Series 66 or 69
         2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series
   4. Finish Coat (Interior)
      a. Polyainide Epoxy; One coat, 2.5 to 4.0 mils DFT
         1) TNE: Hi-Build Epoxoline, Series 66 or 69
         2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series
   5. Finish Coat (Exterior)
      a. Aliphatic Acrylic Polyurethane; One coat, 2.5 to 4.0 mils DFT
         1) TNE: Endura-Shield, Series 73
         2) SW: Acrolon 218 HS, B65 W600 Series

6. Minimum of two coats and a minimum total finished DMT of 5.0.

D. Interior Concrete Walls and Ceilings
   1. Surface Preparation
a. Abrade per ASTM D4259; achieve a profile of 80 grit sandpaper. Fill in voids, holes, pits, and cracks per the manufacturer’s instructions. Scrub existing walls with ADD H2O.

2. Prime Coat and Finish Coat
   a. Epoxy
      1) TNE: Threme-Glaze, Series 280, 2 coats, 8.0 to 10.0 mils DFT per coat
      2) SW: Macropoxy 646 Fast Cure Epoxy, B58-600 Series, 2 coats, 8.0 to 10.0 mils DFT per coat

3. Minimum of two coats and a minimum total finished DMT of 16.0.

E. Concrete Floors
   1. Surface Preparation
      a. Prepare per ASTM D4259; achieve a profile of 80 grit sandpaper, or per manufacturer’s instructions.

2. Clear or Colored Sealer; Gloss Finish
   a. Prime Coat: Epoxy, One coat
      1) TNE: Series 201 Epoxyprime, 10.0 to 12.0 mils DFT
      2) SW: ArmorSeal 1000 HS, B67-2000 Series, 10.0 to 12.0 mils DFT

3. Clear or Colored Sealer; Satin Orange Peel Finish
   a. Prime Coat Epoxy, Two coats, 4.0 to 6.0 mils DFT per coat
      1) TNE: Series 285 Satinglaze
      2) SW: ArmorSeal 1000 HS, B67-2000 Series, 10.0 to 12.0 mils DFT

4. Minimum of two coats and a minimum total finished DMT of 8.0.

F. Drywall
   1. Surface Preparation
   2. Water soluble cleaner per SSPC-SP1

3. Prime Coat Vinyl Acrylic; One coat; 1.0 to 2.0 mils DFT
   a. TNE: 5 1-792 PVA Sealer
   b. SW: ProMar 200 Zero VOC Primer, B28W2600

4. Finish Coat Water-Based Acrylic-Epoxy, Two coats, 4.0 to 6.0 mils DFT per coat
   a. TNE: Series 113/114 H. B. Theme-Tufcoat
   b. SW: Pro Industrial Water Based Catalyzed, B73-300 Series

5. Minimum of three coats and a minimum total finished DMT of 9.0.

G. High-Temperature Metals
   1. Surface Preparation
a. Near-white Metal Blast per SSPC-SP10

2. Prime Coat, One Coat
   a. TNE: Tneme-Zinc, Series 90-96, 2.0 to 3.5 mils DMT
   b. SW: Heat Flex Hi-Temp 1000, 2.0-2.5 mils DFT

3. Finish Coat
   a. TNE: Silicone Aluminum, Series 39-661, Two coats, 1.0 to 1.5 mils DMT per coat
   b. SW: Heat Flex Hi-Temp 1000, 2.0-2.5 mils DFT

4. Minimum of (TNE) three coats and a minimum DFT of 5.0; or (SW) two coats and a minimum DFT of 4.0.

H. Notes
   1. The total finish dry mil thickness shall be in accordance with the manufacturer’s coating system’s requirements.
   2. The term submerged applies to water and wastewater. Special consideration shall be given to applications where acids or other highly corrosive materials will be present.
   3. The minimum total dry film thickness excludes the primer.

2.04 COLORS
A. Comply with OSHA requirements concerning color coding and safety marking.

B. Color code exposed piping. Color code equipment associated with piping, unless otherwise shown or specified. Whenever banding is listed for color coding, bands shall be six inches wide spaced along the pipe at five foot intervals.

C. Color coding shall be generally as follows. Specific colors for each type of service will be selected by the Owner after the submittal of the color charts.

<table>
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<tr>
<th>Application</th>
<th>Color</th>
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<tbody>
<tr>
<td>Dangerous Machine Parts and Energized Equipment</td>
<td>Safety Orange</td>
</tr>
<tr>
<td>Traffic Operations and Housekeeping marking</td>
<td>White</td>
</tr>
<tr>
<td>Fire Protection Equipment and Flammable Materials</td>
<td>Safety Red</td>
</tr>
<tr>
<td>Radiation Hazards</td>
<td>Safety Yellow with Black Legend</td>
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<tr>
<td>Water Lines, Finished or Potable</td>
<td>Dark Blue</td>
</tr>
<tr>
<td>Wastewater Lines</td>
<td>Light Gray</td>
</tr>
<tr>
<td>Sludge Lines</td>
<td>Dark Gray</td>
</tr>
<tr>
<td>Sewer (Sanitary or Other)</td>
<td>Dark Brown</td>
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<td><strong>Application</strong></td>
<td><strong>Color</strong></td>
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### Chemical Lines

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<td>Safety Green</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Safety Yellow</td>
</tr>
<tr>
<td>Other Items</td>
<td>To Be Determined in the Field</td>
</tr>
</tbody>
</table>

2.05 MIXING AND TINTING

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

B. Job tinting shall not be acceptable, unless authorized by the Owner in writing.

C. All mixing shall be done in mixing pails placed in suitably sized non-ferrous or oxide resistant metal pans.

### PART 3 – EXECUTION

3.01 INSPECTION

A. Inspect all surfaces on which paint is to be applied, and notify the Engineer of any defects considered detrimental to the application of the materials specified.

B. If any dirty, rusty, scaly, greasy, damp, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film are painted over, both the removal of the paint and repainting the affected area shall be performed by the Contractor without additional cost to the Owner.

C. Provide all scaffolding, staging, and other temporary facilities required for the proper execution of the work. Scaffolding shall be placed in a manner not to interfere with the work of others. Should it be necessary for the progress of the work on the building in general, the Contractor shall, if so directed by Owner and without extra cost to the Owner, move, relocate, or arrange his scaffolds, ladders, or coverings to permit the Owner or other crafts to proceed with their work without delay.

D. The Contractor shall furnish a low voltage wet sponge instrument for checking film continuity. The Contractor shall also furnish a dry mil thickness gauge for checking film thicknesses.

3.02 SURFACE PREPARATION

A. General

1. All surfaces to be coated shall be prepared in a workman-like manner with the objective of obtaining a clean and dry surface. No coating shall be applied before the prepared surfaces are approved by the Engineer.

2. All preparation and cleaning procedures shall be in strict accordance with the coating manufacturer’s printed instructions and as specified in this Section for each particular substrate condition.
3. Remove or otherwise protect hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be painted prior to surface preparation and painting operations. Remove items, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space, reinstall the removed items. Such removal and reinstalling shall be done by workmen skilled in the trades involved.

4. Clean surfaces to be coated before applying coating or surface treatment. Remove oil and grease with clean cloths and cleaning solvents in accordance with SSPC SP-1 prior to mechanical cleaning. Clean surfaces of galvanized metals, fiberglass and PVC with water soluble detergents prior to etching. Cleaning solvents shall be low toxicity and shall have a flash point in excess of 115°F. Program cleaning and painting so dust and other contaminants from the cleaning process do not fall in wet, newly coated surfaces.

B. Metals

1. All ferrous metal to be primed in the shop shall have all rust, dust, and scale, as well as all other foreign substances, removed by sandblasting in accordance with SSPC SP-6 or SP-10 and achieve a profile ranging from 1.0 to 3.0 mils DFT as recommended by the manufacturer. Immersion (submerged metals) exposure shall receive surface preparation in accordance with SSPC SP-10 near-white blast. Non-immersion (non-submerged metals) exposure shall receive surface preparation in accordance with SSPC SP-6 commercial blast. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Abraded or corroded spots on shop coated surfaces shall be wire brushed and touched up with primer specified in this Section. Remove all surface imperfections that will induce premature coating system failure. Chip or scrape off weld splatter and weld slag. Grind down sharp and rough edges of weld seams to create a smooth transition. Surface cleanliness shall be verified in accordance with SSPC-VIS1.

2. Store shop coated ferrous surfaces out of contact with the ground in such a manner and location as will minimize the formation of water-holding pockets, soiling, contamination, and deterioration of the coating film.

3. All ferrous metals not primed in the shop shall be sand-blasted in the field prior to application of the primer pretreatment in accordance with the criteria specified above.

4. All non-ferrous metals and galvanized surfaces, whether to be shop or field primed, shall be solvent cleaned per SSPC SP-1 prior to the application of a vinyl-phosphoric wash and/or primer.

5. Any piping scheduled for a coating which is supplied with a bituminous coating shall receive two coats of titanium pigmented alcohol-soluble resin before applying primer and colored finished coat.

6. All exterior and interior electrical conduits shall be coated per this Section.

7. All existing coated metals and previously shop coated metals shall be free of all foreign substances and cleaned according to the manufacturer’s recommendations prior to application of primer and finish coats.

8. All non-submerged existing pipe, pipe supports, metal structural members, and miscellaneous metal items to remain which are to be recoated shall have all loose and
poorly adhered existing coating removed with hand tool cleaning to provide a surface preparation of SSPC SP-2 (hand tool cleaning) or SP-3 (power tool cleaning). All submerged existing metal items to remain and to be recoated shall have SSPC SP-10 (near white blast cleaning) or SP-11 (near white power tool cleaning) surface preparation to remove existing coating to bare metal. All rust, dust scale, and other foreign substances shall be removed. Bare metal exposed after cleaning shall be immediately primed to prevent new rusting. Prior to applying new coating, clean existing metals and piping with water-soluble degreasers or solvents per SSPC SP-1.

C. Concrete

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

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

3.03 APPLICATION

A. Coating Thickness

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

2. Deficiencies or excesses in film thickness shall be corrected by the application or removal of an additional coat(s) of material.

B. Application to Concrete Floors

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

C. Application to Concrete Stairs and Skid-Resistant Areas

1. Follow the same procedures as concrete floors, with one of the following additions:

   a. Apply a third coat containing an adequate amount of silica sand or the manufacturer’s standard skid-resistant coating on the top surface of all steps and
landings, or in areas specified to be skid resistant to provide a skid-resistant surface, or

b. For stairs only, provide skid resistant adhesive tape on the surface of all steps and edges of landings in sufficient amount to cover the outer six inches of each step or landing.

c. Other areas to receive skid-resistant coatings will be specifically noted in this Section or on the Drawings.

D. Drying Time

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

3.04 PROTECTIVE COATING OF NON-FERROUS AND GALVANIZED METALS

A. Where non-ferrous metals such as aluminum, copper, and galvanized metal comes in contact with concrete or dissimilar metals, a protective coating must be applied. In the case of galvanized materials, obtain a recommendation from the coating supplier.

B. A vinyl gasket may be used in lieu of the protective coating.

C. The bottom of the aluminum railing posts and aluminum clip angles shall be coated with an aluminum impregnated caulking compound (Aluminastic, or equal) prior to erection.

D. After erection and alignment, the opening between non-ferrous metal surfaces and the concrete shall be sealed in a watertight manner with the proper caulking compound, relative to, and in accordance with, the opening width demand.

3.05 CLEANING

A. Touch-up coatings and restore finish where damaged or defaced by construction activities.

B. Remove coating spatter from all finished surfaces and restore affected finishes.

C. Remove excess materials, scaffolding, staging, drop cloths, equipment, and rubbish from the job site.

3.06 PAYMENT

A. The cost of this work shall be considered incidental to the contract and be included in the bid price as specified in the Bidding and Procurement division of the contract.

END SECTION.
PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and to all following sections within Division 26.

1.02 SUMMARY
A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system’s functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.

B. Division 26 of these Specifications, and Drawings numbered with prefixes E, generally describe these systems, but the scope of the electrical Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.

C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets and circuits without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers’ requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.03 QUALITY ASSURANCE
A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the Work specified.

B. Install all Work in strict conformance with all manufacturers’ requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.

C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish
quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.

D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.04 CODES, REFERENCES AND STANDARDS

A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Architect’s and Engineer’s attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Engineer, without additional compensation. Contractor will be held responsible for any violation of the law.

C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them:

1. IBC International Building Code
2. ADA Americans with Disabilities Act
3. AEIC Association of Edison Illuminating Companies
4. ANSI American National Standards Institute
5. ASTM American Society of Testing Materials
6. AWS American Welding Society
7. AWWA American Water Works Association
8. CSA/USA Canadian Standards Association/USA
9. ICEA Insulated Conductors Engineers Association
10. IEEE Institute of Electrical and Electronics Engineers
11. IES Illuminating Engineering Society
12. NBFU National Board of Fire Underwriters
13. NEC National Electrical Code, NFPA 70
14. NECA National Electrical Contractors Association
15. NEMA National Electrical Manufacturers' Association
16. NETA National Electrical Testing Association
17. NFPA National Fire Protection Association
18. OSHA Occupational Safety and Health Act
19. UL Underwriter's Laboratories

E. Comply with rules and regulations of public utilities and municipal departments affected by connections of services.

F. Perform all electrical work in compliance with applicable safety regulations, including OSHA regulations. All safety lights, guards, and warning signs required for the performance of the electrical work shall be provided by the Contractor.

G. Obtain and pay for all permits, licenses and fees that are required by the governing authorities for the performance of the electrical work.

1.05 DEFINITIONS

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. Furnish: “To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations.”

2. Install: “To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use.”

3. Provide: “To furnish and install complete, and ready for the intended use.”

4. Furnished by Owner (or Owner-Furnished) or Furnished by Others: “An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.

5. Engineer: Where referenced in this Division, “Engineer” is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the “Architect”.

6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.

7. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having
Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ, and standards that meet the specified criteria.

B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

C. Manufacturers: The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

D. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.

2. Sub-base: as used in this Section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.

3. Sub-grade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Architect.

1.06 COORDINATION

A. Coordinate with other Divisions for electrical work included in them but not listed in Division 26 or indicated on electrical Drawings.

B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Make all offsets required to clear equipment, beams and other structural members, and to facilitate concealing conduit in the manner anticipated in the design.

D. Maintain an electrical foreman on the jobsite at all times to coordinate this Work with other trades so that various components of the electrical systems is installed at the proper time, fits the available space, and allows proper service access to all equipment. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.

E. Work of this Division shall progress according to the "Construction Schedule" as described in Division 01 and as approved by the Architect. Cooperate in establishing these schedules
1.07 MEASUREMENTS AND LAYOUTS
   A. The Drawings are schematic in nature but show the various components of the systems
      approximately to scale and attempt to indicate how they are to be integrated with other
      parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine
      exact locations by job measurements, by checking the requirements of other trades, and by
      reviewing all Contract Documents. Correct, at no additional costs to the Using Agency,
      errors that could have been avoided by proper checking and inspection.

1.08 SUBMITTALS
   A. Refer to individual Sections for additional submittal requirements.

1.09 OPERATION AND MAINTENANCE DATA
   A. Refer to individual Sections for additional submittal requirements.

1.10 SPARE PARTS
   A. Provide to the Using Agency the spare parts specified in the individual sections of this
      Division.

1.11 RECORD DRAWINGS
   A. Refer to Division 01 and General Conditions for Record Drawings.

1.12 DELIVERY, STORAGE AND HANDLING
   A. Refer to individual Sections for Delivery, Storage and Handling.

1.13 WARRANTIES
   A. Refer to individual Sections for Warranties.

1.14 TEMPORARY FACILITIES
   A. Refer to Division 01 and General Conditions for Temporary Facilities requirements.

1.15 PROJECT CONDITIONS
   A. Conditions Affecting Excavations: The following project conditions apply:
      1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage
         caused by settlement, lateral movement, undermining, washout, and other hazards
         created by excavation operations.

PART 2 – PRODUCTS

2.01 Refer to Division 31 for Excavation Backfill Material Requirements.

PART 3 – EXECUTION

3.01 PERMITS
   A. Secure and pay for all permits required in connection with the installation of the Electrical
      Work. Arrange with the various utility companies for the installation and connection of all
      required utilities for this facility and pay all charges associated therewith including
connection charges and inspection fees, except where these services or fees are designated to be provided by others.

### 3.02 TEMPORARY ELECTRICAL SERVICE AND WIRING

A. [Refer to Division 01 and General Conditions for Temporary Electrical Service Wiring requirements.]

### 3.03 SELECTIVE DEMOLITION

A. General: Demolish, remove, demount, and disconnect abandoned electrical materials and equipment indicated to be removed and not indicated to be salvaged or saved.

B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing electrical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.

C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

### 3.04 EXISTING CONDITIONS

A. Existing conditions indicated on the Drawings are taken from the best information available from the Using Agency, existing record drawings, and from limited, in-situ, visual site observations; and, they are not to be construed as “AS BUILT” conditions. The information is shown to help establish the extent of the new Work.

B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

### 3.05 EXISTING UTILITIES

A. Schedule and coordinate with the Utility Company, Using Agency and with the Architect/Engineer all connections to, relocation of, or discontinuation of normal utility services from any existing utility line. Include all premium time required for all such work in the Bid.

B. Repair all existing utilities damaged due to construction operations to the satisfaction of the Using Agency or Utility Company without additional cost.

C. Do not leave utilities disconnected at the end of a workday or over a weekend unless authorized by representatives of the Using Agency or Architect/Engineer.

D. Make repairs and restoration of utilities before workmen leave the project at the end of the workday in which the interruption takes place.

E. Include in Bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

### 3.06 EXCAVATION AND BACKFILLING

A. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this Division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.

B. Restore roads, alleys, streets and sidewalks damaged during this Work to the satisfaction of Authorities Having Jurisdiction.
C. Do not excavate trenches close to walks or columns without prior consultation with the Architect.

D. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep them burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.

E. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.

F. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
   1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

G. Install sediment and erosion control measures in accordance with local codes and ordinances.

H. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
   1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
   2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.

I. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
   1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
   2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

J. Trenching: Excavate trenches for electrical installations as follows:
   1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.
   2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
   3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.

5. Excavate trenches for raceway and cables and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.

K. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

L. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
   1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
   2. Under building slabs, use drainage fill materials.
   3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
   4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
   5. Other areas use excavated or borrowed materials.

M. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Inspection, testing, approval, and locations of underground utilities have been recorded.
   4. Removal of trash and debris.

N. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
   1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less that 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.

O. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

P. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
Q. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesion less soils).
   a. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesion less soils.

2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

R. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.07 CLEANING

A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.

B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises broom clean. Clean all material and equipment installed under this Division.

C. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.

D. Touch up and restore damaged finishes to their original condition.

3.08 ADJUSTING, ALIGNING AND TESTING

A. Adjust, align and test all electrical equipment furnished and/or installed under this Division.

B. Check motors for alignment with drive and proper rotation, and adjust as required.

C. Check and test protective devices for specified and required application, and adjust as required.

D. Check, test and adjust adjustable parts of all light fixtures and electrical equipment as required to produce the intended performance.

E. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.

F. After completion, perform tests for continuity, unwanted grounds, and insulation resistance in accordance with the requirements of NFPA 70 and NETA.
G. Be responsible for the operation, service and maintenance of all new electrical equipment during construction and prior to acceptance by the Using Agency of the complete project under this Contract. Maintain all electrical equipment in the best operating condition including proper lubrication.

H. Notify the Architect immediately of all operational failures caused by defective material, labor or both.

I. Maintain service and equipment for all testing of electrical equipment and systems until all Work is approved and accepted by the Using Agency.

J. Keep a calibrated voltmeter and ammeter (true RMS type) available at all times. Provide service for test readings when and as required.

K. Refer to individual Sections for additional and specific requirements.

3.09 START-UP OF SYSTEMS

A. Prior to start-up of electrical systems, check all components and devices, lubricate items appropriately, and tighten all screwed and bolted connections to manufacturers’ recommended torque values using appropriate torque tools.

B. Adjust taps on each transformer for rated secondary voltages.

C. Balance all single phase loads at each panelboard, redistributing branch circuit connections until balance is achieved to plus or minus 10 percent.

D. Replace light fixtures that use LED sources that are installed as part of the finished product, but have failed or damaged during construction.

E. After all systems have been inspected and adjusted, confirm all operating features required by the Drawings and Specifications and make final adjustments as necessary.

F. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.

G. At the time of final review and tests of the power and lighting systems, all equipment and system components shall be in place and all connections at panelboards, switches, circuit breakers, and the like, shall be complete. All fuses shall be in place, and all circuits shall be continuous from point of service connections to all switches, receptacles, outlets, and the like.

H. Low Voltage Testing:

1. Test for Faults: 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 a fault condition is present, the trouble shall be rectified, then retested.

2. Within 2 percent: Voltage test shall be made at each lighting and distribution panel. When potential is not within 2 percent of rated voltage, the condition shall be corrected by tap changes or power company correction of the line voltage.

3. Grounded or Shorted: All wiring devices and electrical apparatus furnished under this contract when grounded or shorted on any integral “live” part, shall be removed and the trouble rectified by replacing all defective parts and materials.

4. Megger Test: All service feeders cables, after being pulled in place and before being connected, shall have a Megger test conducted to determine that the wire and cable
insulation resistance is not less than that recommended by the NEC. Copies of all tests shall be given to the A/E. All cables failing insulation test shall be removed, replaced and retested.

3.10 GROUNDING TESTING

A. 25 Ohms max: The resistance between ground grid and absolute earth shall not exceed 25 ohms.

3.11 TEST REPORTS

A. Perform tests as required by these Specifications and submit the results in the operations and maintenance manuals. The tests shall establish the adequacy, quality, safety, and reliability for each electrical system installed. Notify the Architect and Engineer two working days prior to each test.

B. For specific testing requirements of special systems, refer to the Specification section that describes that system.

C. Upon completing each test, record the results, date and time of each test and the conditions under which the test was conducted. Submit to the Architect, for Engineer’s review, in duplicate, the test results for the following electrical items:

1. Building service entrance voltage and amperes at each phase.
2. Electrical service grounding conditions and grounding resistance.
3. Proper phasing throughout the entire system.
4. Voltages (phase-to-phase and phase-to-neutral) and amperes at each phase for each panelboard, switchboard, and the like.
5. Phase voltages and amperes at each three-phase motor.
6. Test all wiring devices for electrical continuity and proper polarity of connections.

D. Promptly correct all failures or deficiencies revealed by these tests as determined by the Engineer.

END SECTION.
PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. This Section includes:
   B. Utility service voltage:
      1. 480Y/277 volts, three-phase, four-wire, 60Hz
   C. Utility service ampacity: As indicated on the Drawings.
   D. The extent of Work for the secondary electrical service includes providing the following:
      1. Raceways
      2. Provisions for metering
      3. Grounding and Bonding
      4. Pad for utility service transformer
      5. Service lateral
      6. Primary raceways

1.03 RELATED SECTIONS
   A. Section 26 00 10 “General Electrical Requirements” for general requirements and related
      documents that apply to this Section.
   B. Section 26 05 33 “Raceway and Boxes for Electrical Systems” for raceways, fittings, boxes,
      enclosures and cabinets for electrical service.
   C. Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables” for conductors and
      connectors.
   D. Section 26 05 33 “Identification for Electrical Systems” for raceway identification materials
      to use for marking or tagging service raceways and boxes.
   E. Section 26 05 26 “Grounding and Bonding for Electrical Systems” for conductors, connectors
      and electrodes for electrical service grounding systems.

1.04 SUBMITTALS
   A. General: Submit the following in accordance with Division 01 and Division 26 Section
      “General Electrical Requirements”:
      1. Product data for the following products for:
         a. Meter base.
B. Where equipment or material are specified to comply with utility standard and are listed above as required submittals, obtain approval from the serving utility before submitting to the Architect.

C. Record Drawings: Submit Record Drawings as required by Division 01 and Division 26 Section “General Electrical Requirements”:
   1. Accurately record actual routing of all exterior buried raceway and all interior conduits two inches and larger. Indicate dimensions from fixed structural elements.

1.05 QUALITY ASSURANCE

A. Perform all work in accordance with Utility Company installation drawings and service standards.

B. Maintain one copy of Utility Company installation drawings and service standards at the site.

C. Prior to commencing work in this Section, meet with Utility Company representative to review service entrance requirements and details.

D. Verify that field measurements are as indicated on Utility Company drawings.

E. Electrical Components, devices and Accessories:
   1. Listed and labeled as defined in NFPA 70, Article 100 by an NRTL as defined by OSHA in CFR 29 1910.7, and that are acceptable to authorities having jurisdiction.
   2. Marked for intended use.

F. Comply with NFPA 70.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 SECONDARY SERVICE ENTRANCE UNDERGROUND

A. Provide an underground secondary service lateral from the pad mounted utility transformer in accordance with NFPA 70 Article 230 and the Utility Company standards. Reference the Drawings for service lateral conductors and raceway quantities, sizes and types.

B. The Utility Company will provide the utility service transformer.

C. Pad provided by Utility Company for transformer mounting. Contractor to provide coated GRS conduit elbows and riser(s), with grounding bushing(s), to receive primary and secondary raceways. Where direct burial primary is used, set coated GRS conduit elbow(s) and riser(s), with grounding bushing(s), to receive primary cables.

D. Make connections to the secondary terminals of the transformer as required and in conformance with Utility Company requirements. Utility Company will provide primary conductors and terminal connections unless otherwise directed by the Utility Company.

E. Provide underground raceways for primary cables from the transformer pad to the property line, and provide pull cord, per Utility Company standards, for the Utility Company’s use in pulling primary conductors. Install raceways a minimum of 24 inches
below finished grade line unless otherwise indicated on the Drawings or directed by the Utility Company. Provide excavation and backfill as required to accomplish the installation.

3.02 METERING
A. Provide a meter base complying with the Utility Company standards.
B. The Utility Company will provide the meter.

3.03 UTILITY SERVICE CHARGES
A. It shall be the responsibility of the Division 26 contractor to apply for the electrical service, including the preparation and completion of all forms. Submit the completed application along with all other required documentation for the new or modified service.
B. The Owner will pay all charges of the Utility Company for the electrical service.

END SECTION.
SECTION 26 05 19

LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. This Section includes the following:
      1. Copper building wire rated 600 V or less.
      2. Connectors, splices, and terminations rated 600 V or less.
      3. Miscellaneous products.
   B. Related Requirements:
      1. Section 26 00 10 Section “General Electrical Requirements” for general requirements
         and related documents that apply to this Section.
      2. Section 26 05 23 “Control-Voltage Electrical Power Cables” for control system
         communications cables and classes 1, 2, and 3 control cables.
      3. Section 26 05 26 “Grounding & Bonding for Electrical Systems” for conductors and
         connectors for grounding systems.
      4. Section 26 05 53 “Identification for Electrical Systems” for identification of products
         and requirements.

1.03 QUALITY ASSURANCE
   A. Materials shall be manufactured by companies that have been specializing in the products
      specified in this Section, for a minimum of 3 years.
   B. Test Equipment Suitability and Calibration: Comply with NETA ATS, “Suitability of Test
      Equipment” and Test Instruments Calibration”.
   C. Testing Agency Qualifications: An independent testing agency, with experience and
      capability to conduct the testing indicated, that is a member company of the InterNational
      Electrical Testing Association or is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is
      acceptable to AHJ.
      1. Testing Agency’s Field Supervisor: Person currently certified by the InterNational
         Electrical Testing Association or Nation Institute for Certification in Engineering
         Technologies to supervise on-site testing specified in Part-3.
   D. Electrical Components, Devices, and Accessories:
      1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA
         in 29 CFR 1910.7 and that is acceptable to AHJ.
      2. Marked for intended use.
   E. Comply with NFPA 70.
1.04 COORDINATION
A. Coordinate electrical testing of electrical, mechanical and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.02 CONDUCTORS AND CABLES
A. General:
   1. Manufacturers:
      a. Advance wire and Cable
      b. Alcan Aluminum Corporation, Alcan Cable Division.
      c. AFC Cable Systems, Inc.
      d. Alan Wire.
      e. ALFLEX Corporation, a Southwire Company.
      g. Encore Wire Corporation.
      h. General Cable Corporation (Flexible Cords).
      i. Northern Cables, Inc.
      j. Okonite Company.
      k. Southwire Company.
   2. Conductor Material: Annealed (soft) copper complying with ICEA S-95-658/NEMA WC 70 and UL Standards 44 or 83, as applicable; solid conductor for No. 10 AWG and smaller; concentric, compressed stranded for No. 8 AWG and larger and stranded for all flexible cords, cables and control wiring.
   3. Conductor Insulation Types:
4. Size of conductors and cables indicated or specified are American Wire Gage (Brown and Sharpe).

2.03 CONNECTORS
A. Manufacturers:
   1. AMP; Tyco
   2. FCI-Burndy
   3. Gould
   4. Ideal Industries, Inc.
   5. Ilsco
   6. NSi Industries, Inc.
   7. O-Z Gedney
   8. Panduit
   9. Thomas & Betts
   10. 3-M Electrical Products Division
B. Compression connectors for conductors No. 8 AWG and larger; Long barreled, UL 486-listed, tinned or bare copper, compression type (Burndy “Hylug”, or equal), insulated with clamp-on, cold shrink, or molded covers, or wrapped with multiple over-lapping layer of 3-M Scotch electrical tape.
   1. Termination fittings: 1-or 2-hole pad and inspection port.
C. Mechanical connections for conductors No. 8 AWG and larger; UL listed, tinned or bare copper and/or tinned aluminum, dual rated, mechanical type, insulated with clamp-on, cold shrink, or molded covers, or wrapped with multiple over-lapping layer of 3-M Scotch electrical tape.
   1. Termination fittings: 1-or 2-hole pad and inspection port.
D. Connectors for solid conductors No. 10 AWG and smaller: Insulated winged wire nuts, color-coded for size, except use green only for grounding connections.
E. Connectors for stranded conductors No. 10 AWG and smaller: Tinned copper, insulated-sleeve, compression type, UL-listed, with wire insulated grip. Terminations: flanged fork-tongue type.
F. Connectors and terminations for aluminum conductors and cables No. 2 AWG and larger: UL 486B listed and marked AL7CU for 75 deg C rated conductors and AL9CU for 90 deg C rated conductors.

2.04 MISCELLANEOUS PRODUCTS
A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   1. Minimum width: 3/16-inch (5 mm).
   2. Tensile Strength: 50 lb (22kg), minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F (minus 40 to plus 85 deg C).
PART 3 – EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS
   A. Feeders: Copper.
   B. Branch Circuits: Copper. Solid for No. 16 AWG and smaller; stranded for No. 14 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
   A. Service Entrance: Type XHHW-2, single conductors in raceway.
   B. Feeders Concealed in Concrete, below Slabs-on-Grade, and underground: Type XHHW-2, single conductors in raceway.
   C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES
   A. Conceal cables in finished walls, ceilings and floors, unless otherwise indicated.
   B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
   C. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
   D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
   E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems".
   F. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems" for secondary service, feeders and branch circuits.

3.04 CONNECTIONS
   A. 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 and UL486B.
   B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
      1. Use oxide inhibitor in each splice and tap conductor.
   C. Wiring at Outlets: Install conductor at each outlet, with at least 6-inches (150 mm) of slack.

3.05 FIELD QUALITY CONTROL
   A. Testing Agency: Engage a qualified agency to perform tests and inspections.
B. Manufacturer’s Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.


END SECTION.
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes grounding systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
B. This Section includes the following:
   1. Grounding Conductors
   2. Connector Products
   3. Grounding Electrodes
C. Related Requirements:
   1. Section 26 00 10 “General Electrical Requirements” for general requirements and related documents that apply to this Section.
   2. Section 26 05 19 “Low-voltage Electrical Power Conductors and Cables” for building wires, cables, connectors, splices, and terminations, rated 600V and less.
   3. Section 26 05 33 “Raceway and Boxes for Electrical Systems” for conduit, pull, junction, and outlet boxes, and electrical cabinets.

1.03 DEFINITIONS
A. The following apply to this and other Sections of these specifications:
   1. EMT; Electrical metallic tubing.
   2. FMC: Flexible metal conduit.
   4. LFMC: Liquid-tight flexible metal conduit.
   5. RMC: Rigid metal conduit.
   6. GRS: Galvanized rigid steel conduit.
   7. RAC: Rigid aluminum conduit.
   8. RNC: Rigid nonmetallic conduit.
   9. PSF: Pounds per square foot.

1.04 QUALITY ASSURANCE
A. Materials shall be manufactured by companies that have been specializing in the product specified in this Section, for a minimum of 3 years.
B. Testing Equipment Suitability and Calibration: Comply with NETA ATS, “Suitability of Test Equipment” and “Test Instrument Calibration”.

C. Testing Agency Qualifications: An independent testing agency, with experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to AHJ.
   1. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or Nation Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part-3.

D. Electrical Components, Devices, and Accessories:
   1. Listed and labeled as defined in NFPA 70, Article 100, by an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to AHJ.
   2. Marked for intended use.

E. Comply with NFPA 70.

**PART 2 – PRODUCTS**

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the ranking or preference.

2.02 GROUNDING CONDUCTORS, CONNECTORS, AND ELECTRODE

A. Manufacturers:
   1. Apache Grounding/Erico, Inc.
   2. Boggs, Inc.
   3. Chance/Hubbell.
   4. Copperweld Corp.
   5. Dossert Corp.
   7. FCI/Burndy Electrical.
   8. Galvan Industries, Inc.
   11. Heary Brothers Lightning Protection Co.
   12. Ideal Industries, Inc.
13. ILSCO.
15. Korns: C.C. Korns CO.; Division of Robroy Industries.
16. Lightning Master Corp.
17. Lyncole XIT Grounding.
19. Panduit Corp.
20. Raco, Inc.; Division of Hubbell.
24. Thomas & Betts, Electrical.

2.03 GROUNDING CONDUCTORS

A. Equipment Grounding Conductors: Insulated with green-colored insulation.
B. Grounding Electrode Conductors: Bare, stranded, unless otherwise indicated.
C. Underground conductors: Tinned-copper conductor, No. 3/0 AWG minimum stranded, unless otherwise indicated.
D. Bare Copper Conductors: Comply with the following:
E. Copper Bonding Conductors: As follows:
   1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   2. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   3. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   4. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.04 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467, listed for use for specific types, sizes, and combinations of connectors and connected items.
B. Bolted Connectors: Bolted-pressure-type connectors.
   1. Compression Connectors: Burndy Hyground, or equal, permanent, pure, wrought copper, meeting ASTM 8 1 87, essentially the same as the conductors being connected; clearly and permanently marked with the information listed below:
a. Company symbol and/or logo.
b. Catalog number.
c. Conductors accommodated.
d. Installation die index number or die catalog number is required.
e. Underwriters Laboratories “Listing Mark”.
f. The words “Suitable for Direct Burial”, or where space is limited, “Direct Burial” or “Burial” per UL Standard ANSI/UL467 (latest revision).

2. Cast Connectors: copper base alloy according to ASTM B 30 (latest revision).

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer’s written instructions.

2.05 GROUNDING ELECTRODES

A. Ground Rods: UL listed:
   1. Copper-clad steel; bonded copper electrolytically-applied to minimum thickness of 13 mils.
   2. Size: 3/4-inch by 10 feet (19 mm by 3 m) in diameter. Provide sectional types when longer rods are indicated.

PART 3 – EXECUTION

3.01 GENERAL

A. Examine areas and conditions under which electrical grounding connections are to be made and notify Architect/Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Provide all material, labor and equipment for an electrical grounding system in accordance with applicable portions of the NEC and NECA. Coordinate electrical work as necessary to interface installation of electrical grounding systems with other work.

C. Accomplished grounding and bonding of electrical installations and specific requirements for systems, circuits and equipment required to be grounded for both temporary and permanent construction.

3.02 APPLICATIONS

A. Comply with NFPA 70, Article 250, for type, sizes and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and branch circuits.

C. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
3.03 INSTALLATION

A. Ground Rods: Install at least three ground rods spaced at least one-rod length from each other and located at least the same distance from the other grounding electrodes.
   1. Drive rods until tops are 12 inches (100 mm) below finished floor or final grade unless otherwise indicated.
   2. Interconnect ground rods with grounding electrode conductors below grade and as otherwise indicated. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
   3. Verify that final backfill and compaction has been completed before driving rod electrodes.

B. Bonding Straps and Jumpers: Install bonding so vibration is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations; unless a disconnect-type connection; then, use a bolted clamp. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

C. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.
   2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank as part of duct-bank installation. Bury detectable warning tape approximately 6 inches (150 mm) above grounding conductors. Warning tape shall comply with Section 260553.

3.04 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible. Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by the manufacturers for indicated applications. Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, and bonding straps as recommended by the manufacturers for types of service indicated.
Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

Make connections with clean, bare metal at points of contact.

Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

Exothermic-Welded Connections: Comply with manufacturer’s written instructions. Replace welds that are puffed up or that show convex surfaces indicating improper cleaning. Use exothermic welded connections for the following:

1. Connecting conductors together.
2. Connecting conductors to ground rods.

Mechanical Pressure Fittings: Use bolted mechanical (removable) pressure-type clamps for the following:

1. Connecting conductors to pipes.

Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

Tighten screws and bolts for grounding and bonding 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 and UL 486B.

Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

FIELD QUALITY CONTROL

Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at
ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing nature ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

4. Test Values:
   a. The resistance between the main grounding electrode and earth ground shall be no greater than 10 ohms.
   b. Equipment Rated 500 kVA and Less: 10 ohms.
   c. Equipment Rated 500 to 1000 kVA: 5 ohms.
   d. Equipment Rated More than 1000 kVA: 3 ohms.
   e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
   f. Manhole Grounds: 10 ohms.

5. Perform point-to-point megohmmeter tests to determine the resistance between the main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points.


7. Investigate point-to-point resistance values that exceed 0.5 ohms.
   a. Check for loose connections.
   b. Check for absent or broken connections.
   c. Check for poor quality welds.
   d. Consider other reasons.

8. Excessive Grounding Electrode Resistance: If measured resistance to earth ground value exceeds specified values, add grounding electrodes and additional conductors as required to obtain the specified value.

3.06 UTILITY GROUNDING
A. Provide grounding and bonding at Utility Company’s metering equipment in accordance with Utility Company’s requirements.

3.07 LABELING
A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.08 GRADING AND PLANTING
A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Re-establish original grades, unless otherwise indicated. If sod has been removed, replace
it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 31 and 32. Maintain restored surfaces. Restore disturbed paving as indicated.

END SECTION.
SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. This Section includes the following:
      1. Hangers and supports for electrical equipment and systems.
      2. Construction requirements for concrete bases.
   B. Related Requirements:
      1. Section 26 00 10 "General Electrical Requirements" for general requirements and
         related documents that apply to this Section.

1.03 DEFINITIONS
   A. EMT: Electrical metallic tubing.
   B. IMC: Intermediate metal conduit.
   C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS
   A. Design supports for multiple raceways capable of supporting combined weight of
      supported systems and its contents.
   B. Design equipment supports capable of supporting combined operating weight of supported
      equipment and connected systems and components.
   C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads
      calculated or imposed for this Project, with a minimum structural safety factor of five times
      the applied force.

1.05 QUALITY ASSURANCE
   A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural
      Welding Code - Steel."
   B. All products shall be UL labeled for their intended use.
   C. Comply with NFPA 70.

1.06 COORDINATION
   A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
      Concrete, reinforcement, and formwork requirements are specified in Division 03.
PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries. (IL)
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   3. Toggle Bolts: All-steel springhead type.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Sections for steel shapes and plates.
PART 3 – EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Sections for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.03 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit and four inches high, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Edges shall be chamfered.

B. Use fiber reinforced 3000-psi(20.7-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Concrete Sections.

C. Install dowel rods to connect concrete bases to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.

D. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer’s setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer’s written instructions.

END SECTION.
SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes the following:
1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
B. Related Requirements:
1. Section 26 00 10 “General Electrical Requirements” general requirements and related documents that apply to this Section.
2. Section 26 05 26 “Grounding & Bonding for Electrical Systems” for conductors and connectors for grounding systems.
3. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.
4. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems” for exterior ductbanks, manholes, and underground utility construction.
5. Section 26 05 53 “Identification for Electrical Systems” for identification of products and requirements.

1.03 DEFINITIONS
A. GRC: Galvanized rigid steel conduit.
B. IMC: Intermediate metal conduit.
C. EMT: Electrical metallic tubing.
D. ENT: Electrical nonmetallic tubing.
E. EDPM: Ethylene-propylene-diene terpolymer rubber.
F. FMC: Flexible metal conduit.
G. LFMC: Liquidtight flexible metal conduit.
H. LFNC: Liquidtight flexible nonmetallic conduit.
I. NBR: Acrylonitrile-butadiene rubber.
J. RNC: Rigid nonmetallic conduit.

1.04 QUALITY ASSURANCE
A. Materials shall be manufactured by companies that have been specializing in the products specified in the Section, for a minimum of 3 years.

B. Electrical components, Devices and Accessories:
   1. Listed and labeled as defined in NFPA 70, Article 100 by an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to AHJ.
   2. Mark for intended use.

C. Comply with NFPA 70.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

2.02 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, products of all manufacturers are acceptable provided they have a smooth interior, are UL listed and labeled as defined in NFPA 70 for the intended location and application and are electro-galvanized steel (EMT) or hot dipped galvanized steel inside and out (GRC). Conduit and fittings shall be obtained from the same manufacturer:
   1. AFC Cable Systems, Inc.
   3. Anamet Electrical, Inc.
   4. Electri-Flex Company.
   5. O-Z/Gedney.
   6. Picoma Industries.
   7. Republic Conduit.
   8. Robroy Industries.
  10. Thomas & Betts Corporation.
  11. Western Tube and Conduit Corporation.
  13. <<Insert manufacturer’s name>>.
B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating thickness: 0.040-inch (1).

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Electrical nonmetallic tubing (ENT or “blue tube”) and liquid-tight flexible nonmetallic conduit (LFNC) are not acceptable for use on any Project.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. FMC shall be steel/malleable iron – insulaCoating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040-inch (1 mm) with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.03 NON-METALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, products of all manufacturers are acceptable provided they are sunlight resistant and UL listed and labeled as defined in NFPA 70 and marked for intended location and application. Conduit and fittings shall be obtained from the same manufacturer:
   1. AFC Cable Systems, Inc.
   2. Anamet Electrical, Inc.
   3. Arnco Corporation.
   4. CANTEX Inc.
   5. CertainTeed Corporation.
   7. Electri-Flex Company.
   8. Kraloy.
   9. Lamson & Sessions; Carlon Electrical Products.
   10. Niedax-Kleinhuis USA, Inc.
   11. RACO; Hubbell.
12. Thomas & Betts Corporation.
13. <Insert manufacturer’s name>.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Collapsible HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the ‘Illinois Department of Health Services’ "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw cover unless otherwise indicated.

E. Finish: Manufacturer’s standard enamel finish.

2.05 BOXES, ENCLOSURES, AND CABINETS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Adalet.
   2. Cooper Technologies Company; Cooper Crouse-Hinds.
   3. EGS/Appleton Electric.
   4. FSR Inc.
   5. Hoffman; a Pentair company.
   6. Hubbell Incorporated; Killark Division.
   8. Milbank Manufacturing Co.
   11. RACO; a Hubbell Company.
   12. Spring City Electrical Manufacturing Company.
   15. Wiremold / Legrand.
   16. <Insert manufacturer’s name>.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast with gasketed cover.

F. Gangable boxes are prohibited.

2.06 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:
   1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
   2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of a dry mix of gravel, sand and bounded with polyester resin, and reinforced with fiberglass cloth.

   1. Subject to compliance with requirements by one of the following:
a. Oldcastle Enclosure Solutions, H-Series.
b. Armorcast Products Company.
c. Highline.
d. New Basis.
e. Quazite: Hubbell Power Systems, Inc.

3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, “ELECTRIC” or other custom logo and lettering.
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 11-inches Wide by 18-inches Long (279 mm Wide by 457 mm Long) up to 48-inches Wide by 48-inches Long (1219 mm Wide by 1219 mm Long).

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC and RNC, Type EPC-40-PVC
   2. Underground Conduit: RNC, Type EPC-40-PVC.
   3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
   4. Boxes and Enclosures, Aboveground: NEMA 250 Type 3R.

B. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

C. Mixing different types of conduits indiscriminately in the same system is prohibited.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated.
      Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. Flexible Conduit: Use only steel fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
3.02 BOX INSTALLATION SCHEDULE

A. Cast boxes shall be used in:
   1. Exterior locations, in general all areas of this project are considered “exterior”.

3.03 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Installation of all new conduits must be minimum 12 inches from ceiling grid except where approved by Using Agency.

D. Complete raceway installation before starting conductor installation.

E. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

F. Arrange stub-ups so curved portions of bends are not visible above finished slab.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.

R. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Final connections to motors or equipment subject to vibration, noise transmission, or movement shall use FMC not exceeding four feet in length.
   3. Short lengths of FMC shall be used for final primary and secondary connections to Low Voltage transformers (<600V).

T. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

V. Set cast and metal floor boxes level and flush with finished floor surface.

3.04 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
   1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 “Earth Moving” for pipe less than 6-inches (150 mm) in nominal diameter.
   2. Install backfill as specified in Section 312000 “Earth Moving”.
   3. After installing conduit, backfill and compact. Start tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during the process. Firmly hand tamp and backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12-inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 “Earth Moving”.
   4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
   5. Install manufactured rigid conduit elbows for stub-ups at equipment racks.
   6. Underground Warning Tape: Comply with requirements in Section 260553 “Identification for Electrical Systems”.

3.05 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES
A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1-inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer’s written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

END SECTION.
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes the following:
   1. Identification for raceways and metal-clad cable.
   2. Identification for conductors, communication and control cable.
   4. Warning labels and signs.
   5. Instruction signs.
   7. Miscellaneous identification products.
B. Related Requirements:
   1. Section 26 00 10 “General Electrical Requirements” for general requirements and related documents that apply to this Section.

1.03 QUALITY ASSURANCE
A. Electrical Components, Devices and Accessories:
   1. Listed and labeled as defined in NFPA 70, Article 100 by an NRTL as defined by OSHA in 29 CFR 1910.7 and that are acceptable to authorizes having jurisdiction.
   2. Marked for intended use.
D. Comply with NFPA 70 (NEC).
F. Comply with ANSI Z535.4 for safety signs and labels.
G. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.04 COORDINATION
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.01 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tapes not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
   4. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
5. Overall Thickness: 5 mils (0.125 mm).
6. Foil Core Thickness: 0.35 mils (0.00889 mm).
7. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
8. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.04 WIRING DEVICES
A. Self-adhesive Labels: Label machine printed clear with black letters, pressure-sensitive adhesive labels, configured for display on top of device cover, unless otherwise indicated. Provide a single line of text with 1/4-inch-high letters on 1/2-inch-high label; where two lines of text are required, use labels 1 inches high or two, stacked labels.

2.05 WARNING LABELS AND SIGNS
A. Comply with NFPA 70 and 29 CFR 1910.145. Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied and shall not compromise any NRTL listing or labeling criteria.
B. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).
C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER – ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
   3. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 48 INCHES (1220 MM)."

2.06 INSTRUCTION SIGNS
A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal
transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay
shall provide a weatherproof and UV-resistant seal for label.

2.07 EQUIPMENT IDENTIFICATION NAMEPLATES
A. Attachment method shall be acceptable to the manufacturers of the equipment to which
the nameplates are being applied and shall not compromise any NRTL listing or labeling
criteria.
B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Nameplate: Adhesive backed with
white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
Refer to Drawings for Nameplate Details.
C. Stenciled Legend: In non-fading, waterproof, red ink or paint. Minimum letter height shall
be 1-inch (25mm).

2.08 CABLE TIES
A. General-Purpose Cables-Ties: Fungus insert, self-extinguishing, one-piece, self-locking, Type
6/6 nylon.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior
sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
   3. Temperature Range: Minus 40 to plus 185 deg F.
C. Plenum-Rated Cable Ties: self-extinguishing, UV stabilized, one-piece, self-locking.
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 7,000 psi.
   3. UL 94 Flame Rating: 94V-0.

PART 3 – EXECUTION

3.01 INSTALLATION
A. Location: Install identification materials and devices at locations for most convenient
viewing without interference with operation and maintenance of equipment.
B. Apply identification devices to surfaces that require finish after completing finish work.
C. Self-Adhesive Identification Products: Clean surfaces before application, using materials
and methods recommended by manufacturer of identification device.
D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways Larger than Two Inches: Each color-coding band shall completely encircle conduit. Locate bands at changes in direction, at penetrations of walls and floors, at 30-foot maximum intervals in straight runs, and within six inches of pull or junction boxes.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 18 inches overall. Comply with Section 260543.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend, system voltage, and panel/circuit number. System legends shall comply with Section 260533.

1. Normal power.

B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

   a. Color shall be factory applied.

   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.

   c. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.

   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

   e. For new work in existing buildings, the existing identification method shall be used for new conductors provided it meets all requirements of this Section and the NEC.
C. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

H. Receptacle Identification Labels: On each power receptacle, install unique designation label that states the panel and circuit breaker source. Clean device cover prior to installing label.

I. Equipment Identification Nameplates: On each unit of equipment, install unique designation nameplate that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply nameplates to Switchgears, Switchboards, Distribution Panels, Panelboards, Motor Control Centers, Transformers, Individual Starters, Contactors, Disconnect Switches, Transfer Switches, Control Panels and Similar Equipment. Systems include power, lighting, and control systems unless equipment is provided with its own identification.
   1. Colors for equipment nameplates:
      a. NORMAL power system: white letters on black background.
   2. Labeling Instructions:
      a. Identify the piece of equipment, the source, voltage characteristics, and the load served.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine nameplate. Unless otherwise indicated on the drawings, provide a single line of text with one-inch-(26-mm-) high letters on 3-inch- (76-mm-) high label; where two lines of text are required, use labels 4 inches (100 mm) high.
      c. Fasten nameplates with appropriate stainless steel screws that do not change the NEMA or NRTL rating of the enclosure. Stick-on or adhesives are not acceptable unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.
3. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets and enclosures.
   b. Transformers.

END SECTION.
SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. This Section includes the following types of dry-type transformers rated 600V and less, with
      capacities up to 1500 kVA:
      1. Distribution transformers.
   B. Related Requirements:
      1. Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables”.
      2. Section 26 05 26 “Grounding and Bonding for Electrical Systems”.

1.03 ACTION SUBMITTALS
   A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum
      clearances, installed devices and features, and performance for each type and size of
      transformer indicated.
   B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads,
      required clearances, method of field assembly, components, and location and size of each
      field connection.
      2. Transformer ratings including:
         a. kVA
         b. Primary and secondary voltage
         c. Taps
         d. Basic impulse level (BIL) for equipment over 600 volts
         e. Design impedance
         f. Insulation class and temperature rise
         g. Sound level

1.04 INFORMATIONAL SUBMITTALS
   A. Qualification Data: For testing agency.
   B. Source quality-control test reports.
   C. Field quality-control test reports.
   D. Submit Letter of Compliance with NEMA TP-1 and DOE 2016.
E. Submit certification of sound level compliance.

1.05 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE
A. Source Limitations: Obtain each transformer type through one source form a single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. Comply with IEEE C57.12.91, “Testing Code for Dry-Type Distribution Transformers and Power Transformers”.
D. Comply with NFPA 70 (NEC).
E. Comply with FM Global requirements.

1.07 DELIVERY, STORAGE, AND HANDLING
A. Temporary Heating: Apply temporary heat according to manufacturer’s written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.08 COORDINATION
A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   4. Square D; a brand of Schneider Electric.

2.02 GENERAL TRANSFORMER REQUIREMENTS
A. Description: Factory-assembled and tested, air-cooled units for 60-Hz service.
B. Cores: One leg per phase. Cores shall be constructed of high grade, non-aging silicon steel. The core and coil assembly shall be impregnated with non-hydroscopic, thermosetting
varnish and cured to reduce hot spots and seal out moisture. The complete core and coil shall be bolted to the base of the enclosure but isolated by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor or strap sized in accordance with UL and NEC requirements. The neutral shall be brought to a stud to facilitate the required external grounding of the secondary.

C. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Copper.

D. Connections to the transformer shall be by flexible metal conduit and using flexible couplings.

E. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.

F. Wiring Terminations:
   1. Recommended external cable shall be rated 90 deg C (sized at 75 deg C ampacity) for encapsulated and 75 deg C for ventilated designs.
   2. Conductors should be selected on the basis of type and cable size used to wire the specific transformer.
   3. Lug kits shall be provided by the Manufacturer of the transformer.

2.03 DISTRIBUTION TRANSFORMERS

A. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Test according to NEMA TP 2.

B. Furnish with nameplate, color shall be per the specification.

C. Comply with NEMA ST 20 and list and label as complying with UL 1561.

D. Enclosures: Unless otherwise specified, transformer enclosures shall be ventilated and be fabricated of heavy gauge, sheet steel construction. Enclosures shall be baked polyester powder coated finish-gray in color and suitable for interior or exterior applications. Enclosures shall be constructed so that there are no exposed live parts. Enclosures shall have a removable front cover to allow access to internal parts and wiring terminations.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
   2. Transformer locations:
      a. Dry locations:
         1) Ventilated
         2) NEMA 250, Type 2.
      b. Damp or wet:
1) Ventilated. Provide weather shields over ventilation openings.

2) NEMA 250, Type 3R.

c. Corrosive locations:
   1) Totally enclosed, non-ventilated
   2) NEMA 250, Type 4X, stainless steel.

3. The maximum temperature of the enclosure shall not exceed 90 deg C.

4. The maximum temperature of the top of the enclosure shall not exceed 50 deg C rise above a 40 deg C ambient.

E. Transformer Enclosure Finish: Comply with NEMA 250.

F. Taps for Three-phase Transformers smaller than 24 kVA and all single-phase transformers: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

G. Insulation Class for Transformers less than 15 kVA: 185 degree C, UL-component-recognized insulation system with a maximum of 115 degree rise above 40 deg C ambient temperature.

H. Accessories: The following accessory items are required where indicated:
      a. Connect shield to terminal marked “Shield” for grounding connection.
      b. Capacitance: Arrange shield to provide a maximum of 33 picoarads primary-to-secondary capacitance over a frequency range of 20Hz to 1MHz.

I. Mounting Methods:
   1. Rack Mounting: Provide required brackets.

2.04 IDENTIFICATION DEVICES

A. Manufacturer’s Nameplates: Nameplates (minimum of two required) for each distribution transformer shall be permanently affixed to the left and right side of each transformer enclosure so that the transformer remains permanently identified when front or back covers are removed. The placement of a single manufacturer nameplate on the front cover of the enclosure is unacceptable.

B. Identification Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer shall be used to identify the transformer name, kVA rating, source name, load name and feeder size for both primary and secondary. Nameplates and label products are specified in Section 26 05 53 "Identification for Electrical Systems."

2.05 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

2.06 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
1. Ratio tests at rated voltage connection and at all tap connections.
2. Polarity and phase relation test on the rated voltage connection
3. Applied potential tests.
4. Induced potential test.
5. No-load and excitation current at rated voltage on the rated voltage connection.

PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
C. Examine rack for suitable mounting conditions where transformers will be installed.
D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Install rack-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.03 CONNECTIONS
A. Connection to Transformers: Liquid-tight Flexible Metallic Conduit (FMC), primary and secondary.
B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
   1. External cable shall be rated 90 degrees C (sized at 75 degrees C ampacity) for encapsulated and 75 degrees C for ventilated designs. Connectors should be selected on the basis of the type and cable size used to wire the specific transformer.
   2. Verify tightness and torque all accessible bolted electrical connections to manufacturer's specified values using a calibrated torque wrench.

3.04 FIELD QUALITY CONTROL
A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.05 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

3.06 CLEANING

A. Remove paint splatters and other spots, dirt, debris. Repair scratches and mars on finish to match original finish.

B. Clean components internally using methods and materials recommended by manufacturer.

C. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END SECTION.
SECTION 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Lighting and appliance branch-circuit panelboards.

1.03 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

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

1.04 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.

1.05 QUALITY ASSURANCE
A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency’s Field Supervisor: Currently certified by NETA to supervise on-site testing.
B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
E. Comply with NEMA PB 1.
F. Comply with NFPA 70 (NEC).

1.06 DELIVERY, STORAGE, AND HANDLING
A. Handle and prepare panelboards for installation according to NEMA PB 1 and NECA 407.

1.07 PROJECT CONDITIONS
A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).
C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Using Agency or others unless permitted under the following conditions and
then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Using Agency no fewer than seven days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Using Agency’s written permission.
3. Using Agency Lock-out/Tag-out procedures shall be used with Contractor controlled locks and tags.
4. Comply with NFPA 70E.

1.08 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One (1) year from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spare for each type of panelboard cabinet lock.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.
   a. Outdoor Locations: NEMA 250, Type 3R.
   b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within door hinged trim cover.

3. Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

4. Finishes:
   a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pre-treating with manufacturer’s standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel. Same finish as panels and trim.


B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   3. Fully rated Neutral bus.

D. Conductor Connectors: Suitable for use with conductor material and sizes.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Adjustments for Oversized Conductors: Provide suitable means to terminate conductor sizes and quantities for supply and load feeders indicated on the drawings, including but not limited to larger lugs, buses, or overcurrent protective device frame sizes.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


I. Nameplates:
   1. Provide engraved laminated phenolic nameplates for the panelboard and each device. Nameplate color shall be per the specifications.
   2. The panelboard nameplate shall indicate the name of the equipment as designated on the Drawings and Specifications. The nameplate shall also indicate the source feeding the equipment.
   3. The feeder device nameplates shall indicate the name of the equipment or load being served as designated on the Drawings and Specifications.

J. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

2.02 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
4. Square D; a brand of Schneider Electric., NF or NQ Series.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
C. Mains: Circuit breaker or lugs, as indicated on the drawings.
D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ranges and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handles in on or off position.
   e. Handle Clamp: Loose attachment, for holding circuit-breaker handles in on position.
   f. Multi-pole circuit breakers shall have common trip, use of handle ties is not permitted.

B. Nameplates:
   1. The equipment nameplates shall indicate the name of the equipment or load being served as designated on the Drawings and Specifications.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1 and NECA 407.
B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1 and NECA 407. Where possible panelboards installed in finished areas shall be flush mounted and served through concealed conduit.

B. Mount panelboard cabinet plumb and rigid without distortion of box.

C. Install filler plates in unused spaces.

D. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

E. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Using Agency’s final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Directory shall contain complete and detailed information for loads on each circuit.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform test and inspections

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

3. Comply with NETS.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Instruments and Equipment:
   a. Use an infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

3.05 CLEANING
   A. Vacuum dirt and debris from panelboard tubs; do not use compressed air to assist in cleaning.

3.06 ADJUSTING
   A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

   B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
      1. Measure as directed during period of normal system loading.
      2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
      3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
      4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END SECTION.
SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Receptacles and associated device plates.
   2. Toggle switches.

1.03 DEFINITIONS
A. GFCI: Ground-fault circuit interrupter.
B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.04 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: List of legends and description of materials and process used for
   premarking wall plates.
C. Samples: One for each type of device and wall plate specified, in each color specified.

1.05 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For wiring devices to include in all manufacturers'
   packing-label warnings and instruction manuals that include labeling conditions.

PART 2 – PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS
A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by
   a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.
C. Devices that are manufactured for use with modular plug-in connectors may be substituted
   under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.02 STRAIGHT-BLADE RECEPTACLES
A. Weather Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device - Kellems; BR20 WRTR or a comparable product by one of the following:
   c. Pass & Seymour/Legrand (Pass & Seymour).

2.03 TOGGLE SWITCHES
A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
B. Switches, 120/277 V, 20 A:
   1. Single Pole:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Incorporated; Wiring Device-Kellems; 1221 or a comparable product by one of the following:
         1) Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.; AH 1221.
         2) Leviton Manufacturing Co., Inc.; 1221-2.
         3) Pass & Seymour/Legrand (Pass & Seymour); PSAC1.

2.04 WALL PLATES
A. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.05 FINISHES
A. Device Color:

PART 3 – EXECUTION

3.01 INSTALLATION
A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
B. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
C. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Receptacle Orientation:
   1. Install ground pin of vertically mounted receptacles down.

3.02 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.

   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

   3. Ground Impedance: Values of up to 2 ohms are acceptable.

   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

   5. Using the test plug, verify that the device and its outlet box are securely mounted.

   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
C. Wiring device will be considered defective if it does not pass tests and inspections.

END SECTION.
PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Engineered soils and aggregates materials.
   2. Bank run soils materials.
   3. Manufactured and special soils.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C33 Spec. for Concrete Aggregates.
   2. ASTM C88 Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
   3. ASTM C117 Test for Material Finer than No. 200 Sieve in Mineral Aggregates by Washing.
   5. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates.
   6. ASTM C144 Spec. for Aggregate for Masonry Mortar.
   8. ASTM C535 Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  10. ASTM D75 Sampling Aggregates.
  11. ASTM D422 Particle Size Analysis of Soils.
  13. ASTM D1140 Test for Amount of Material in Soils Finer than the No. 200 Sieve.
  15. ASTM D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
  16. ASTM D2487 Classification of Soils for Engineering Purposes.
B. IDOT Standard Specifications for Road and Bridge Construction, current edition, and all supplemental interim supplemental specifications, as they may pertain.

1.03 SUBMITTALS

A. Provide test reports showing the results of required material testing.

B. Provide topsoil analysis performed in accordance with ASTM D5268 and demonstrating the topsoil meets Soil Conservation Service specified soil types. Also, submit results of test for nutrient levels and provide recommendations for fertilizer type and application.

C. Daily delivery tickets for each load of material delivered to the site.

1.04 QUALITY ASSURANCE

A. An independent testing laboratory approved by the Owner shall be obtained by the Contractor and provide quality control testing.

PART 2 – PRODUCTS

2.01 GENERAL

A. Material shall be clean, sound, hard, dense, durable, field or quarry stone which is free from seams, cracks, or other structural defects. It shall be angular material from shot rock (blasted) or crushed rock having substantially all face of which have resulted from artificial crushing.

B. Loss due to sulfate soundness test shall not exceed 10 percent.

C. Loss due to abrasion test shall not exceed 40 percent.

D. Material shall not be frozen.

2.02 GRADATION

A. All soils and aggregate gradations shall conform to the gradations specified in the IDOT Standard Specification for Road and Bridge Construction.

PART 3 – EXECUTION

3.01 APPLICATION

A. Use the soil classification as specified or stated on Drawings.

B. Place material in accordance with the Drawings and appropriate Specification Sections for the type of work being performed.

3.02 PAYMENT

A. The cost of this work shall be considered incidental to the contract and be included in the bid price as specified in the Bidding and Procurement division of the contract.

END SECTION.
SECTION 31 10 00
SITE CLEARING

PART 1 – GENERAL

1.01 SUMMARY
A. The Contractor shall provide:
   1. Protection of benchmarks
   2. Protection of all trees and shrubs
   3. Relocation of Utilities
   4. Stripping
   5. Topsoil Storage
   6. Disposal

1.02 PROTECTION OF BENCHMARKS
A. All benchmarks, monuments and other reference points are to be maintained. If disturbed, or destroyed, they shall be replaced by the Contractor as directed by the Owner via the Engineer at no cost to the Owner.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 PROTECTION OF TREES AND SHRUBS
A. Existing trees and shrubs shall be protected during construction operations unless their removal for purposes of construction is authorized by the Owner via the Engineer. Any trees, shrubs, or other vegetation which are approved for removal by the Owner via the Engineer shall be completely removed by the Contractor, including roots and stumps.
B. The Contractor shall be responsible for any damage or claims for damage caused by construction operations to trees, shrubs, or other landscape improvements which were not authorized for removal.

3.02 RELOCATION OF UTILITIES
A. The contractor shall be responsible to locate all utilities whether or not shown on the drawings, surveys or site inspection report.
B. Active utilities which do not interfere with the work shall be supported and protected from damage. Relocate, or remove active utilities, with the Owner’s approval, which will interfere with the work as indicated. The Contractor shall pay for repairing the damage to active utilities and for relocation or removal of all interfering utilities.
C. Inactive or abandoned utilities and appurtenant structures encountered during excavation shall be filled or removed to avoid interference as directed by the Owner via Engineer. Exposed ends of abandoned lines shall be plugged or capped in a watertight manner,
except that any active or inactive field tile encountered shall be repaired and restored to their original function, by the Contractor who damages such tile.

3.03 STRIPPING

A. Turf and weeds shall be stripped to full depth in areas where buildings, walks, drives and other paving is shown. In other areas to be excavated or graded, topsoil which is suitable for subsequent topsoiling operations under this Contract and is approved for quality shall also be stripped to full depth of topsoil and conserved, except where new grades are to be the same as or not over six (6) inches above existing grades.

3.04 TOPSOIL STORAGE

A. Topsoil which is suitable for re-use shall be placed in storage piles convenient to areas that are subsequently to receive application of topsoil. Topsoil shall be kept separate from other excavated materials and shall be free of roots, stones larger than 2 inches, and other undesirable material that would interfere with planting.

3.05 DISPOSAL

A. Any rubbish or debris resulting from site preparation operations shall be removed from the site by the Contractor and legally disposed of at his own expense.

END SECTION.
SECTION 31 22 00

GRADING

PART 1 – GENERAL

1.01 SUMMARY
   A. Work under this Section includes:
      1. Rough and final grading of the site.
      2. Topsoil placement.

1.02 RELATED SECTIONS
   A. Related work specified elsewhere:
      1. 31 23 33 – Trenching, Backfilling, and Compacting
      2. 32 92 00 - Turfs and Grasses

PART 2 – PRODUCTS

2.01 TOPSOIL
   A. Topsoil shall be fertile, friable, natural topsoil typical of the area, free from subsoil, stones, plants, roots or other extraneous material and shall not be used while muddy or frozen.
   B. Topsoil shall contain not less than 8% organic matter (AASHTO T194). The topsoil shall consist of either natural topsoils typical of the locality and free from coarse stone aggregate or surface soils stripped from the site and enriched with humus at a rate of 8% by volume. The soil mixture prepared by mixing surface soils and humus shall be free of oil, cinders, coarse stone, and woody root material. Humus shall be dark brown to black in color, shall be free from sticks, stones and weedy roots and shall have an organic matter content of not less than 85% by weight when oven dried.

PART 3 – EXECUTION

3.01 ROUGH GRADING
   A. Provide all rough grading and filling to achieve the lines and grades shown on the Drawings, with an allowance for the thickness of paving, surfacing, or top soil. All earthwork shall be done in a manner that provides drainage and prevents surface drainage from entering excavations.
   B. Upon completion of site preparation work, remove any additional organic material or debris where fill is to be placed. Ground surfaces sloped steeper than 1 vertical to 4 horizontal shall be plowed, stepped or benched, or broken up to allow the fill material to bond with the existing surface.
   C. Level surfaces shall be disked, wetted or dried as required, and recompacted. Backfill all holes made by demolition, clearing, grubbing, and other site preparation work.
   D. Lift thicknesses and compaction requirements are specified in Section 31 23 33.
E. Fill material and the surface to be filled shall be free of any frozen material. If, based on the observation of the Engineer, found that fill already placed has loosened due to frost action, the fill shall be recompacted prior to placing additional lifts. Compacted material that has been flooded and no longer meets the density specified shall be removed and replaced.

3.02 TOPSOIL PLACEMENT

A. Provide all topsoil placement, finish grading, rough grading, and filling to achieve the lines and grades shown on the Drawings. All earthwork shall be provided in a manner that provides drainage as shown on the Drawings.

B. Place stockpiled topsoil in uniform thickness on all areas of new grading to the proposed elevations and grades. Grade flush with sidewalks, curbs, and paving.

3.03 FINISH GRADING

A. All areas of the project sites including all previously grassed areas that have been disturbed, borrow sites, excavated and filled sections and adjacent transition areas shall be uniformly smooth-graded. Depressions from settlement shall be filled and compacted. Tops of embankments and breaks in grade shall be rounded. All surfaces shall be finished to provide adequate drainage. Finished surfaces shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the smoothness obtained by blade-grader operations.

B. Slope grades to drain away from structures at a minimum of 1/4 inch per foot for 10 feet.

C. Finished surfaces adjacent to paved or surfaced areas and within 10 feet of structures shall be within 1 inch of the proposed grade. All other areas shall be within 3 inches of the proposed grade.

D. Newly graded areas shall be protected from traffic and erosion. All settlement or washing away that may occur from any cause prior to seeding or acceptance shall be repaired and grades re-established to the required elevations and slopes at no additional cost to the Owner.

E. Unless specified otherwise, all surplus material shall be disposed of by the Contractor at his own expense.

END SECTION.
SECTION 31 23 00
EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SUMMARY
A. The Contractor shall furnish all labor, tools, equipment, and materials necessary to complete all stripping, storage, and redistribution of top soil; cut and fill operations; rough and finish grading; and construction of drainage swales in conformity with the lines, grades, and slopes as shown on the Drawings.

B. Keep open excavations free of water, both surface and subterranean per Specification Section 31 23 19.

1.02 QUALITY ASSURANCE
A. The Contractor shall employ and pay for the services of an independent testing laboratory to perform specified services, necessary sub grade bearing tests, and field density tests to ensure that proper compaction is obtained.

B. If, based on testing services reports and inspections, the sub grade or fills which have been placed are found to be below the specified density, the Contractor shall provide additional compaction and testing at no additional cost to the Owner.

1.03 SUBMITTALS
A. Bearing Conditions Report:
   1. Submit a report from an independent testing laboratory containing observed bearing conditions, estimated allowable bearing capacity, and comparison to the specified bearing capacity on the Plans.
   2. Bearing conditions shall be determined on an interval not less than recommended by the independent testing laboratory field personnel to accurately estimate the allowable bearing capacity. In no case shall there be less than one (1) Bearing Conditions Report per foundation or footing.

B. Backfill Density Report
   1. Submit one (1) Optimum Density Report for each backfill soil type per ASTM D698.
   2. Submit one (1) Field Density Report per lift per 1,000 square feet of footing, foundation, sidewalk, or roadway backfill.

1.04 JOB CONDITIONS
A. Maintain bench marks, monuments, and other reference points, and replace any that are disturbed or destroyed.

B. Selected information, including a full soils report, from subsurface investigations performed by other consultants, if any, are included as an appendix to these Specifications or on the Drawings, if performed. Absence of subsurface information indicates no investigation has been made. Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the Drawings or specified in the Specifications, he shall immediately give notice to the Engineer of such conditions before they are disturbed.
The Engineer will then consult with the Owner and investigate the conditions; and if he finds that they materially differ from those made available at the time of design by the Owner, and as such shown on the Drawings or specified in the Specifications, he will make such changes in the Drawings and/or Specifications as he may find necessary. Any increase or decrease of cost resulting from such changes shall be adjusted by the Owner via Engineer in the manner provided in the General Conditions.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Backfill:
   1. Suitable earth removed from the excavation, free of rocks, boulders, stones larger than two (2) inches or other building materials debris.
   2. Brown sandy clays may be used for backfill around the exterior of foundations.
   3. Topsoil and soil containing decomposed organic materials shall be considered suitable for topsoil fill material only.
   4. Aeration of some backfill may be required for compaction.

B. Granular Fill:
   1. As shown on the Drawings and specified according to the Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation, latest edition.
   2. IDOT Coarse Aggregate Gradation CA6 or CA10 shall be used if not shown or specified otherwise on the Drawings.

C. Topsoil
   1. Natural, fertile, agricultural soil, capable of sustaining vigorous plant and lawn growth.
   2. Uniform composition throughout, without admixture of subsoil.
   3. Free of stones, lumps, clods, sod, live plants and/or their roots, sticks, and other extraneous matter.

PART 3 – EXECUTION

3.01 PREPARATION

A. Clear and grub areas as required.

B. Remove all topsoil at the construction areas. Stockpile the topsoil for use in the finish grading operations. Do not use topsoil for fill.

C. No fill materials shall be placed until the Bearing Conditions Report has been reviewed by the Engineer.

3.02 EXCAVATION

A. Excavate true to line and grade, level at the bottom. Excavate to undisturbed structurally stable subsoil. Where excavation, in order to reach such subsoil, must continue deeper than required by the elevations indicated on the Drawings, the extra excavation will be paid for at
a unit price to be negotiated. No additional payments will be made for unauthorized excess excavation.

B. Excavations shall be of the dimensions indicated plus sufficient space to permit erection of forms, shoring, masonry, and foundations and excavation inspections.

C. Excavation below slabs and paving shall be sufficient to permit placement of sub-base material.

D. Foundations and Sub-Grades:
   1. If suitable bearing is not encountered at the depth indicated on the Drawings for foundations, immediately notify the Engineer. Do not proceed further until instructions are given by the Engineer and required tests are completed.
   2. Do not construct foundations, footings, slabs, or piping on loose soil, frozen soil, mud, or other unsuitable soil.

E. Provide shoring or piling as required to protect the excavation bank.

F. All excavated material shall be piled in a manner that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural watercourses shall not be obstructed.

G. Excavations and related safety shall be the sole responsibility of the Contractor.

H. No explosives shall be used on this project.

3.03 STRIPPING AND STOCKPILING OF TOPSOIL

A. Strip topsoil and vegetation from the excavated areas. Clean topsoil may be stockpiled for reuse as the upper six inches of the areas to be seeded. Additionally, suitable excavated material may be stockpiled, in on-site locations identified by the Owner, for filling and backfilling.

B. Do not intermix grass, weeds, roots, root mat, brush, and stones larger than three inches with stockpiled topsoil. Dispose of root contaminated topsoil and unsuitable materials as excavated. Surplus suitable materials shall be removed from the job site as trenches are backfilled.

3.04 PAVEMENT AND WALK REMOVAL

A. Remove existing pavement and walks from the excavated areas and the job site.

B. All pavement and walks shall be cut along a straight line and all faces shall be vertical.

3.05 DEWATERING

A. The Contractor shall keep excavations free from water until foundations, structure, and piping are completed and will safely withstand forces generated by water. Provide sufficient dewater equipment and make proper arrangements for the disposal of water from the dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other work. Do not use sanitary sewers for the disposal of clean water from the dewatering operations.

3.06 SHEETING
A. Supporting systems, such as piling, cribbing, shoring, and bracing shall be designed by a qualified Contractor’s representative and meet all federal, state and local OSHA requirements.

B. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning shall be in good serviceable condition. Timbers shall be sound, free from large or loose knots, and of proper dimensions.

C. Take special precautions in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Ensure that joints and seams of material comprising a face and to the slope of such seams and joints are protected.

D. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above or near an excavation, sheet-pile, shore, and brace the side of the excavation as necessary to resist the extra pressure due to such superimposed loads.

E. If the stability of adjoining building or walls is endangered by excavations, provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing, or underpinning shall be inspected daily or more often, as conditions warrant, by a competent Contractor’s representative. The protection shall be effectively maintained.

F. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and other property on the project site, as well as on private grounds.

G. Drive sheeting ahead of the excavation. Do not remove sheeting until the excavation backfill has reached within two feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 BACKFILLING EXCAVATIONS FOR PAVEMENTS, FOUNDATIONS, AND STRUCTURES

A. Remove debris, water, and other unsuitable materials from excavations before backfilling is started.

B. Backfill excavations in areas to be paved, to be subjected to traffic, beneath footings and foundations, and beneath soil-supported slabs to 95% Standard Proctor density per ASTM D698. Method is dependent on type of fill. Use compaction equipment which is suited to the soil being compacted. Backfill beneath structure footings and foundations shall be Granular Fill with a minimum 6” thickness.

C. Backfill and fill shall be provided within +2% of optimum moisture content.

D. Backfill non-load bearing excavations with suitable excavated material. Place backfill and fill materials in lifts no greater than eight (8) inches in loose depth. Place backfill and fill materials in lifts no greater than four inches in loose depth where hand tampers are used. Compact backfill and fill for non-load bearing excavations to not less than 90% of the Standard Proctor density per ASTM D698. Method is dependent on type of fill. Use compaction equipment which is suited to the soil being compacted.

E. Do not use the following materials for any backfilling:
1. Unsuitable materials;
2. Frozen materials; or
3. Materials which are too wet or too dry to be compacted to the densities specified in this Article.

F. Do not place fill over frozen, wet, or muddy sub-grade.

G. Place backfill and fill in a manner not to overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.

3.08 CLEANUP AND MAINTENANCE

A. Cleanup the jobsite, within 1,000 feet of excavations, as backfilling is completed. Remove all excess material, and restore items moved, damaged, or destroyed during construction. Then, grade the area to be restored, and leave backfill mounded over trenches which are not backfilled with Special Backfill. Maintain the job site until the work has been completed and accepted. Keep dust conditions to a minimum by the use of water, salt, calcium chloride, or other acceptable means.

END SECTION.
SECTION 31 23 19
DEWATERING

PART 1 – GENERAL
1.01 DESCRIPTION

1.02 SUMMARY
A. The Contractor shall provide all labor, materials, and equipment necessary to temporarily
dewater any and all excavations required for the proper construction of the Project, at no
additional cost to the Owner.

1.03 RESPONSIBILITY
A. The Contractor shall be solely responsible for the design, installation, operation, and
subsequent removal of his dewater system, all safety aspects associated with the system,
and the conformity of the system with all local and state codes and regulations.

1.04 SUBMITTALS
A. Prior to the beginning of any work, the Contractor shall submit his proposed dewatering plan
and details to the Engineer for review.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION
3.01 SITE DEWATERING
A. At all times during pipeline and structural excavation, the Contractor shall provide ample
means and equipment to promptly remove and dispose of all water entering any excavation
or other parts of the work. The dewatering system shall remain in operation until all
underground construction is completed and accepted. All excavations shall be kept dry.

B. The dewatering system shall take into consideration the construction procedures, the soil
type, and the depth of the foundation relative to the ground water level.

C. Water pumped or drained from the work hereunder shall be disposed of in a suitable manner
without damage to adjacent property or to other work under construction. Any and all
damage caused by dewater the work shall be promptly repaired by the responsible
Contractor at his expense.

D. Water pumped or drained from the work shall be clear of any sediment or other debris. If
necessary, the water shall be routed through erosion control devices to remove such
sediment, silt, debris, etc.

E. Contractor shall provide a standby system for emergency operation in case of failure of the
primary dewatering means.

END SECTION.
SECTION 31 23 33
TRENCHING, BACKFILLING AND COMPACTING

PART 1 – GENERAL

1.01 SUMMARY
A. Section Includes
   1. Obstruction removal.
   2. Dewatering.
   3. Trench excavation.
   4. Trenching, backfilling and compaction.
   5. Field quality control.
B. This section applies to below ground pressure and gravity pipe lines.

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM):
   1. D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
   2. D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. D6938-07 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS
A. Submit two (2) copies of the results of quality control testing (include location where test was done):
   1. Installation testing.
   2. Additional density testing when provided.

1.04 QUALITY ASSURANCE
A. Obtain an independent testing laboratory as necessary.
B. Material Testing Requirements
   1. Source Testing:
      a. Provide IDOT stockpile certification for each material source.
   2. Installation Testing:
a. Determine optimum moisture/density relationship per ASTM D698 and where trench crosses a load bearing soil (roadways, sidewalks, footings, foundations) in place density by ASTM D1556 and/or D6938.

3. Additional Density and Gradation Testing:
   a. Soil density does not meet project requirements.
   b. Change in method of compaction.
   c. Change in source or quality of bedding or backfill material.

C. Acceptable test results do not relieve the Contractor from making corrections to the tested work during the warranty period.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Native Backfill Material
   1. Unless specified otherwise, use excavated material as backfill material.
   2. Backfill material shall be free of:
      a. Vegetable or other organic material.
      b. Concrete or concrete fragments.
      c. Stones larger than 3 inches.
      d. Frozen material.
      e. Blasted rock.
      f. All types of refuse.

B. Select Granular Backfill Material

C. Controlled Low Strength Material (CLSM)
   1. IDOT Mix #1.

2.02 SOURCE QUALITY CONTROL

1. Provide IDOT certification for all stockpile material and CLSM mixes.

PART 3 – EXECUTION

3.01 OBSTRUCTION REMOVAL

A. Remove obstructions from within the construction limits as required; such as:
   1. Mounds of dirt, stone or debris.
   2. Street signs, culverts and end walls, advertising signs and guard posts (shall be replaced to original condition).

B. Unless specified otherwise, the construction limits shall be:
1. Street right-of-way.
2. Easement boundaries.
3. Project site property lines.

C. Strip and stockpile topsoil in accordance with section: 31 10 00 "Site Clearing."

D. Remove pavement, curb and gutter, sidewalk, and driveway and other surfaces within the maximum trench width for payment purposes at the ground surface or as shown on the Drawings, whichever is greater.
   1. Sawcut vertically pavement, curb and gutter, sidewalk, driveway and other surfaces to a minimum depth of 3 inches prior to removal.
   2. Remove concrete surfaces to the nearest joint.

3.02 DEWATERING
   A. Determine groundwater conditions.
   B. Provide and maintain necessary means and methods to dewater excavations as required.
   C. Dispose of water.
   D. Prevent runoff and dewatering system discharge from entering excavation.
   E. Secure permits from regulatory and governmental agencies governing dewatering.
   F. Provide wells, water, pumping equipment, generating equipment and/or power.
   G. Correct damage caused to private wells due to dewatering.
   H. Provide where specified on the Drawings or elsewhere.
   I. Maintain a water supply to private and public wells affected by the dewatering operation.
   J. Dewater to a minimum depth of 12 inches below excavations.
   K. Maintain dewatering operation until backfill and compaction procedures are completed.
   L. Groundwater Disposal
      1. Convey groundwater to point of discharge through pipelines.
         a. Open ditches and trenches shall not be permitted.
         b. Use of Owner's utilities shall not be permitted without written consent.
      2. Maximum Sediment Content: 10 milligrams per liter.

3.03 TRENCH EXCAVATION
   A. Excavate trench to sufficient width and depth to permit proper utility construction at line and grade shown on the drawings.
   B. The bottom of the excavation shall conform to the pipe embedment details with a minimum width of the pipe outside diameter plus 24 inches.
   C. Do not open more than 200 feet of trench at any one time.
   D. Place excavated material in a location that will minimize inconvenience to public travel, adjacent property owners and other contractors. Do not place excavated material on the wetlands.
E. Disposal of Surplus Excavated Material
   1. Remove surplus excavated material from the site as soon it is determined it will not be used for backfill material.
   2. Dispose of pavement separately from soils material.
   3. Dispose of surplus material which includes:
      a. Loading and hauling.
      b. Dumping and leveling.
      c. Providing a dump site (when not specified by Owner)
         1) Conform with governing authorities.
         2) No limit on haul distance.
   4. Do not dispose of excavated surplus material in state waters, such as creek, stream, river, and other flowing water body, floodplain, or wetlands without written approval of the appropriate regulatory agency.
   5. Comply with conditions included in the Nation Wide Permit No. 12.

F. Sheetling and Bracing
   1. Sheet and brace trenches and excavations as required by applicable federal and state codes, by the Contract Documents, and as necessary to protect life and property.
      a. When close sheeting is required, prevent soil from entering the trench either below or through such sheeting:
   2. Removal of Sheetling and Bracing:
      a. Remove sheeting and bracing as the excavation is backfilled in such a manner to avoid disturbance of adjacent structures and to insure adequate protection of the completed pipe section.
      b. If the sheeting and bracing cannot be removed without damage to the pipe or adjacent areas, leave in place.

G. Portable Trench Shoe Shield (Shoe)
   1. A shield may be used with the following restrictions.
      a. Construct as required by State or Federal authority.
      b. Do not exceed trench limits.
      c. Do not disturb or alter pipe and bedding.

H. Rock Removal
   1. Remove and dispose of rock in accordance with the applicable local, state and federal requirements.

3.04 TRENCH BACKFILLING AND COMPACTION
   A. Provide pipe foundation material below the bedding as shown on the Drawings and specified in this section.
   B. Notify Engineer of poor soils below the pipe foundation and/or the pipe bedding.
C. Backfill the trench as shown on the Drawings.

D. Provide pipe embedment as required for the type of pipe installed per the appropriate Section.

E. Backfill the trench with excavated material in layers not exceeding 6-inches unless select backfill material is specified elsewhere.

F. Backfill Compaction
   1. Compact trenches using mechanical compaction methods.
   2. Compact backfill in layers not exceeding 18 inches to the following densities:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Density Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Material</td>
<td>90% Std. Proctor</td>
</tr>
<tr>
<td></td>
<td>(Non-load bearing)</td>
</tr>
<tr>
<td></td>
<td>95% Std. Proctor (Load bearing)</td>
</tr>
<tr>
<td>Granular Backfill</td>
<td>Minimum of 95% of the Std. Proctor Density</td>
</tr>
</tbody>
</table>

G. Provide select backfill material as shown on the Drawings and as specified in this section.

H. Backfill trench to last pipe joint (not to exceed 10 feet) at the end of each work day.
   1. Backfill during nights, weekends, and when no work is in progress.

3.05 FIELD QUALITY CONTROL

A. Background Testing
   1. Determine moisture/density relationships of select soils and aggregates in accordance with ASTM D698 (Standard Proctor).
   2. Perform five (5) moisture/density tests for each major native soil type to determine density of undisturbed soil.

B. Installation Testing
   1. Perform a minimum of one (1) moisture/density compaction percentage test in accordance with ASTM D1556 and/or D6938 per 6" lift per 100 lineal feet of pipe installed within gravel, concrete, or lagoon berm areas.
   2. Additional installation testing may be required by the Owner in the seeded areas based on observed methods and conditions. Testing in seeded areas will be paid as per Articles 10 and 12 of Section 00 72 00, as supplemented by Section 00 73 00.

C. Additional Density and Gradation Testing
   1. Perform under following circumstances:
      a. Soil density does not meet project requirements.
      b. Change in method of compaction.
      c. Change in source or quality of bedding or backfill material.

3.06 SURFACE RESTORATION

A. Remove surplus material (earth, rubbish, construction material, etc.) and restore areas affected by construction activities.

B. Restore roads, streets, and highways meeting the following provisions:
1. Shape subgrade and grade for installation of required base course and pavement.

2. Install base course to final pavement grade, compacted to 95 percent Standard Proctor density and fine graded.

3. Maintain base course surface grade and control dust until paving is completed.

4. If paving is by others, provide maintenance of the base course for a period of 6 months from the date of Substantial Completion.

C. Restore the following surfaces to the thickness stated on the Drawings or, if not stated on the Drawings, then restored to the thickness of the existing surface or to the minimum thickness stated as follows, whichever is better, Other criteria specified below applies in all cases.

1. Portland Cement Concrete Pavement:
   a. Concrete (4,000 psi compressive strength).
   b. Minimum thickness: 8 inches

2. Asphaltic Concrete Pavement:
   a. Match existing type.
   b. Minimum Thickness: 3 inches

3. Base Course:
   a. IDOT CA6/10.
   b. Minimum Thickness: 8 inches
   c. Compaction: 95 percent Standard Proctor density.

4. Unpaved Roads:
   a. IDOT CA6/10.
   b. Minimum Thickness: 6 inches.
   c. Compaction: 95 percent Standard Proctor density.

5. Curb and Gutter:
   a. Concrete (4,000 psi compressive strength).
   b. Curb and gutter to match existing style and size.
   c. Minimum 6-inch aggregate base, IDOT CA6/10, compaction 95 percent Standard Proctor density.

6. Sidewalk:
   a. Concrete (4,000 psi compressive strength).
   b. Minimum Sidewalk Thickness: 4 inches
   c. Provide 2” IDOT CA6/10 to level base, compaction 95 percent (Standard Proctor density).

7. Driveways and Parking Lots:
   a. Concrete: (4,000 psi compressive strength).
b. Asphalitic Concrete: Minimum thickness - 3 inches.

c. Minimum 6-inch base, IDOT CA6/10, compaction 95 percent Standard Proctor density.

8. Landscaping:

9. Perform as defined in section 32 92 00 "Turf and Grasses".

10. Make restitution to the Owner of trees and shrubs damaged during construction.

END SECTION.
SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Erosion and bales.
   2. Inlet protection.
   3. Silt fence.
   4. Riprap and breaker run stone.
   5. Vegetal cover.
   6. Erosion mats
   7. Soil stabilizers.
   8. Ditch checks.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM D1388 Test Method for Stiffness of Fabrics
   2. ASTM D2487 Test Method for Classification of Soils for Engineering Purposes
   3. ASTM D3776 Test Method for Mass Per Unit Area (Weight) of Woven Fabric
   4. ASTM D4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
   5. ASTM D4491 Test Method for Water Permeability of Geotextiles by Permittivity
   6. ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
   7. ASTM D4751 Test Method for Determining Apparent Opening and Size of a Geotextile
   8. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
   9. ASTM Test Method for Breaking Strength and Elongation of Textile Fabric (Strip Method)
   10. ASTM D5338 Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions

1.03 SYSTEM DESCRIPTION
A. Design Requirements
   1. Select and design method of erosion and sediment control in accordance with state and local erosion control ordinances and standards.
B. Provide additional erosion and sediment control to prevent erosion which may be caused due to selected construction methods.

1.04 SUBMITTALS
A. Manufacturer's certification for manmade products.
B. Riprap design.
C. A list of ditch checks materials

PART 2 – PRODUCTS

2.01 EROSION BALES AND BAGS
A. Sand Bags:
   1. Minimum unfilled size of 16” by 26”.
   2. Completely filled with a granular soil (P200 <50%).
B. Rock Filled Filter Bags:
   1. Minimum unfilled size of 18” x 30”.
   2. Construct bag of high-density polyethylene as manufactured by Erotex.
   3. Seal bag with a high-density polyethylene draw string knitted directly into the bag opening in a rolled seam using minimum of 480 denier polyester sewing yam.
   4. Fill bag with well graded coarse aggregate conforming to the following AASHTO M43 Size No. 76:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td>--</td>
</tr>
<tr>
<td>1 ½ inch</td>
<td>--</td>
</tr>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>20-55</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-10</td>
</tr>
<tr>
<td>No. 8</td>
<td>0-5</td>
</tr>
</tbody>
</table>

A. Erosion Bales:
   1. Tightly compacted bales of grain straw or hay.
   2. Use straw, if required to function for more than 15 days.
B. Support Post:
   1. Wood or steel construction, minimum length 4 feet.
   2. Wood Posts: 2” x 2” or equivalent steel posts.

2.02 INLET PROTECTION
A. Geotextile Fabric:
1. Approved Products and Manufacturers
   a. Filterweave 401 manufactured by Mirafi
   b. GTF 403 manufactured by Linq
   c. W401 manufactured by TNS
   d. WecTex 403 manufactured by Kintex
   e. TerraTex EP12 manufactured by WebTec

2. The fabric shall be woven polypropylene meeting the following requirements:

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Value (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength, lb. (N)</td>
<td>ASTM D4632</td>
<td>200 (900) min.</td>
</tr>
<tr>
<td>Puncture Strength, lb. (N)</td>
<td>ASTM D4833</td>
<td>105 (460) min.</td>
</tr>
<tr>
<td>Apparent Breaking Elongation, Machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direction, %</td>
<td>ASTM D4632</td>
<td>24 min.</td>
</tr>
<tr>
<td>Apparent Breaking Elongation,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross Direction, %</td>
<td>ASTM D4632</td>
<td>10 min. Cross Direction, %</td>
</tr>
<tr>
<td>Apparent Opening Size, µm</td>
<td>ASTM D4751</td>
<td>600 max.</td>
</tr>
<tr>
<td>Permittivity, s⁻¹</td>
<td>ASTM D4491</td>
<td>1.9 min.</td>
</tr>
</tbody>
</table>

(1) All numerical values represent minimum/maximum average roll values (i.e., the average of minimum test results on any roll in a lot should meet or exceed the minimum specified values).

B. Wood Stakes and Boards:
   1. Type A Inlet Protection:
      a. Wood Stakes: 2"x4"x48"
      b. Wood Cross Bracing: 2"x4"

C. Type C Inlet Protection:
   a. Wood Boards: 1 1/2" x 3 1/2" minimum

2.03 SILT FENCE

A. Geotextile Fabric:
   1. Fabric shall be either woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene or polyvinylidene chloride.
   2. Fabric shall have the minimum strength values in the weakest principal direction.
   3. Non-woven fabric may be needle punched, heat bonded, resin bonded or combination thereof.
   4. Fabric shall meet the following requirements:
      a. If silty soils are encountered on-site, then:
         1. Grab Tensile Strength ASTM D4632 101 lbs. (450 N)
         2. Apparent Opening Size ASTM D4751 0.3 mm
B. Types:

1. Class I: A short term duration (six months or greater), light duty, organic "Erosion Control Revegetative Mat" (ECRM). Non-organic, photodegradable or biodegradable netting allowed.
   a. Type A: Minimum Product Permissible Shear Stress: 1.0 lbs./ft² (50Pa)
   b. Type B: Minimum Product Permissible Shear Stress: 1.5 lbs./ft² (70Pa)
   c. Urban Type A: No minimum product permissible shear stress required for netted products. A product for use on slopes 4:1 and flatter. Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting. Non-netted materials must have a minimum permissible shear stress of 1.0 lb./sf.
   d. Urban Type B: Minimum Product Permissible Shear Stress: 1.0 lbs/sq. ft.) A product for use on 2.5:1 slopes and flatter. Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting.

2. Class II: A long term duration (three years or greater), organic "Erosion Control Revegetative Mat" (ECRM):
   a. Type A - Jute Fiber Only: Shall meet the following general requirements:
      1) Uniform, open weave of single jute yam.
      2) Twisted construction having an average twist of not less than one and one-half turns per inch.
      3) Furnished in rolled strips 48 inches wide with a minimum of 78 wrapped ends.
      4) Fabric shall have a minimum of 41 weft yams per linear yard of length.
      5) Weight of fabric shall be a minimum of 92 lbs. per 100 square yards.
      6) Non-toxic to vegetation.
      7) Smolder resistant.
   b. Type B: Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95Pa). For use on slopes 2:1 or flatter or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95Pa) or less. Non-organic, photodegradable or biodegradable netting allowed.
   c. Type C: Minimum Product Permissible Shear Stress: 2.0 lbs/ft² (95Pa). For use on slopes 2:1 or flatter or in channels when the calculated (design) shear stress is 2.0 lbs/ft² (95Pa) or less. Only 100% organic fibers allowed. Woven mats are allowed with a maximum opening of 1/2 inch (12mm). Recommended for use in environmentally sensitive areas that have a high probability of entrapping animals in plastic netting.

3. Class III: A permanent 100% synthetic “Erosion Control Revegetative Mat” (ECRM) or “Turf Reinforcement Mat” (TRM):
a. Type A: Minimum Product Permissible Shear Stress: 2.0 lbs./ft² (95Pa). An ECRM mat, as opposed to a TRM mat, for use on slopes 2:1 or flatter or in channels when the calculated (design) shear stress is 2.0 lbs./ft² (95Pa) or less.

b. Type B: Minimum Product Permissible Shear Stress: 2.0 lbs./ft² (95Pa). A TRM mat for use on slopes 2:1 or flatter or in channels when the calculated (design) shear stress is 2.0 lbs./ft² (95Pa) or less.

c. Type C: Minimum Product Permissible Shear Stress: 3.5 lbs./ft² (170Pa). A TRM mat for use on slopes 2:1 or flatter or in channels when the calculated (design) shear stress is 3.5 lbs./ft² (170Pa) or less.

d. Type D: Minimum Product Permissible Shear Stress: 5.0 lbs./ft² (240Pa). A TRM mat for use on slopes 1:1 or flatter or in channels when the calculated (design) shear stress is 5.0 lbs./ft² (240Pa) or less.

C. Anchoring Devices:
1. Anchoring and components for temporary erosion mats shall be completely biodegradable as determined by ASTM D5338.
2. Materials shall be environmentally safe for soil and groundwater.
3. Do not use petroleum-based plastics or composites.
4. Do not use materials which may present a hazard from splintering or spearing.
5. Design anchors to hold a minimum of two months and be substantially degraded within four months during the summer (warm soil conditions).

D. Material Properties:
1. Porosity Calculated: 85-90%.
2. Stiffness ASTM D1388 2,000 mg-cm (maximum).
4. Tensile Strength ASTM D5035 (2-inch strip):
   a. Length Direction: 15 lb.
   b. Width Direction: 5 lb.
5. Elongation ASTM D5035 (2-inch strip):
   a. Length Direction: 150%
   b. Width Direction: 100%

E. Use flexible mat of polyvinylchloride monofilaments bonded together into a three-dimensional web designed exclusively to serve as an erosion control and revegetative mat.

F. Staples:
1. Staples for anchoring erosion mat shall meet the following minimum requirements:
   a. U-shaped.
   b. No. 11 gage or larger diameter steel wire.
   c. Width of one to two inches.
   d. Length:
1) Not less than six (6) inches for firm soil.
2) Not less than twelve (12) inches for soft or loose soils.
3) Not less than eight (8) inches where erosion mat is placed over sod.

2. Pins shall have a 3/16-inch shank diameter with attached 1 1/2-inch washer.
3. Staples shall have a % inch shank diameter with a 1” minimum top width.

2.04 TACKIFIERS

A. Latex Base:
   1. Latex emulsion polymer by weight shall consist of:
      a. Styrene (%): 48
      b. Butadien (%): 50
      c. Additive (%): 2
      d. Percent Solids: 42 to 46
      e. pH (as shipped): 8.5 to 10.0
   2. Emulsion shall not be frozen at any time or exposed to sunlight for extended periods of time.

B. Guar Gum:
   1. Minimum of 95% guar gum by weight.
   2. Remaining weight shall consist of dispersing and cross-linking additives.

C. Other Tackifiers:
   1. Other tackifiers shall include the following, but not limited to:
      a. Water soluble natural vegetable gums.
      b. Guar gums blended with gelling and hardening agents.
      c. Water soluble blend of hydrophobic polymers, visosifers, sticking aids, and other gums.

2.05 SOIL STABILIZERS

A. Soil Binder/Fiber Stabilizer:
   1. Shall be a cementitious soil binder added to wood cellulose fiber mulch or a bonded fiber matrix.
   2. Shall show similar vegetative density and sediment loss standards as temporary erosion mats.

B. Polyacrylamide (PAM) and Calcium Solution Stabilizer:
   1. Shall effectively bond soil particles to increase the soil particle size to 1.0 mm or larger.
   2. Shall reduce the movement of soil through chemical bonding.
   3. Shall be anionic (cationic is not allowed).
   4. Shall be non-combustible.
   5. In pure form shall contain no more than 0.05% acrylic monomer by weight.
6. Application for PAM, in its pure form, shall not exceed 200 lbs/acre (225 kg/ha).
7. Any PAM used on the site shall have preapproval of the Illinois Department of Natural Resources regarding toxicity.
8. PAM manufacturer shall submit certified test data confirming that the material achieved no less than 80% reduction in soil loss induced by 2 inches per hour (50 mm/hr).

2.06 DITCH CHECKS
A. Make ditch checks of materials that are either biodegradable, that can be removed during long term erosion control construction activities, or that will not conflict with long term erosion and sediment control structures if left in-place.
B. Submit a list of ditch checks materials to the Engineer for review.

2.07 GEOTEXTILE FABRICS
A. See Item 2.2 (A) of this section.

PART 3 – EXECUTION

3.01 GENERAL
A. Keep disturbed areas to a minimum.
B. Stabilize and protect disturbed areas with temporary seed and mulch within 14 days of active disturbance of the soil surface.
C. Place excavated trench material on the high side of the trench where appropriate.
D. Discharge trench water to filter barrier prior to release into a drainage way.
E. Install gravel mats at site vehicle entrance and site exit locations to prevent tracking of soil.
F. Collect tracked soil and clean from paved roads near the construction site the same day it occurs.
G. Sediment control measures shall be in place at the end of each working day.
H. Locate soil stockpiles no closer than 25 feet of a roadway, wetland, or drainage control channel and control by covering the pile with tarpaulins, temporary seed and mulch or other suitable means, if the pile is exposed for 14 days or more.
I. Protect storm inlets including inlets in paved roadways with erosion bales, geotextile fence or other suitable approved barriers.
J. When it is necessary to cross waterways, provide crossing structures for machinery.
K. Repair, replace, and maintain erosion and sedimentation structures until vegetation is re-established or permanent structures are installed.
L. Remove temporary erosion control structures and accumulated sediment and/or debris when vegetation is established.

3.02 EARTH STRUCTURES
A. Utilize one or more of the following:
   1. Earth Structures:
a. Berms or embankments.
b. Sedimentation basins and traps.
c. Temporary diversion ditches.
d. Temporary chutes and ditches.
e. Grade control structures.

2. Construct earthen structures using standard net weights and techniques including fine grading and compaction.

3.03 EROSION AND SEDIMENTATION CONTROL DEVICES

A. Erosion Bales:
   1. Place where shown on the Drawings at a minimum.
   2. Place bales or bags end to end across surface water flow path.
   3. Place bales or bags at right angles to the direction of water flow.
   4. Embed and securely anchor bales with wood or steel stakes or posts.
   5. Excavate shallow sump on the upstream side of bales or bags.
   6. Place bales so that the bindings are oriented around the sides rather than on top and bottom.
   7. Wedge gaps between bales with straw to prevent water from flowing between bales.
   8. Entrench straw bales fence or sand bags at least 4 inches into the ground. Slope up the upslope side of fence to the bales at least 4 inches.
   9. Place bales or bags prior to disturbing upslope areas.
  10. Drive support posts a minimum of 12 inches into the subgrade and extend to the top of the bales or bags.
  11. Remove from the site after final stabilization.

B. Erosion Bags:
   1. Place type (sand or rock filled) where shown on the Drawings at a minimum.
   2. Place bags end to end across surface water flow path.
   3. Place bags at right angles to the direction of water flow.
   4. Excavate shallow sump on the upstream side of bags.
   5. Entrench bags at least 4 inches into the ground.
   6. Place bags prior to disturbing upslope areas.
   7. Drive support posts a minimum of 12 inches into the subgrade and extend to the top of the bags.
   8. Remove from the site after final stabilization.

C. Inlet Protection:
   1. Type A:
a. Provide after construction of inlets around field inlets until permanent stabilization has been established.

b. Provide after construction of inlets or roadway excavation around existing inlets until curb and gutter or pavement is installed.

c. Install wood stakes to a depth of 24”.

d. Bury geotextile fabric a minimum of 12”.

e. Remove without allowing soil to enter inlet after potential for erosion is eliminated.

2. Type B:
   a. Provide prior to disturbing upslope areas for existing inlets, or immediately after paving is complete for new construction.

b. Provide 8” minimum of excess material beyond the outside edge of the grate.

c. Remove without allowing soil to enter inlet after potential for erosion is eliminated.

3. Type C:
   a. Provide prior to disturbing upslope areas for existing inlets, or immediately after paving is complete for new construction.

b. Provide 8” minimum of excess material beyond the outside edge of the grate.

c. Extend wood board 8” beyond the grate width on both sides.

d. The wood board shall not block the entire opening of the curb box.

e. Wrap an additional 18” of fabric around the wood board and secure with staples.

f. Remove without allowing soil to enter inlet after potential for erosion is eliminated.

D. Silt Fences:
   1. Place geotextile (silt) fence prior to disturbing upslope areas.

   2. Excavate trench approximately 4” by 4” along perimeter of area to be fenced.

   3. Secure and continuously anchor bottom of geotextile (silt) fence with excavated material in trench bottom.

   4. Install support post on downstream side of the geotextile to a depth adequate to stabilize geotextile fence (12” minimum depth).

   5. Secure geotextile to posts.

      a. Staples: 1/2” deep.

      b. Staple to up slope side of post.

   6. Backfill over geotextile in trench and compact.

   7. Maximum spacing of the posts shall not exceed 10 linear feet.

E. Riprap:
   1. Place riprap by mechanical methods.
2. Place riprap upon appropriate geotextile fabric.

F. Erosion Mats:
   1. Installation:
      a. See plan details for anchor trench (at ends, checks and edges) installation procedures.
         1) Anchor trenches shall be 1211 deep.
         2) Compact anchor trench backfill.
      b. Place staples in end and check trenches spaced at 12".
      c. Follow manufacturer's specifications and instructions for placement unless project documents are more stringent.
      d. Roll width overlaps shall be 12" at edges. Pin or staple every 3 feet along overlap length.
      e. Roll end overlaps may be spliced by overlapping (in the direction of water flow) two feet with the upstream portion of the mat on top of the downstream portion. This overlap shall receive at least three pins or staples with a maximum spacing of 1211
      f. Pins or staples shall be 1811 in length minimum driven flush with the mat.
      g. Place mat flat conforming to contours in soil surface. Do not stretch mat.
      h. Place mat from toe of slope toward top of slope.
      i. Mat can be placed from downstream toward upstream or from upstream toward downstream.
   2. Site Preparation:
      a. Place seed and fertilizer prior to placing permanent erosion geomat.
      b. Seed and fertilizer may be placed after permanent erosion mat installation with Engineer's approval.
      c. Ground surface shall be smooth and compact.
      d. Remove all rocks, dirt clods, stumps, roots, grass clumps, trash and other obstructions from lying in direct contact with the soil surface and the erosion mat.

3. Erosion Control Revegetative Mats (ECRM):
   a. ECRM are placed on top of the soil.

4. Turf Reinforcement Mats (TRM):
   a. TRM are buried below the surface

G. Tackifiers:
   1. Installation:
      a. Spray tackifiers immediately after installation of the mulch.
      b. Do not apply tackifier during periods of windy conditions which effect proper placement.
c. Protect signs, structures and other items not related to mulch.

d. Latex-base tackifier application per hectare shall be as follows:
   1) Latex Base: 37 gallons of adhesive (or manufacturer's recommendation rate).
   2) Paper Filter: 620 lbs. of newsprint with 925 gallons of water.

2. Guar Gum Tackifier: Mix 120 pounds of dry adhesive and a minimum of 620 pounds of recycled newsprint as a tracer with 3,225 gallons of water.

3. Other Tackifiers (Hydrophobic Polymers): Mix 240 pounds of dry adhesive or the manufacturer's recommended rate, whichever is greater and a minimum of 620 pounds of recycled newsprint as a tracer with 3,225 gallons of water.

H. Soil Stabilizers:

1. Installation:
   a. Install soil stabilizers using conventional hydraulic seeding equipment.
   b. Follow manufacturer's recommendations for application rates.
   c. Application of PAM, in its pure form, shall not exceed 200 lbs./acre (225 kg/ha).
   d. Do not use asphalt-based products as soil stabilizers.
   e. Do not place soil stabilizers in channels.

I. Ditch Checks:

1. Installation:
   a. Ditch checks shall be capable of maintaining location and form during and after rainfall events.
   b. Ditch checks shall be placed at locations shown on the Drawings.
   c. Place ditch checks generally perpendicular to the flow line of the ditch and extend far enough so the ground level on the ends of the ditch checks are a minimum 18" higher than the flow line.

3.04 MAINTENANCE

A. Inspect silt fences and filter barriers immediately after each rainfall and at least daily during prolonged rainfall.

1. Make any required repairs immediately.

2. Maintain temporary erosion and sedimentation control structures until permanent soil erosion controls are completed and/or vegetation is established:
   a. Repair damaged structures.
   b. Replace lost structures.
   c. Remove sediment from deposition areas adjacent to erosion control structures without damaging structures on a regular basis.
   d. Refill eroded areas as required for grade stabilization.

B. If the fabric on a silt fence or filter barrier decomposes or becomes ineffective prior to the end of the expected usable life and the barrier still be necessary, replace the fabric promptly.
C. Remove sediment deposits after each major storm event and when deposits reach approximately one-half the height of the barrier.

D. Remove any sediment deposits remaining in place after the silt fence or filter barrier is no longer required and dress to conform with the existing grade, prepared and seeded.

E. Repair/restore any washed-out areas.

F. Maintenance period to be entire project period including the one-year warranty.

G. Owner may direct Contractor to remove the temporary erosion control measures during the one-year correction period.

H. Construct permanent erosion control measures immediately after earthwork is completed.

END SECTION.
PART 1 – GENERAL

1.01 SUMMARY

A. Work in this Section includes the furnishing of all labor, materials and equipment necessary for the construction of all Portland cement concrete surfaces, hot-mix asphalt pavement, and aggregate surface course as shown on the Contract Drawings.

1.02 QUALITY ASSURANCE

A. Reference Standard: Materials and construction requirements for this section shall conform to the "Standard Specifications for Road and Bridge Construction," latest edition, by the State of Illinois, Department of Transportation, where applicable.

1.03 SUBMITTALS

A. The Contractor shall submit to the Engineer for review, written certification from an IDOT approved source plant that the bituminous mixtures or concrete mixtures meet the specified standards.

PART 2 – PRODUCTS

2.01 CRUSHED STONE BASE COURSE

A. Crushed Stone for constructing Crushed Stone (or Aggregate) Base Course shall conform to Gradation No. CA 6 or CA 10 as specified in Article 1004.01 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition.

2.02 HOT-MIX ASPHALT PAVEMENT

A. Hot-Mix Asphalt Pavement shall conform to Section 406 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition. Provide a prime coat over the aggregate base course, at a rate of 0.25 lbs/sq ft. Prime coat shall meet Note 1 of Article 406.02, item indicated as “prime coat on aggregate bases” of IDOT Standard Specifications.

B. The first lift shall be HMA Binder Course, IL-9.5, N50. The second lift shall be HMA Surface Course, Mix “C”, N50.

2.03 AGGREGATE SURFACE COURSE PAVING

A. Aggregate Surface Course shall conform to Type B as specified in Section 402 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition.

2.04 PORTLAND CEMENT CONCRETE PAVING

A. Portland Cement Concrete shall conform to requirements specified in Section 420 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition. Minimum compressive strength at twenty-eight (28) days shall be four thousand (4,000) pounds per square inch.
PART 3 – EXECUTION

3.01 CONSTRUCTION REQUIREMENTS
A. Existing pavement to be removed shall be cut with a pavement saw before breaking. The width of cut shall not exceed the actual width of the top of the trench by twelve (12) inches on each side or a total of two (2) feet.
B. Removal and disposal of surplus materials and debris shall be considered incidental to the contract unit price for the type of surface replacement indicated on the Drawings.

3.02 HOT-MIX ASPHALT PAVEMENT OVER PORTLAND CEMENT CONCRETE BASE COURSE
A. Base Course for “Hot-Mix Asphalt Pavement over Portland Cement Concrete Base Course” shall consist of a minimum of 8 inches of Portland Cement Concrete Base Course meeting Section 353 of IDOT Standard Specifications, and reinforced with welded wire fabric as per Article 706.10(c) of IDOT Standard Specifications and IDOT Standard 2347-5 (Type A - with W4 x W6.5 wire and 6” x 12” wire spacings, 12” laps). Provide high early strength Portland Cement Concrete Base Course where indicated on the Drawings. At locations where new Portland Cement Concrete Base Course for pavement adjoins either existing Portland Cement Concrete Base Course or combination curb & gutter, the Contractor shall furnish and install into the existing slab 3/4-inch diameter, self-drilling expansion anchors with 18” long J-type hooked bolts, placed on 30-inch centers along said joint, to dowel the existing and new slabs. The expansion anchors shall meet Article 706.09 of IDOT Standard Specifications and shall be drilled into the existing pavement or curb & gutter unit not less than 60 inches.
B. Surfacing for “Hot-Mix Asphalt Pavement over Portland Cement Concrete Base Course” shall consist of a minimum of 3-inches of hot-mix asphalt pavement, constructed in two 1-1/2 inch lifts. The first lift shall be HMA Binder Course, IL-9.5, N50. The second lift shall be HMA Surface Course, Mix “C”, N50. Provide a tack coat, at a rate of 0.05 lbs/sq ft over Portland Cement Concrete Base Course.

3.03 HOT-MIX ASPHALT PAVEMENT OVER AGGREGATE BASE COURSE
A. Hot-Mix Asphalt over Aggregate Base Course shall consist of a minimum of 8 inches of Crushed Stone Base Course, Type B and a minimum of 3-inches of hot-mix asphalt pavement except that where the hot-mix asphalt pavement is to replace an existing bituminous pavement, the thicknesses of the aggregate base course and the surface courses shall be increased as necessary to match the existing thicknesses.
B. Surfacing for “Hot-Mix Asphalt Pavement over Aggregate Base Course” shall consist of a minimum of 3-inches of Hot-Mix Asphalt, constructed in two 1-1/2 inch lifts. The first lift shall be HMA Binder Course, IL-9.5, N50. The second lift shall be HMA Surface Course, Mix “C”, N50. Provide a prime coat, at a rate of 0.25 lbs/sq ft over Aggregate Base Course.
C. In areas where the existing 6-inch crushed stone base course is undisturbed, it may be used for the proposed hot-mix asphalt pavement. The existing base course shall be scarified and compacted prior to the placement of the hot-mix asphalt pavement.

3.04 AGGREGATE PAVEMENTS
A. Aggregate Pavements shall consist of a minimum thickness of 12 inches of Aggregate Surface Course, Type B.

3.05 PORTLAND CEMENT CONCRETE SURFACES
A. Concrete sidewalks shall be constructed of a minimum thickness of 5-inches Portland Cement Concrete.

B. Concrete driveways shall be constructed of a minimum thickness of 6-inches Portland Cement Concrete, matching the existing cross section, finish marking and reinforcement.

C. Concrete pavement shall be constructed in conformance with Section 420 and shall be constructed of a minimum thickness of 8 inches of Portland Cement Concrete matching the existing cross section, and finish marking.

D. Final Finish. Broom final finish shall be used in lieu of Type A or B finish.

E. Replacement combination concrete curb and gutter, either barrier type or mountable type, shall be constructed in accordance with IDOT Standard 606001 and Section 606 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition. Concrete curb and gutter and concrete gutter shall be constructed of Portland Cement Concrete meeting Section 720 of the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition.

END SECTION.
SECTION 32 31 00
CHAIN LINK FENCE

PART 1 – GENERAL

1.01 SUMMARY
A. The Contractor shall provide all labor, materials, tools, and equipment necessary for the new chain link fencing and gates as shown on the Drawings. Perform all work as shown or specified, and all additional work as necessary to produce a complete, finished job.

PART 2 – PRODUCTS

2.01 HEIGHT
A. The fence shall have a fabric height, including top rail of six feet above finished grade prior to adding barbed wire.

2.02 FABRIC
A. Zinc-coated fabric shall be galvanized after weaving with a minimum 1.2 ounces of zinc per square foot of surface area and shall conform to ASTM A-392, Class 1. The fabric shall be nine-gauge wire woven in a two-inch diamond mesh.
B. The top selvage shall be twisted and barbed. The bottom selvage shall be knuckled.

2.03 LINE POSTS
A. Line posts shall be 2 ½ inch O.D. Standard Schedule 40 galvanized pipe conforming to ASTM F 1043 – Group 1A. The length of the line posts shall be approximately three feet longer than the height of the fabric.
B. Line post minimum weight shall be 3.65 pounds per foot. Tubing, conduit, or open seam material is not permitted.

2.04 TERMINAL AND CORNER POSTS
A. Terminal and corner posts and pull posts shall be three inch O.D. Standard Schedule 40 galvanized pipe conforming to ASTM F 1043 – Group 1A. Terminal and corner posts shall not exceed a maximum spacing of 100 feet.
B. The length of terminal and corner posts and pull posts shall be approximately three feet – six inches longer than the height of the fabric. The minimum weight shall be 5.79 pounds per foot.

2.05 EXTENSION ARMS
A. The Contractor shall provide galvanized press steel or aluminum extension arms with three strands of barbwire at a 45° overhang.
B. The top strand of barbwire shall be approximately twelve inches above the fabric.

2.06 BARBED WIRE
A. Zinc-coated barbed wire shall be two-strand twisted 12-½ gauge wire with 4 point barbs at five inch spacing. The coating shall consist of a minimum of 0.80 ounces of zinc per square foot of wire surface conforming to ASTM A-121.
2.07 RAILS
A. The top rail and brace rails shall be 1-5/8 inch O.D. Standard Schedule 40 galvanized pipe conforming to ASTM F 1043 – Group 1A. The minimum weight shall be 2.27 pounds per foot. Tubing, conduit, or open seam material shall not be permitted.

2.08 FITTINGS
A. The Contractor shall provide hot dipped galvanized steel, aluminum, or non-metallic moldings of sufficient strength to ensure the integrity of the fence.

2.09 TENSION WIRE
A. Zinc-coated tension wire shall be seven-gauge steel wire with a minimum coating of 0.40 ounces per square foot. The wire shall be stretched taut.

2.10 GATES
A. Gate frame assemblies shall be two inch O.D. Standard Schedule 40 galvanized pipe – Group 1A, with welded joints. The minimum weight shall be 2.72 pounds per foot. Weld areas are to be repaired with a zinc-rich coating applied per the manufacturer’s instructions. Fabric shall match the fence.

B. Gates shall be complete with galvanized malleable iron hinges, latch and latch catch, center rests and iron bolt for closed position, and chain hold for open position. The center stop shall be of the round disc with groove type.

C. Frames shall be electrically welded at all joints.

D. Provide suitable gate latches for a padlock which may be attached and operated from either side of the gate.

E. Hinges must permit the gate to swing back 180º. Gate braces shall be 1 5/8 inch O.D. galvanized steel pipe. Two hinges are required for gate openings up to four feet wide, or three for gate openings over four feet wide.

2.11 GATE POSTS
A. Gate Opening: Single, up to six feet wide or double, up to twelve feet wide: Post O.D. shall be three (3) inches, with a minimum 5.79 pounds per linear foot.

B. Gate Opening: Single, seven feet wide to twelve feet wide or double, 13 feet to 24 feet wide: Post O.D. shall be four (4) inches, with a minimum 9.11 pounds per linear foot.

PART 3 – EXECUTION

3.01 FENCE AND GATES
A. The Contractor shall install the fence and gate in a workmanlike manner utilizing the following construction practices.

1. For the top rail, use galvanized couplings of the outside sleeve type at a minimum seven inches in length to join the top rail. Pass the top rail through the line post top to form a continuous brace for each stretch of fence. Secure the top rail to each terminal post with receptacle fitting.

2. Provide 3/8-inch diagonal truss rod from the terminal posts to the first adjacent line post.
3. Fasten the fabric to the top rail and braces with suitable tie wire at approximately 18-inch intervals between the line posts. Secure the fabric to the line posts with six-gauge post clips at approximately twelve inch centers. Provide galvanized or non-ferrous material for the tie wire.

B. Space the line posts no further apart than ten linear feet per post. Terminal posts shall be spaced not to exceed 100 feet. Place concrete into holes three feet six inches (3’6”) deep for line posts and four feet deep for terminal posts. Use nine-inch diameter holes for line posts and twelve-inch diameter holes for terminal, corner, and gate posts.

C. Stretch the tension wire taut along the bottom of the fabric and fasten at intervals of 18-inch centers, with 11-gauge bottom clips.

D. Install fabric such that bottom is one to three inches above finished grade.

E. Slope the ground around posts and along fence away from the fencing at 4:1 slope to match the existing grade.

F. Install gates so the bottom rail is three inches above the ground.

G. Corner posts shall be used at bends greater than ten degrees.

H. Gates shall have a horizontal middle brace rail, 1-½ inch O.D., and diagonal 3/8-inch truss rod.

END SECTION.
SECTION 32 92 00

TURFS AND GRASSES

PART 1 – GENERAL

1.01 SUMMARY

A. Work in this Section shall include providing all labor, material, and equipment necessary for seeding and other landscaping procedures as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Materials and construction requirements for landscaping procedures shall conform to the "Standard Specifications for Road and Bridge Construction" of the Illinois Department of Transportation, latest edition.

1.03 SUBMITTALS

A. Inspection Certificates: An inspection certificate shall be submitted for each material as specified herein. The certificate shall accompany each shipment of the material and, on arrival, shall be submitted to the Engineer.

1.04 PERIOD OF ESTABLISHMENT AND WARRANTY

A. To be acceptable for final payment, the seeding must be fully established. To be fully established, the plant materials shall be in a live healthy condition, fully rooted, and shall have been growing in place for not less than 75 days prior to the date of the Final Acceptance inspection.

B. Contractor shall warrant the work specified in this section for a period of one (1) calendar year after the date of Final Completion Date.

PART 2 – PRODUCTS

2.01 SEEDING

A. All existing grassed areas or lawns disturbed by the work shall be seeded using Class 1, “Lawn Mixture” seeding type, as specified in Article 250.07 of IDOT’s Standard Specifications. The percent purity, germination and weed content shall meet the requirements set forth in Article 1081.04 of the Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction", latest edition. Seeding times shall conform to the Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction", latest edition.

2.02 FERTILIZER

A. Fertilizer shall be standard commercial 10-8-6 or 10-6-4, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers each fully labeled, conforming to applicable State Laws.

2.03 LIMESTONE

A. Lime shall be ground limestone containing all of the finer particles obtained in the grinding process and ground sufficiently fine so that not less than 80% will pass through a No. 8 sieve. The calcium carbonate equivalent must be at least 80%. One or both must be greater than
so that the multiplication of the percent of calcium carbonate equivalent by the percent of material passing through the No. 8 sieve will equal to or be in excess of 0.72. The moisture content at the time of shipment must not exceed 8 percent.

2.04 MULCH

A. Mulch material shall be free from noxious weeds and weed seed, non-toxic to vegetation and to the germination of seed. Straw shall meet IDOT Standard Specification Article 1081.06 (a)(1) and shall be stalks of wheat, rye, or oats and shall be air-dried. Hay shall be obtained from fields of timothy, red top, mature brome grass or other mature grasses, and shall be air-dried.

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall not commence the work of seeding until all other work which would disturb these areas are completed. Before seeding is started, all debris and rubbish from the construction work, within the project area, shall have been disposed of. Seeding shall be performed during the season which is normal for work in this locality, and under favorable weather conditions.

B. The Contractor shall seed as specified herein all existing lawns and grassed areas disturbed by the work.

3.02 SEEDING

A. Ground Preparation:

1. Final grading shall consist of removal of all stones, roots, surplus oil, waste materials and all debris from the project site and bringing to grade the disturbed areas.

2. After the areas to be seeded have been brought to the proper grades and cleared of all stones, boulders and debris, the areas shall be thoroughly tilled to a depth of at least three (3) inches by discing, harrowing or other approved methods until the condition of the soil meets these specifications. If, as a result of a rain, a crust is formed over the prepared surface, the surface shall again be placed in a suitable condition for planting.

B. Fertilizing:

1. Fertilizer shall be distributed uniformly at the rate of two hundred seventy (270) pounds per acre, over all areas to be seeded and shall be incorporated into the soil to a depth of at least three (3) inches by discing or harrowing. The incorporation of fertilizer may be a part of the tillage operation specified above.

C. Liming:

1. Lime shall be distributed uniformly on all areas to be seeded at the rate of 2.0 tons/acre and shall be incorporated in the soil to a depth of at least three (3) inches by discing, harrowing or by other equivalent methods, immediately following or simultaneously with the incorporation of the fertilizing.

D. Seeding:

1. No seed shall be sown during high winds or when the ground is not in a proper condition for seeding nor shall any seed be sown until the purity test has been completed for the seeds to be used, and shows that the seed meets the noxious weed seed requirements.
Equipment shall be operated in a manner to insure complete coverage of the entire area to be seeded. When seed or fertilizer is applied with a hydraulic seeder, the rate of application shall be not less than 1,000 gallons of slurry per acre. This slurry shall contain the proper quantity of seed or fertilizer specified per acre. When using a hydraulic seeder, the fertilizer nutrients and seed shall be applied in two separate operations. The optimum depth for seeding shall be one quarter (1/4) inch.

E. Rolling:
   1. Within 12 hours all seeded areas shall be rolled at right angles to the run-off with an approved type roller or culti-packer to compact the seed bed and place the seed in contact with the soil. On areas seeded with a hydraulic seeder, rolling shall not be required.

F. Mulching:
   1. Within 24 hours from the time of seeding, all seeded areas shall be given a covering of mulch applied either by hand or machine. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material. The mulch shall be loose enough to permit air circulation but compact enough to reduce erosion.
   2. Immediately following the application of the mulch material, a mulch stabilizer shall be used to anchor mulch into the soil by means of dull blades or disks. These blades or disks shall be without camber, and approximately 20-inches in diameter. The disks shall be notched and shall be spaced at approximately 3-inch intervals and shall be equipped with scrapers. The stabilizer shall weigh approximately 1,000 pounds, have a working width not to exceed 72-inches and be equipped with a ballast compartment, so that when directed, weight can be increased.

G. Maintenance:
   1. Watering and mowing of the seeded areas shall be at the discretion of the Contractor, with the Contractor having the contractual obligation to provide to the Owner at the time of Final Acceptance, fully established lawn restorations resulting from the work specified herein.

END SECTION.
SECTION 33 00 04
DUCTILE IRON PIPE AND FITTINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Push-On Joint Pipe and Fittings
   2. Push-On Lock Joint Pipe
   3. Tyton™ Push-On Joint Pipe
   4. Mechanical Joint Pipe and Fittings
   5. Flanged Joint Pipe and Fittings

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
   2. C110 Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in. for Water
   3. C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
   4. C115 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
   6. C150 Thickness Design of Ductile-Iron Pipe
   7. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water
   8. C153 Ductile-Iron Compact Fittings, 3-in. through 24-in. and 54-in. through 64-in., for Water Service
   9. C600 Installation of Ductile-Iron Water Mains and their Appurtenances
   10. C606 Grooved and Shouldered Joints

1.03 SUBMITTALS

A. Submit manufacturer's certification that materials delivered comply with the requirements of this section and the referenced standard.
B. Submit joint details and instructions for installation.

1.04 QUALITY ASSURANCE

A. Pipe shall be available to Owner's Representative for inspection.
B. Material brands and/or pipe shall not be mixed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery insure that each pipe is clearly marked with the following information:
   1. Weight.
2. Class or nominal thickness.
3. Casting period.
4. Manufacturer’s mark.
5. Country where cast.
6. Year the pipe was produced
7. Letters "DI" or "DUCTILE".

B. Handling and storage in accordance with AWWA C600:
   1. Load and unload pipe and fittings by lifting with lift hoists, fork truck, or other suitable lifting device.
   2. Do not drop material.
   3. Do not roll or skid pipe against another pipe.
   4. Provide padded slings, hooks, or pipe tongs to prevent damage to the exterior surface or internal lining of the pipe and fittings.
   5. Store so pipe remains free of dirt and foreign material.
   6. Store bolts and accessories in a dry location without intermingling types and sizes.

PART 2 – PRODUCTS

2.01 DUCTILE IRON PIPE
   A. Conform to AWWAC151.
   B. Exterior Coating:
      1. In below grade applications, use asphaltic coating, minimum of 1 mil thick.
      2. In above grade applications, use fusion-bonded epoxy in accordance with AWWA C116 where shown on the drawings or specified elsewhere.
   C. Interior Lining:
      1. Standard thickness of cement-mortar conforming to AWWA C104.
      2. Air Service: Unlined
   D. Pipe Thickness:
      1. Push-on, Push-on Lock Joint, and Mechanical Joint Pipe
         a. Minimum Special Thickness Class 52.
         b. Minimum Pressure Class 350 can be used only when saddles are used for tapping pipe.
      2. Flanged Joint Pipe:
         a. Minimum Special Thickness Class 53.
         b. Maximum Working Pressure of 250 psi in accordance with AWWA C115.

2.02 PIPE JOINTS
A. Push-On:
   1. Conform to AWWA C111.
   2. Gaskets:
      a. Plain rubber for wastewater and water to temperatures not exceeding 150° F.
      b. Buna-N Nitrile (NBR) in petroleum contaminated soils.
      c. EPDM for air service.

B. Push-on Lock Joint:
   1. Conform to AWWA C111.
   2. Joints shall be held in place with a boltless locking ring.
   3. Gaskets:
      a. Plain rubber for wastewater and water to temperatures not exceeding 150°F.
      b. Buna-N Nitrile (NBR) in petroleum contaminated soils.
      c. EPDM for air service.

C. Tyton ™ Push-On Joint:
   1. For Air Service
   2. Conform to AWWA C111.
   3. Gaskets:
      a. EPDM for air service

D. Mechanical Joint:
   1. Conform to AWWA C111.
   2. Joints shall include:
      a. Ductile or gray iron follower gland.
      b. Tee-head bolts and hexagonal nuts shall be corrosion resistant, low strength, high
alloy steel in compliance with AWWA C111/A21.11.
      c. Gaskets:
         1) Plain rubber gasket for sewer and water to temperatures not exceeding
            150°F.
         2) Buna-N Nitrile (NBR) in petroleum contaminated soils.
         3) EPDM for air service.

E. Flange Joint:
   1. Conform to AWWA C115.
   2. Joints shall include:
      a. Ductile iron flanges.
      b. Bolts with nuts.
c. Gaskets:
   1) Sheet rubber gaskets, full face, minimum 1/8 inch thick for sewer and water to temperatures not exceeding 150°F.
   2) EPDM, full face, minimum 1/8 inch thick for air service.

d. Use above grade, in manholes, in structures and other areas where the joint is exposed.

2.03 FITTINGS

A. For use below grade:
   1. Standard ductile iron mechanical joint conforming to AWWA C110 or compact ductile iron mechanical joint conforming to AWWA C153.

B. For use within manholes, structures, or above grade:
   1. Ductile iron flanged joint conforming to AWWA C110.

C. Exterior Coatings:
   1. Asphaltic coating, minimum of 1 mil thick.
   2. Fusion-bonded epoxy in accordance with AWWA C116 where shown on the drawings or specified elsewhere.

D. Interior Lining:
   1. Standard thickness of cement-mortar conforming with AWWA C104.
   2. Air piping shall be unlined.

PART 3 – EXECUTION

3.01 APPLICATION

A. Install piping in accordance with the Drawings and appropriate specification sections for the type of work being performed.

END SECTION.
SECTION 33 00 09

POLY VINYL CHLORIDE PLASTIC PIPE AND FITTINGS

PART 1 – GENERAL

1.01  SUMMARY

A.  Section includes:

1.  PVC pipe for mainline gravity sewer.
2.  PVC pipe for water main.
3.  PVC pipe for pressure and/or force main.

B.  The products described are not installed under this Section.

1.02  REFERENCES

A.  American Society for Testing and Materials (ASTM)

1.  ASTM D1784 - Spec. for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
2.  ASTM D1785 - Spec. for Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120
4.  ASTM D2466 - Spec. for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
5.  ASTM D2467 - Spec. for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
8.  ASTM D2672 - Standard Specifications for Joints for IPS PVC Pipe Using Solvent Cement
10. ASTM D3034 - Spec. for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
11. ASTM D3139 - Spec. for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
14. ASTM F679 - Spec. for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
15. ASTM F1866 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings

B. American Water Works Association (AWWA)
   1. AWWA C104 - Cement-Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water
   2. AWWA C110 - Gray Iron and Ductile Iron Fittings, 3-in. through 48-in. for Water and Other Liquids
   3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
   4. AWWA C153 - Ductile-Iron Compact Fittings 3-in. through 16-in., for Water and Other Liquids
   5. AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for water

1.03 SUBMITTALS
A. Submit the following:
   1. Certification of production date of all materials.
   2. Manufacturer's certification that the materials delivered were manufactured, sampled, tested, and inspected in accordance with this specification and appropriate referenced standards.
   4. Manufacturer's recommendations for assembly.

1.04 QUALITY ASSURANCE
A. Make pipe available to Engineer for inspection.
B. Pipe shall be considered defective and be rejected when:
   1. Pitted or cratered.
   2. Flaking
   3. Straightness varies more than inch in 10 feet.
   4. Any defect which prevents assembly according to manufacturer's recommendations.
   5. Not utilized within six (6) months of date of production.
   6. Pipe is not properly marked.
C. Material brands and/or pipe classes shall not be mixed.
D. Pipe Marking- pipe and fittings shall be marked as follows:
   1. Manufacturer's name, trademark or logo.
   2. Nominal size.
   3. PVC cell classification.
4. Pipe stiffness designation, dimension ratio or schedule size and pressure class.
5. ASTM or AWWA specification designation.
6. National Sanitation Foundation approval (pipe for potable water).
7. Production date.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Inspect the pipe shipment to identify shifted loads, broken packaging or rough treatment, which could be an indication of damage.
B. Unload the pipe in a manner which will not put stress on the pipe or strike anything causing damage.
C. Place and store the pipe package units on level ground stacked no more than 8 feet high. Do not store close to heat sources.
D. Store gaskets away from excessive exposure to heat, direct sunlight, ozone, oil or grease.
E. Store solvent cement in tightly sealed containers away from excessive heat.
F. Handle pipe in a manner to prevent impact blows, abrasion damage, gouging or cutting.
G. When handling pipe in cold weather, provide additional care to prevent damage due to impact. Impact strength is reduced in cold weather.

PART 2 – PRODUCTS

2.01 NON-PRESSURE RATED PIPE
A. Mainline Gravity Sewer
   1. Pipe, fittings and repair couplings shall be manufactured and tested in accordance with the following standards:
      a. Sizes 4-15 inch: ASTM D3034 SDR 26
      b. Sizes 18 inch through 48 inch and depths up to 30 feet: ASTM F949, with PVC 12454 minimum cell classification.
   2. Elastomeric Gaskets: Conform with ASTM F477
   3. Elastomeric Joints: ASTM D3212
B. Sewer Services- Not Used

2.02 PRESSURE RATED PIPE
A. Water Main, Water Service, Force Main, and Casing Pipe (3 inches and smaller)
   1. Manufacture and test the pipe and joints in accordance with the following standards:
      a. Pipe sizes 1/2-inch through 3-inch: ASTM D1785, Sch 40
   2. Joints shall conform to ASTM D2855
   3. Fittings shall conform to ASTM D2466
4. Primer shall conform to ASTM F656 and solvent cement shall conform to ASTM D2564 and be handled in accordance with ASTM F402.

5. All water service piping and appurtenances must meet NSF61.

B. Water Main, Water Service, Force Main, and Casing Pipe (4 Inches and Larger)
   1. Pipe and joints shall meet one of the following minimums:
      a. Pipe sizes 4-inch through 12-inch:
         1) AWWA C900, pressure Class 150, thickness Class DR 18.
         2) ASTM D2241, pressure Class 160, thickness Class SDR 26.
      b. Pipe sizes 14-inch through 36-inch: AWWA C900, pressure Class 150, thickness Class DR 18.
   2. Elastomeric Joints: ASTM D3139
   3. Solvent weld joints shall not be used.
   4. Fittings
      a. Standard ductile iron mechanical joint conforming to AWWA C110 or compact ductile iron mechanical joint conforming to AWWA C153.
      b. Cement mortar lined conforming to AWWA C104.
      c. Rubber gasket joints conforming to AWWA C111.
      d. Bolts and nuts shall conform to AWWA C111A21.11.

PART 3 – EXECUTION – NOT USED

END SECTION.
SECTION 33 05 01
TESTING AND INSPECTION OF PIPELINES AND APPURTEYNANCES

PART 1 – GENERAL

1.01 SUMMARY
A. Section Includes:
   1. Pressure and Leakage Tests for pressurized pipelines.

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM)
   1. ASTM D3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   4. ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
B. American Water Works Association (AWWA)
   1. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.
   2. AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
   3. AWWA C651 Disinfecting Water Mains.
C. Standard Specifications for Water and Sewer Main Construction in Illinois, May 1996

1.03 SUBMITTALS
A. Quality Control Submittals
   1. Test reports and results.
   2. Proposed method to correct deficiencies.
   3. Record of deficiency repair method and location.

1.04 PROJECT/SITE CONDITIONS
A. Notify Engineer a minimum of 48 hours prior to any testing.
B. Notify Engineer when testing equipment is setup and ready for testing.
C. Testing shall be performed in the presence of the Engineer.
D. Provide access to test equipment to enable the Engineer to monitor and record test results.
E. Repeat failed test after correction of deficiencies until satisfactory tests are obtained.
F. Proposed correction of deficiencies shall be approved by Engineer prior to correction.
G. Repair visible leaks within the pipeline and/or pipeline appurtenances.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Standard Pressure and Leakage Test
   1. High pressure pump with electric or gas engine drive with capacity in excess of test conditions.
   2. Provide calibrated vessel for measuring water pumped into the main to replace leakage.
   3. Provide certified pressure gauge calibrated in pounds per square inch of sufficient capacity to conduct test.

PART 3 – EXECUTION

3.01 PREPARATION OF PIPELINE BEFORE TESTING

A. Clean pipeline of any debris, soils, and construction material.
B. Repair or replace piping, valves, fittings, manholes, inlets and other parts of the piping system which have visible defects or leakage, before commencing tests, even though amount of leakage or pressure loss may be below the allowable limit.
C. Provide traffic control and other safety equipment including confined space entry equipment, if required.

3.02 PRESSURE AND LEAKAGE TEST FOR PRESSURIZED PIPELINES

A. Provide pressure and leakage tests for pressurized pipelines.
   1. Testing shall be in accordance with AWWA C600 for ductile iron pipe, as modified herein.
B. Preparation
   1. Install temporary plugs or caps, as required, prior to testing.
   2. Install thrust restraints before testing including temporary plugs or caps.
      a. If high-early cement concrete thrust restraints are used, then test after 36 hours of thrust restraint replacement.
      b. If standard cement concrete thrust restraints are used, then test after 7 days of thrust restraint replacement.
   3. At a minimum, provide bedding, cover material and partial backfill for buried pipe, except joints may be left uncovered until testing is completed.
   4. Install appurtenances including, but not limited to, hydrants, valves, services and air release valves prior to testing to ensure the entire system is being tested.
   5. Filling and flushing with water.
a. Fill each valved section with water slowly with maximum velocity of 1 ft./sec., venting air completely from the pipeline and appurtenances.

b. Where permanent air vents are not located at high points or dead ends, install corporation stops/valves to vent air as the line is filled with water.
   1) Close all these corporation stops/valves before applying pressure or leakage tests.
   2) At the conclusion of the leakage and pressure test, remove and plug corporation stops/valves, or at the discretion of the Owner left in place.

c. After filling, flush the lines with a minimum of three changes of water at blowoffs and dead ends with a minimum velocity of 3 ft/sec. purging the lines of air.

d. Discharge water without causing erosion, nuisance, or interruption of traffic.

6. Provide test connections and pressurize the pipe to normal working pressure.
   a. Inspect pipeline and repair visible leaks.
   b. Re-pressurize pipeline to normal working pressure as many times as necessary until there are no visible leaks.

7. Provide backflow protection acceptable to the owner of the water system when existing water mains are used to supply test water.

C. Pressure Test

1. At the option of the Contractor, the pressure and leakage tests may be performed at the same time.

2. Test pressure at the lowest point of elevation of the segment being tested shall be not less than 90 psi. Test pressure shall not exceed the pressure rating of the type of pipe specified.

3. Pressurize the system being tested to pressure required above by adding water with high pressure test pump.

4. Repair any visible leaks occurring due to test pressure application.

5. Repeat pressurizing of system to test pressure until no visible leaks can be found.

6. Test period shall be two (2) continuous hours with no visible leaks occurring.

7. Measure pipeline pressure during test period.

8. Maintain system pressure within plus or minus 5 lbs. per sq. inch of the required test pressure by adding water with the test pump.

D. Leakage Test

1. Perform a leakage test after satisfactory completion of the pressure test.

2. Test pressure at the lowest point of elevation of the segment being tested shall be not less than 90 psi. Test pressure shall not exceed the pressure rating of the type of pipe specified.

3. Leakage is defined as the quantity of water supplied into the pipe section being tested to maintain a pressure within 5 lbs. per sq. inch of the specified leakage test pressure after the pipe has been filled with water and the pipeline air has been expelled.
4. Provide gauges, measuring device, pump, piping, connections, container of water and all other apparatus required to perform the test.

5. Leakage shall not exceed the number of gallons per hour as determined by the following formula:

\[ L = \frac{SD\sqrt{P}}{148,00} \]

When:

- \( L \) = Allowable Leakage in Gallons/Hr.
- \( S \) = Length of Pipe Tested in Feet
- \( D \) = Nominal Pipe Dia. in Inches
- \( P \) = Average Test Pressure in lbs/sq. in.

6. When the section under test contains various diameters of pipe, the available leakage will be the sum of the computed leakage for each size of pipe.

7. Test period shall be two (2) continuous hours without exceeding the allowable leakage.

8. Repair pipeline as required to meet allowable leakage requirements, repeating the test after each repair.

3.03 PAYMENT

A. The cost of this work shall be considered incidental to the contract and no separate compensation will be allowed.

END SECTION.
SECTION 33 05 05
UTILITY PIPING - GENERAL PROVISIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Safety and related matters.
2. Location of existing utilities and structures.
3. Conflict with utilities.
5. Work in waterways and wetlands.
6. Work within easements.
7. Protection of property markers.
8. Cleaning of the work.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 SAFETY AND RELATED MATTERS

A. Comply with all federal, state, and local rules and regulations concerning:

1. Construction safety including confined entry.
2. Noise control.
3. Dust and smoke control.
4. Stormwater.

B. Heating

1. When weather dictates, provide temporary heat to protect work from freezing.

C. Access to Public Services

1. Insure free access to all fire hydrants, valve boxes, manholes, curb stops, fire alarms, police call boxes, etc.
2. Notify police, sheriff, fire department, and ambulance services before blocking or partially blocking any public road or access.

D. Protection of Work, Public, and Property

1. Provide safe passage for local vehicular and pedestrian traffic.
2. Provide vehicular and pedestrian access to properties abutting street where utilities are being constructed.
3. Provide all necessary barricades, warning lights, and signs, signals, flagmen, etc. in accordance with federal, state, and local regulations.

E. Provide and maintain safety equipment for confined entry at the project site at all times for use by the Contractor's personnel and Owner's Representative.

F. Organize and perform construction activities to minimize the creation of airborne dust and the tracking of mud and dirt into public streets.
   1. If dust is generated, implement control measures such as:
      a. Street sweeping and cleaning.
      b. Water sprinkling or application of chemical dust suppressant.
      c. Cover dusty materials in piles or in transit.
      d. Protect buildings that may be adversely affected.
      e. Protect new and existing machinery, motors, instrument panels or similar equipment with suitable dust screens.
         1) Provide proper ventilation with dust screens.

3.02 INTERFERENCE WITH THE WORK OF OTHERS
   A. Arrange work in a manner as to not interfere with any other work.
      1. Coordinate work with other contractors through Owner's Representative.

3.03 EXISTING UTILITIES AND STRUCTURES
   A. The existing utilities and structures are shown on the drawings may not be all inclusive.
   B. The locations of existing utilities and structures are shown on the drawings for information to the Contractor but shall not be construed as a representative of the exact location.
   C. The Contractor shall be responsible to field-locate all existing utilities at the project site, whether or not, shown on the Drawings, at his expense. No separate compensation will be allowed.
   D. Maintain or provide:
      1. Service of water, sewers, gas, culverts, drains, electricity, or other utilities encountered.
      2. Temporary connections and outlets for all private and public utilities that are interrupting construction.
      3. Disposal for all drainage and sewage resulting from relocations and/or interruptions in accordance with regulations and permits of the controlling governmental agency(s).
   E. Correct any damage to below or above ground utilities and structures encountered during construction.

3.04 CONFLICT OF UTILITIES
   A. Separation of Water Mains and Sewers
      1. The following separations shall be minimum:
         a. Parallel.
1) 10 feet clear.

b. Vertical (when pipelines cross or when horizontal clearance is impossible).

1) Water Main Below a Sewer: 18 inches clear.
   (Both pipes must be constructed of water main quality pipe and joints for ten feet either side of the crossing.)

2) Water Main Above a Sewer: 18 inches clear.

2. When crossing a sewer, center a full length of water main or sewer to position joints as far as possible from sewer.

B. Utility Location

1. Coordinate relocation of any utilities with the work schedule.

3.05 WORK ON STREET, HIGHWAY, RAILROAD RIGHT-OF-WAY AND WORK IN WATERWAYS AND WETLANDS

A. Work on street, highway, railroad rights-of-way, or in waterways and wetlands are subject to provisions of special permits required and issued by governmental agencies having jurisdiction in addition to requirements of specifications for this work.

B. Do not commence Work prior to receiving required permits.

C. Provide special bonds when required by permit.

D. Notify controlling authority prior to beginning and after completing any construction in rights-of-way or streams.

E. Bear all expenses related to permit compliance.

3.06 EASEMENTS

A. Owner will provide all easements.

B. Work on easements shall be in strict compliance with the terms of the easements agreements.

C. Owner, easement grantee, and Contractor shall be in full agreement on the method of execution prior to beginning work.

   1. Only structures, trees, shrubs, and other obstructions are to be removed as mutually agreed.

   2. Restoration shall be equal to original condition or the conditions of the agreement.

3.07 PROTECTION OF ESTABLISHED PROPERTY MARKERS

A. Protect all property markers (iron pipe, concrete, or wood posts, etc.) from movement from original position.

B. Pay costs of replacement of property markers moved during construction.

3.08 CLEANING OF WORK

A. Pipelines

   1. Interiors of utility pipelines (including existing) affected by construction procedures shall be free of all extraneous materials.
2. Pipelines shall be left clean at the completion of work.

B. Final Cleanup and Inspection

1. Remove the following:
   a. Temporary offices and storage structures.
   b. Temporary fencing and roads.
   c. Surplus material and rubbish.
   d. Material (liquid or solid) resulting from cleaning operations.

2. The Engineer and Owner may make a final inspection of the work during the progress of the final cleaning and repairing. Any portion of the work accepted by the Owner shall be kept clean by the Contractor until final acceptance of the entire project.

3. When the Contractor has completed the final cleaning operation, he shall notify the Engineer in writing that he is ready for final inspection.

4. After written notification to the Contractor, the Owner may elect to remove from the work site and/or adjacent properties, all rubbish, surplus or waste materials which the Contractor has neglected or refused to remove and deduct the costs of removal from any monies due the Contractor.

5. During construction, the Contractor shall clean up as the Work proceeds. The premises shall be kept free of accumulations of waste materials and earth, rubbish and other debris resulting from the work. If in the judgment of the Engineer, the Contractor fails to keep the sites clean as described herein above, the Engineer will recommend to the Owner withholding all progress payments until the sites have been cleaned up to the Engineer’s satisfaction.

6. All debris and waste materials and salvaged materials, unless required by the Specifications to be reused or delivered to the Owner, shall become the property of the Contractor and shall be removed by the Contractor from the construction sites.

7. Where truck crossings occur over sidewalks, they shall be kept free from all spilled earth and grading materials and shall at all times be maintained in a passable condition for foot traffic.

8. Generally, the transportation of materials to and from the sites shall be over regular streets. When the Contractor’s operations or that of its shippers, haulers, or subcontractors are such that dirt, mud, or debris is spilled or otherwise deposited on streets, driveways, sidewalks, or other thoroughfares, the Contractor shall clean up the large chunks before the close of every day’s operations or before it is broken up or becomes impacted on the surface. In case of dispute or Contractor’s failure to perform this cleanup work, the Owner may clean the streets and walks, remove the rubbish, etc., and will charge the cost to the Contractor, by withholding monies due to cover all charged work.

9. After completion of work in any of the site work areas, the Contractor will remove all waste materials, rubbish and debris from and about the premises as well as all tools and surplus materials and will leave the sites clean and ready for occupancy by the Owner. The Contractor will restore to their original condition any roads, utilities, walks, buildings, etc. disturbed or damaged by the Contractor’s operations.
10. Open burning of debris will not be permitted unless specifically authorized in writing by the Owner, and then only following state, municipal or other local codes, ordinances, rules or regulations.

11. Payment for cleaning up and complying with all items in this Section shall be made incidental to construction. No separate compensation will be allowed.

3.09 PAYMENT

A. The cost of this work shall be considered incidental to the contract and that no separate compensation will be allowed.

END SECTION.
SECTION 40 05 13
PROCESS PIPING

PART 1 – GENERAL

1.01 SUMMARY
A. Section includes exposed piping.
   1. Pipe Related Materials
   2. Couplings and Adapters
   3. Flexible Connectors
   4. Tapping Saddles
   5. Wall Sleeves, Wall Pipe and Seals
   6. Pipe Supports and Anchors

1.02 REFERENCES
A. American Society of Mechanical Engineers (ASME)
   1. ASME B31.3 Process Piping
B. Manufacturers Standardization Society of Valve and Fittings Industry, Inc. (MSS)
   1. MSS SP-69 Pipe Hangers and Supports – Selection and Application
   2. MSS SP-58-88 Pipe Hangers and Supports – Materials, Design and Manufacture
   3. MSS SP-89 Pipe Hangers and Supports – Fabrication and Installation Practices

1.03 SUBMITTALS
A. Submit product data for couplings, expansion joints and wall seals.
B. Submit drawings for all types of hangers, joints, supports, and materials used in the piping system.
C. Submit results of test data.
D. Submit record drawings of piping system.

1.04 QUALITY ASSURANCE
A. Make pipe and materials available to Owner’s Representative for inspection.
B. Material brands and/or pipe classes shall not be mixed.
C. Pipe Marking
   Pipe and fittings shall be marked as follows:
   1. Manufacturer’s name, trademark or logo.
   2. Nominal size.
   3. ASTM or AWWA or other specification designation.
   4. All other markings required for the specification designation.
5. Production date.

1.05 EXISTING CONDITIONS

A. Verify existing piping conditions and penetrations prior to ordering materials.
B. Expose existing pipes which are to be connected to new pipelines.
C. Verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes.
D. Inspect size and location of structure penetrations to verify adequacy of wall sleeves and other openings before installing connecting pipes.

1.06 SEQUENCING AND SCHEDULING

A. For slab, floor, wall, and roof penetrations, make pertinent wall pipes and sleeves available prior to when they are required for placement in concrete forms.
B. Verify and coordinate the size and location of building and structure pipe penetrations before forming and placing concrete.

PART 2 – PRODUCTS

2.01 PIPING SYSTEM MATERIALS

A. See Section 33 00 04 – Ductile Iron (DI) Pipe and Section 33 00 09 – Polyvinyl Chloride Plastic Pipe and Accessories.

2.02 RELATED PIPING MATERIALS

A. Corporation Stops/Valves:
   1. Conform to the requirements of AWWA C800.
   2. Ball type valve with double O-ring seals.
   3. Compression outlet connection.
   4. Acceptable Manufacturers: Mueller, Ford and A.Y. McDonald

2.03 COUPLINGS AND ADAPTERS

A. Mechanical couplings for joining plain end pipe of same diameter:
   1. Dresser Style 38
   2. Smith-Blair No. 411
   3. Or Equal.
B. Mechanical couplings for joining pipe with diameters differing up to ¾ inch:
   1. Dresser style 162
   2. Smith-Blair No. 413
   3. Or Equal.
C. Mechanical couplings for joining pipe with diameters differing more than ¾ inch:
   1. Dresser style 62
   2. Smith-Blair No. 415
3. Or Equal.

D. Expansion joint couplings for absorbing concentrated pipe movement:
   1. Dresser style 63
   2. Smith-Blair No. 611
   3. Or Equal.

E. Flanged coupling adapters for joining plain end pipe to flanged pipe, valves or fittings:
   1. Dresser style 128 with two anchor pins.
   2. Smith-Blair No. 913 with two anchor pins.
   3. Or Equal.

2.04 FLEXIBLE CONNECTORS

A. Provide flexible connectors as shown on the Drawings for all pumps, blowers, and other
   items of equipment which may induce vibration to the piping system.

B. Joints shall allow a minimum of 0.625 inches pipe expansion, 0.25 inches pipe compression.
   Construct flexible connectors with a filled arch to eliminate sedimentation of solids in the
   arch area.

C. Provide tie rods at all flexible connectors and expansion joints on pump discharge. Tie rods
   shall be of sufficient number and strength to restrain the connection at test pressure. Use a
   minimum of two \frac{5}{8}” diameter tie rods at all connections.

D. Approved manufacturers of flexible connectors to isolate vibration:
   1. Redflex
   2. Metraflex
   3. General Rubber
   4. Goodall

E. Approved manufacturers of reducing flanged flexible connectors:
   1. Redflex J-10
   2. Metraflex
   3. Or Equal.

2.05 TAPPING SADDLES:

A. Bodies
   1. Malleable iron, ASTM A47, grade 32510 or ASTM A536, ductile iron.

B. Straps
   2. Quantity:
      a. Two straps per saddle for pipe up to 19.25-inch O.D.
      b. Three straps per saddle for pipe larger than 19.25-inch O.D.
3. Gaskets:
   a. Rockwell grade 60, chemical resistant.
   b. Minimum Pressure Rating: 250 psi
4. Saddles shall wrap from 160° to 180° around pipe.
5. Acceptable Manufacturers: Rockwell or equal.

2.06 PIPE SUPPORTS AND ANCHORS
A. Manufacturers shall be Lee & Mason, Grinnel, Unistrut, Elcan, or equal.
B. Horizontal Piping Hangers and Supports:
   1. Adjustable Steel Clevis Hanger, MSS Type 1: For suspension of noninsulated or insulated stationary pipelines 4 to 30 inches in diameter.
   2. Yoke Type Pipe Clamp, MSS Type 2: For suspension of insulated pipe, 4 to 16 inches in diameter.
   3. Adjustable Steel Band Hanger, MSS Type 7: For suspension of noninsulated stationary pipelines ½ to 8 inches in diameter.
   4. U-bolt, MSS Type 24: For support of heavy loads ½ to 30 inches in diameter.
   5. Pipe Stanchion Saddle, MSS Type 37: Including steel pipe base support, cast iron floor flange and U-bolt pipe retainer.
   6. Adjustable Roller Hanger, MSS Type 43: For suspension of pipe from a single rod where horizontal movement may occur because of expansion or contraction, 2½ to 20 inches in diameter.
   7. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
C. Vertical Piping Clamps:
   1. Extension Pipe or Riser Clamp, MSS Type 8: For supporting noninsulated or insulated pipe risers, ¾ to 20 inches in diameter.
D. Hanger Rods:
   1. Shall be electro-galvanized or cadmium plated after threads are cut.
E. Building Attachment:
   1. Steel or Malleable Concrete Inserts, MSS Type 18: For suspending pipe hangers from concrete ceiling.
   2. Top Beam C-Clamp, MSS Type 19: For under roof installations with bar joist construction for attachment to top flange of structural shapes.
   3. Center-Beam Clamp, MSS Type 21: For attachment to center of bottom flange of beams.
   4. C-Clamp, MSS Type 23, for attachment to structural shapes.
   5. Top Beam Clamp, MSS Type 25: For attachment to top of beams when hanger rod is required tangent to edge of flange.
6. Side Beam Clamp, MSS Type 27: For attachment to bottom of steel I-beams.

7. Welded Steel Brackets: For supporting from above or below:
   a. MSS Type 31, Light: 750 lb. load
   b. MSS Type 32, Medium: 1,500 lb. load
   c. MSS Type 33, Heavy: 3,000 lb. load

2.07 ISOLATION JOINTS

A. Dielectric Fittings:
   1. Provide dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings, and valves.
   2. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure, temperature, and corrosive application.

B. Isolation Joints:
   1. Provide isolation joints between non-threaded ferrous and nonferrous metallic pipe fittings and valves.
   2. Isolation joints shall consist of an isolation gasket of the dielectric type, isolation washers and isolation sleeves for flange bolts.
   3. Isolation gaskets shall be full faced with an outside diameter equal to the flange outside diameter.
   4. Bolt isolation sleeves shall be full length.
   5. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

PART 3 – EXECUTION

3.01 PREPARATION

A. Close pipe and equipment openings with caps or plugs during installation to protect from dirt and other debris from entering.

B. Clean ends of pipes and remove foreign matter and dirt from inside of pipes prior to installation.

C. Coordinate the work with all trades to insure proper scheduling of inter-related work so as not to cause unnecessary delays or upset the treatment plant process to the extent that they violate their permit.

D. Before fabrication, verify all measurements at the site and obtain all necessary additional information required for the completion of the Work.

E. The drawings are diagrammatic representing what is required. Coordinate the architectural, structural, electrical and other mechanical drawings to determine true dimensions, details, obstructions, and conflicts.
1. Piping shown on Drawings are drawn for maximum clarity and are not necessarily intended to indicate a dimensional location.

2. Group piping on walls and ceilings, and coordinate and run with other mechanical and electrical work to allow a neat finished appearance.

3. Install pipe runs in straight lines parallel to or at right angles to the walls, floors or other pipe runs.

3.02 INSTALLATION

A. General Requirements:

1. Perform the necessary Work required to provide a complete and functioning system. If there are specific work items which the Contractor believes are not specifically identified, but are required to provide a functionally complete Project, then the identified specific work items shall be included in the Work.

2. Make connections to existing systems without damage to existing systems and equipment. Repair any damaged systems and equipment.

3. Provide access to gauges, valves or any other equipment located in walls, above ceilings or in any other inaccessible location.

4. Do not run pipe through structural beams.

5. Field route piping in nominal size 2 inches and smaller, unless shown as specified.

6. Install piping in a manner not to interfere with the operation or accessibility of doors or windows, encroachment on aisles, passageways and equipment, and the servicing or maintenance of any equipment.

7. Provide flashing and sealant for pipe passing through the roof.

B. Grooved and Shouldered Coupling System:

1. Locate and install grooves such that coupled keys bear against shoulder of groove nearest each end of pipe or fitting being connected so as to prevent separation of joints or longitudinal movement.

2. Cut grooves to produce clean and sharp grooves without burrs or check marks.

3. Tighten joint bolts sufficiently to allow housing bolt pads to meet.

C. Coupling and Adapters:

1. Cut pipe clean with smooth ends.

2. Space pipe a minimum of ½ inch to a maximum of 1 inch.

3. Install mechanical couplings in accordance with manufacturer's recommendations.

4. Restrain to prevent movement.

D. Pipe Supports and Anchors:

1. Concrete Inserts:
   a. Provide at locations where structural steel supports cannot be used.
   b. Install inserts before placing concrete, fasten to forms.
2. Precast Prestressed Concrete:
   a. Fasten anchors only with methods approved by the precast manufacturer.

3. Pipe Hangers:
   a. Install so pipe will be free to expand and contract.
   b. Hangers shall be adjustable and allow for required pitch.
   c. Provide hangers in a sufficient number to ensure safe support of the piping system.
   d. Hangers for fiberglass reinforced (FRP) pipe shall be provided with a saddle.

4. Hanger and Support Spacing:
   a. Maximum horizontal pipe hangers and support spacing in accordance with MSS SP-69.
   b. Minimum hanger rod diameter in accordance with MSS SP-69.
   c. Plastic pipe shall be supported in accordance with manufacturer’s recommendations for the service conditions.
   d. In addition to the spacing schedule, provide additional support as follows:
      1) At each change in direction.
      2) On each side of large valves.
      3) Within 5 feet of each equipment connection.
      4) At all branches or risers.
      5) At all floor openings.
      6) Minimum of one support for each length of cast iron or ductile iron pipe.
   e. Expansion joints shall be adequately supported to prevent stress on joint:
      1) Vertical supports shall be located within 3 pipe diameters of the connection and shall be provided on both sides of the connection.

5. Anchors:
   a. For suspended piping, anchors shall be centered as closely as possible between expansion joints and between elbows and expansion joints. Anchors shall hold the pipe securely and shall be sufficiently rigid to force expansion and contraction movement to take place at expansion joints and elbows.
   b. Anchorage shall be provided as required to resist thrusts due to changes in diameter or direction or dead ending of pipeline. Anchorage shall be required wherever bending stresses exceed the allowable for the pipe.

E. Piping Identification:
   1. Identify piping and direction of flow such that piping and support system can be painted and labeled in accordance with section High Performance Coatings.

F. Connecting Dissimilar Pipe:
1. Install dielectric fittings and isolation joints in accordance with the manufacturer's instructions.

G. Clean-up:
   1. Clean and degrease surfaces required to be painted.
   2. Remove all debris, tools, scaffolding, trash and excess materials from the site.

3.03 FIELD QUALITY CONTROL

A. Pipe Testing:

B. Valve Testing:
   1. Demonstrate in the presence of the Engineer that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications.
   2. Perform seat and shell-testing on all plug valves.
   3. Examine air and vacuum relief valves as the associated pipe is being filled to verify venting and seating is fully functional.
   4. Set, verify and record set pressures for all relief and regulating valves.

3.04 SCHEDULES

A. See Construction Drawings for piping schedule.

END SECTION.
SECTION 40 05 23

PROCESS VALVES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Check Valves.
   2. Ball Valves.
   4. Diaphragm Valves.
   5. Gate Valves.
   6. Hydrostatic Pressure Relief Valves.
   7. Knife Gate Valves.
   8. Mud or Plug Drain Valves.
  11. Solenoid Valves
  13. Telescopic Valves.
  14. Other Valves
  15. Valve Operators.

B. Provide numbers, type of valves, type of actuators, operators and other accessories as shown on the Drawings.

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. AWWA C111 Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
   2. AWWA C504 Rubber-Seated Butterfly Valves
   3. AWWA C509 Resilient-Seated Gate Valves for Water Supply Service
   4. AWWA C540 Power-Actuating Devices for Valves and Sluice Gates
   5. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants

B. American Society for Testing and Materials (ASTM):
   1. ASTM A48 Specification for Gray Iron Castings
3. ASTM A351 Specification for Castings, Austenitic, Austenitic-Ferritic for Pressure Containing Parts
4. ASTM A536 Standard Specification for Ductile Iron Castings

C. American National Standards Institute (ANSI):
   1. ANSI B16.1 Face to Face and End to End Dimensions of Valves
   2. ANSI B16.5 Pipe Flanges and Flanged Fittings
   3. ANSI B16.34 Valves - Flanged, Threaded and Welding End
   4. ANSI B1.20.1 Pipe Threads, General Purpose (Inch)

1.03 SUBMITTALS
A. Product Data:
   1. Submit product data for valves, operators and accessories.
   2. Data shall show all information required to conformance with the Specifications.
   3. Provide manufacturer's recommendations and instructions for installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Check Valves:
   1. Swing Check Valve:
      a. Val-Matic
      b. Golden Anderson
      c. Henry Pratt
   2. Thermoplastic Ball Check Valve:
      a. Chemtrol
      b. Or Equivalent
   3. Duckbill Elastomeric Check Valve:
      a. Tideflex Series 35
      b. Or Equivalent
   4. In-line Elastomeric Check Valve:
      a. Tideflex CheckMate™
      b. Or Equivalent
B. Ball Valves:
1. General Purpose Ball Valves:
   a. Apollo
   b. Or Equivalent

2. Small Diameter General Purpose Ball Valves:
   a. Ladish
   b. Or Equivalent

3. Thermoplastic Ball Valves:
   a. Chemtrol
   b. Or Equivalent

C. Butterfly Valves:
   1. Standard service butterfly valves
   2. Pratt
   3. Val-Matic

D. Diaphragm Valves:
   1. ITT Grinnel
   2. Saunders
   3. Tru-Tech

E. Gate Valves:
   1. Clow / McWayne Corporation
   2. Kennedy
   3. Pratt

F. Hydrostatic Pressure Relief Valves:
   1. Neenah Foundry
   2. Clow
   3. Troy Valve

G. Knife Gate Valves:
   1. Pratt Figure L77
   2. Red Valve/RKL

H. Mud or Plug Drain Valves:
   1. Clow (cast iron)
   2. M & H (cast iron)
   3. Latanick (stainless steel)
   4. Trumbull (cast iron)
   5. Or Equivalent
I. Pinch Valves:
   1. Red Valve/RKL
   2. Or Equivalent

J. Plug Valves:
   1. Valmatic
   2. Henry Pratt

K. Solenoid Valves:
   1. ASCO
   2. Or Equivalent

L. Air Release and Vacuum Relief Valves:
   1. Vent-O-Mat
   2. ValMatic
   3. Henry Pratt

M. Telescopic Valves:
   1. Vulcan
   2. Latanick
   3. Troy Valve

N. Other Valves:
   1. Foot Valves:
      a. As recommended by System Manufacturer where specified to be installed on Drawings.
   2. Y-Pattern Valves:
      a. Chemtrol Or Equal
   3. Gas Isolation Valves:
      a. Siemens/Wallace & Tiernan
   4. Control Valves:
      a. As recommended by System Manufacturer where specified to be installed on Drawings
   5. Pressure Reducing Valves:
      a. As recommended by System Manufacturer where specified to be installed on Drawings

O. Electric Motor Operators:
   1. Limitorque MX
   2. Auma

2.02 GENERAL REQUIREMENTS FOR VALVES
A. Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and all other accessories required for complete operation.
   1. Size operators to operate the associated valve for the full range of pressures and velocities.
   2. Operators, actuators, and accessories shall be factory mounted.
B. Valves shall be the same size as the adjoining pipe.
C. Valve end connections shall be compatible with adjacent piping system.
D. Valve shall open by turning counterclockwise.
E. Valve stems crossing a process liquid-air interface shall be stainless steel.

2.03 FACTORY COATING
A. Valves shall have a 7.0 mils dry film thickness epoxy lining and coating in accordance with AWWA C550 unless otherwise specified.
B. Exposed valves shall be coated in accordance with section 09 91 00 "Painting".

2.04 CHECK VALVES
A. Unless otherwise noted, all check valves shall be full body swing and weighted lever.
B. Swing Check Valve:
   1. Swing check valves, 2.5" through 12″ shall have cast iron body, with ANSI 16.5 flanged ends.
   2. Valves shall have a bronze-mounted swing clearway or full opening bronze faced disk.
   3. Hinges shall be solid bronze with a stainless steel hinge shaft with outside adjustable weighted lever.
   4. Valves shall be rated for 200 psi service.
C. Small Diameter Swing Check Valve:
   1. Swing check valves, 2" and smaller, shall have 316 stainless steel body, bolted flanged cover, screwed ends, integral seat and renewable disc.
   2. Body, disc holder and other wetted parts material shall conform to ASTM A351, grade CF8M or ANSI 316 stainless steel.
   3. PTFE disc facing and cover gasket material.
   4. Threads shall conform to ANSI B2.1.
   5. Valves shall be rated for 200 psi service.
D. Thermoplastic Ball Check Valve:
   1. Thermoplastic check valves, 0.25" through 16", shall be ball-check design, full port, PVC body and ball.
   2. End connection shall be solvent weld socket.
   3. Valves shall have Viton O-ring seals and seats.
   4. Valves shall be rated for 150 psi service.
E. Duckbill Elastomeric Check Valves:
   1. Valve shall have integral, all-rubber flange.
   2. EPDM construction.
   3. Flange drilling shall conform to ANSI B16.5 Class 150 standards.
   4. Furnish with stainless steel backup rings for installation.
   5. Valve shall be capable of drip tight closure in liquid/solid slurries not exceeding 2% solids concentration.

F. In-Line Elastomeric Check Valves
   1. When line pressure exceeds the backpressure, the line pressure forces the bill and disc of the valve open, allowing flow to pass. When the backpressure exceeds the line pressure, or in the absence of any upstream or downstream pressure, the bill and disc of the valve is forced closed, preventing backflow.
   2. A maximum line pressure of less than 1“ shall crack open the valve.
   3. In-line check valves shall be the flow-operated check type with slip-in cuff connection. The entire valve shall be 100% elastomer reinforced construction throughout the body, disc and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable. The valve shall be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure any component of the valve to a valve housing. The port area of the disc shall contour into a circumferential sealing area concentric with the pipe which shall allow passage of flow in one direction while preventing reverse flow. The entire valve shall fit within the pipe inside diameter. Once installed, the valve shall not protrude beyond the face of the structure or end of the pipe.
   4. Elastomer material for in-line check valve construction shall be EPDM suitable for screened wastewater with an operating temperature range of -50°F to +300°F.
   5. The outside diameter of the upstream and downstream sections of the valve must be circumferentially in contact with the inside diameter of the pipe.
   6. The valves shall be furnished with a set of stainless-steel expansion clamps. The clamps, which will secure the valve in place, shall be installed in the upstream or downstream cuff of the valve, depending on installation orientation, and shall expand outwards by means of turnbuckle. Each band shall be pre-drilled allowing for the valve to be pinned and secured into position in accordance with the manufacturer's installation instructions.
   7. Submit product literature that includes information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, headloss, flow data and pressure ratings.
   8. Provide shop drawings that clearly identify the valve materials of construction and dimensions.
   9. Manufacturer shall have conducted independent hydraulic testing to determine headloss, jet velocity and vertical opening height characteristics on multiple sizes of inline type elastomeric valves ranging from 4” through 72”. The testing shall be conducted for free discharge (discharge to atmosphere) and submerged conditions.
10. Manufacturer shall submit flow test data from an accredited hydraulics laboratory to confirm pressure drop and hydraulic data. Company name, plant location, valve size, patent number, and serial number shall be bonded to the check valve.

2.05 BALL VALVES

A. General Purpose Ball Valves:
   1. Ball valves, 2" through 12", shall conform to ANSI B16.34 Class 150.
   2. Body shall be full port 316 stainless steel with vented stainless-steel ball and stem.
   3. Seats and seals shall be PTFE.
   4. Valves shall be rated for 200 psi service.

B. Small Diameter General Purpose Ball Valves:
   1. Ball valves, 2” and smaller, shall be end entry type with threaded end connections.
   2. Body shall be full bore 316 stainless steel, two-piece body with vented stainless-steel ball and stem.
   3. Seats and seals shall be PTFE.
   4. Provide hand lever operator with stops at the full open and full close positions.
   5. Valves shall be rated for 400 psi service.

C. Thermoplastic Ball Valves:
   1. Thermoplastic ball valves, 6" and smaller, shall have full port, PVC body, ball and stem.
   2. Valves shall be end entry, double union design with solvent weld socket in accordance with ANSI B1.20.1 or flanged end connections.
   3. Seats shall be PTFE and seals shall be Viton O-ring stem seals.
   4. Provide hand lever operator with stops at the full open and full closed positions.

2.06 BUTTERFLY VALVES

A. Water Service Butterfly Valves:
   1. Conform with AWWA C-504, Class 150-B.
   2. Stainless steel nuts and bolts.
   3. Provide full-faced flanges in accordance with ANSI B16.1.
   4. Provide valves to have retained seat providing tight shut off up to the full valve rating on dead end or isolation service without the use of downstream flanges.
      a. Design to be leak-tight in both directions and bi-directional seat adjustment.
      b. Provide 360-degree seating surface with controlled interface between seat and mating surface.
      c. Rubber body seats shall be of one-piece construction, simultaneously molded and bonded into a recessed cavity in the valve body in sizes 3” thru 20”. Valves 24” and larger seats shall be retained in the valve body by mechanical means without retaining rings, segments, screws or hardware of any kind in the flow stream. Seats shall be a full 360° without interruption and have a plurality of grooves.
mating with a spherical disc edge seating surface. Valve seats shall be field adjustable around the full 360° circumference and replaceable without dismantling the actuator, disc or shaft and without removing the valve from the line.

5. Material:
   a. Valve Body: Cast iron ASTM A126, Class B
   b. Valve Shaft: Stainless steel 304
   c. Valve Seats: Natural rubber
   d. Valve Disc: Valve disc shall be non-hollow type manufactured of cast iron ASTM A126 CL B.
   e. Valve Shaft: Stainless steel 304 supported on self-lubricating non-metallic or sleeve type bearings.
   f. Equip with worm gear or traveling nut operators.

B. Standard Service Butterfly Valves:
   1. Butterfly valves 2 inches to 72 inches shall conform to AWWA C504 (Potable Water Service) or API 608 Category A Design Standards (Otherwise).
   2. Valve bodies shall be ASTM A126 Class B cast iron lugged style suitable for use between ANSI 125- or 150-pound flanges.
   3. Valves shall be rated at 175 psi and for potable water service shall also conform to 75B rating.
   4. Valves shall have retained seat providing tight shut off up to the full valve rating on dead end or isolation service without the use of downstream flanges.
   5. Discs shall be 316 stainless steel.
   6. Shafts shall be stainless steel supported on self-lubricating bronze or TFE coated stainless steel sleeve type bearings.
   7. Valve seats not molded to the body shall be molded to a rigid corrosive reinforcing ring. For potable water service, seats shall be 18-8 stainless (castings conforming to ASTM A743).
   8. Seats shall be natural or synthetic rubber suitable for the specified pipeline applied to disc with clamps or applied to the body by cementing and clamping, bonding or vulcanizing.
   9. Valves through 6 inches shall have an infinite position lever with adjustable position memory stop for balancing service or have a 10 position, latch lock lever for on-off service.
   10. Valves 8 inches and larger shall have enclosed handwheel or chain wheel operated gear actuators with adjustable open position stop if for balancing service.

C. Thermoplastic Butterfly Valves
   1. Butterfly valves 1.5 inches and larger shall have lugged body style constructed of polyvinyl chloride (PVC).
2. Valves shall be rated for 150 psi service.

3. Valves shall have PVC discs, natural rubber seats and seals.

4. Operator is to be hand lever up to 4" diameter and gear for larger valves.

2.07 DIAPHRAGM VALVES

A. Diaphragm valves shall have ASTM A48-60T, Grade 30, cast iron bodies or ASTM 536, GR 65-45-12 ductile iron, lined with hard rubber.

B. Valve shall be straight through type, with natural synthetic rubber diaphragms.

C. Provide indicating stems except where extended stems are shown on the drawings or specified elsewhere.

D. Valves shall be rated for 150 psi service.

2.08 GATE VALVES

A. Gate valves, 3" through 20", shall be resilient seated conforming to AWWA C509 with cast iron body.

B. Bonnet shall be NRS bolted type.

C. Discs shall be wedge type of rubber coated ductile iron construction.

D. Stem shall be non-rising with O-ring seals.

E. Bolts and nuts for buried end connections shall be Cor-Blue.

F. Valves 3" through 12" shall be rated for 200 psi service and valves 14" through 20" shall be rated for 150 psi.

G. Valves not buried shall have gearing and handwheels.

H. Valves for buried service shall have 3-piece box with cover for depth as shown on the drawings.

I. One valve wrench shall be furnished for maximum depth of bury as shown on the drawings.

2.09 PRESSURE RELIEF VALVES

A. Hydrostatic pressure relief valves shall be cast iron construction with neoprene seats and face on disc.

   1. Valves shall be 6-inch diameter unless shown otherwise on drawings.

   2. Valves shall be tested at 6-foot head before shipment.

2.10 KNIFE GATE VALVES

A. Knife gate valves shall be bonnetless with non-rising stem.

B. Gates shall be 316 stainless steel with resilient seat suitable for municipal sewage or sludge.

C. Stem shall be 304 stainless steel, gate seats, body and chest to be 316 stainless steel, gland studs to be cadmium plated. Stem nut to be bronze. Valve body shall be cast iron.

D. Valves shall be rated for 125 psi service.

2.11 MUD OR PLUG DRAIN VALVES

A. Cast Iron Mud or Plug Drain Valves:
1. Where shown on the Drawings, mud or plug drain valves shall be of cast iron construction with non-rising stem.
2. The stem, stem nut, disc ring and seat ring shall be bronze.
3. Provide extension stem, with indicating floor stand and handwheel.

B. Stainless Steel Mud Valves:
1. Where shown on the Drawings, mud valves shall be of stainless-steel construction with non-rising stem.
2. Seat, base flange, plug guide, stem, fasteners, 2" square operating nut and washer shall be 304 SS.
3. Stem nut, yoke, thrust rings and bushings shall be bronze.
4. Sealing seat shall have integral rubber "O" ring gasket seal.
5. Base flange shall be drilled to meet ANSI 125 lb. hole pattern.
6. Provide stainless steel extension stems, stem guides, floor stands, operators, T-wrenches, etc. as shown on the Drawings.

2.12 PINCH VALVES
A. Manually-Actuated Pinch Valves:
1. Pinch valves shall have cast iron body, with ANSI B16.5 Class 125/150 flanged connections.
2. The sleeve shall be EPDM.
3. Pinch mechanisms shall be external hardened steel.
4. Provide operator as shown on the drawings.
5. Valves shall be rated for 50 psig service.

B. Electrically-Actuated Pinch Valves:
1. Electrically-actuated.
2. Sleeve is only wetted part.
3. Pinch valves shall have cast iron body, with ANSI B16.5 Class 125/150 flanged connections.
4. The sleeve shall be EPDM, EPR or EPT nylon reinforced.
5. Pinch mechanisms shall be external hardened steel.
6. Provide handwheel operator with "% open" position indicator.
7. Valves shall be rated for 150 psi service.
8. Valves shall be supplied with electrically-actuated operator installed, plumbed and tested by valve manufacturer.
9. Provide Pinch Valves as manufactured by Red Valves (model numbers as shown on the Drawings).

C. Electric-Actuators for Pinch Valves:
1. Operator shall include the motor, integral combination reversing starter, local control facilities, operator unit gearing, limit switch gearing, limit switches, torque switches, bored and key-wayed drive sleeve, declutch lever and auxiliary handwheel as a self-contained unit. The unit enclosure shall be rated NEMA 4 and 6 (21 feet of water for 72 hours submergence).

2. The motor shall be specifically designed for valve operator service and shall be of high torque, totally enclosed, non-ventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.
   a. The motor shall be of sufficient size to open or close the valve against 20 psi maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.
   b. Motor shall be pre-lubricated, and all bearings shall be anti-friction type.

3. The power gearing shall consist of generated helical gears of heat-treated steel and worm gearing.
   a. The worm shall be of carburized and hardened alloy steel with the threads ground after heat treating.
   b. The worm gear shall be of alloy bronze.
   c. Power gearing shall be grease lubricated.
   d. Ball or roller bearings shall be used throughout.
   e. Torque and Turns Limitations:
      1) Four contacts shall be provided that can be selected to indicate any position of the valve with each contact selectable as normally open or normally closed. The contacts shall be rated at 5A, 250VAC, 30VDC. In the event of power failure, the discrete contacts must continue to supply actuator position feedback and maintain interlock capabilities. The discrete contacts must be continuously updated regardless of the presence of power supply. As an alternative to providing valve position, any of the four above-specified contacts shall be selectable to signal one of the following:
         i) Valve opening or closing
         ii) Valve moving (continuous or pulsing)
         iii) Motor tripped on torque in mid-travel
         iv) Motor stalled
         v) Actuator being operated by handwheel
      2) Torque and turns limitation to be adjustable as follows:
         i) Position setting range: 0.25 to 100,000 turns, with resolution to 15° of actuator output.
         ii) Torque setting: 40% to 100% rated torque.
         iii) Torque sensing must be affected purely electrically or electronically. Extrapolating torque from mechanically measured motor speed is not equivalent due to response time.
iv) "Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during starting in mid-travel against high inertia loads.

v) All seating of the torque and limits shall be set by the setting tool and programmable to either NO or NC contacts.

f. The operator shall include digital position indicator with display from fully open to fully closed in 1 percent increments. Red, green and yellow lights corresponding to open, closed and intermediate positions and indication of torque overload, and actuator fault shall be included. The digital display shall be maintained even when the power to the actuator is isolated.

g. Provide hand held configuration and setting tool that allow non-intrusive infra-red communication with the valve operator. The setting tool shall provide access to the set-up, calibration, and adjustment menus of the operator display giving the use access to the actuator configuration. Provide one setting tool for each valve.

h. Provide operator with Modbus DDS, Foundation Fieldbus H1, PROFIBUS DPVI, PROFIBUS PA, DeviceNet, and/or Hart network communication capability as specified in Divisions 26 and 40. All control, status and alarm parameters shall be available for remote access through the network communication. All valves shall communicate control, status and alarm parameters with the PLC for remote control and monitoring. Provide interface cards, power supplies, connectors required to integrate with the valve control system.

4. Manual Operation:

a. Provide a handwheel for manual operation that does not rotate during electric operation, is operational at all other times.

b. Handwheel shall not require more than 40 lbf under any operating condition.

c. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation.

d. When placed in the manual operating position, it shall remain in this position until motor is energized when the valve operator automatically returns to electric operation.

1) The movement from motor operation to handwheel operation shall be by positive declutching lever which will disengage the motor and motor gearing mechanically but not electrically.

2) When the motor is running, it shall be impossible to place the unit in manual operation.

e. The valve control shall have a built-in lost motion device that travels a minimum of 135° and allows the motor to attain full speed before imparting a hammer blow to start valve in motion in either the closing or opening direction.

1) The load is to be shared equally by two lugs cast integrally on the drive sleeve.
2) Do not provide lost motion device for valves used in inching, throttling, regulating or modulating service.

3) Valve operators shall be sized by the operator manufacturer to suit the torque requirements to operate the valve at a 15 to 30 second cycle time.
   
i) Operators shall be supplied, and factory mounted on the valve by the valve manufacturer.
   
ii) Electrical supply and control voltage shall be as shown on drawings.
   
iii) Valve supplier shall furnish any required integral reversing controller, limit switch compartment heater, local or remote push button stations or power transformers.

D. Acceptable Manufacturers:
   
   1. Limitorque MX by Flowserve
   
   2. Or Equal.

E. Additional electric operator requirements are located elsewhere in Division 26 and Division 40.

2.13 PLUG VALVES

A. Plug valves shall be non-lubricated, tight closing, eccentric or concentric design as shown on the Drawings, with resilient faced plugs. Plug face shall be machined offset from the centerline. Plug shall compress into seat only when closed.

B. Port areas should be at least 100% of the full pipe area for valves under 4”, 85% of the full pipe area for valves from 4” to 16”, 80% of the full pipe area for valves from 18” to 24”, and 75% of the full pipe area for valves 30” or larger. Round port plug valves shall not be acceptable for valves greater than 12”.

C. Valve bodies shall be cast iron, ASTM A126 Class B with exposed nuts, bolts, springs, washers, etc. shall be cadmium plated except buried or submerged service shall be stainless steel. Manufacturer's name shall be casted into the valve.

D. Resilient plug facings shall be of neoprene suitable for use with sewage or sludge.

E. Valve seats shall be corrosion resistant with welded overlay of high nickel content (minimum 95% nickel) on all surfaces containing the piping face. Seat shall be raised ½” wide.

F. Provide replaceable, sleeve-type bearings in the upper and lower journals. Sleeves and bearings shall be stainless steel, permanently lubricated.

G. Valve Shaft Seals:
   
   1. Valve shaft seals shall be split V-type packing with multiple rings and adjustable packing gland which will allow replacement of packing under pressure without valve disassembly. The valve may also utilize a self-adjusting U-cup type packing eliminating the need for a packing gland.

   2. "O" ring seals within a replaceable cartridge may be used with clear liquid containing no abrasives.

   3. Grit seals top and bottom shall be included.
2.14 SOLENOID VALVES

A. Solenoid valve shall have the following materials when in contact with process fluid:
   1. Body shall be 304 Stainless Steel
   2. Seals and Disc shall be NBR or PTFE
   3. Disc-Holder shall be PA
   4. Core Tube shall be 305 Stainless Steel
   5. Core and Plugnut shall be 430F Stainless Steel
   6. Springs shall be 302 Stainless Steel
   7. Shading Coil shall be Copper or Silver

B. Solenoid valve shall be rated for 125 psig working service pressure.

C. Solenoid valve shall be rated for the voltage and phase noted on the Drawings

D. Solenoid valve insulation shall be Class F.

E. Solenoid valve shall be rated for operation in temperatures ranging from 32 - 125°F.

F. Solenoid valve shall be UL listed and CSA certified.

2.15 AIR RELEASE AND VACUUM RELIEF VALVE

A. Air Release, Vacuum Relief Valves:
   1. Conform to AWWA C512 combination air valve.
   2. Provide 4-inch and smaller valves of single chamber design.
   3. Maximum working pressure of 150 psi.
   4. Provide double orifice with anti-shock orifice mechanism to limit transient pressure rise or shock induced by closure to 1.5 times the rated working pressure.
   5. Provide O-Ring sealing against single-piece flat face orifice housed in dovetail groove circumferentially around the orifice.
   6. Provide in manhole valve chamber.
   7. Provide an isolation valve at each air release valve.
   8. Provide and connect air release, vacuum relief valves to the main with a tee fitting and isolation valve.

B. Install per manufacturer's recommendations.

2.16 TELESCOPIC VALVES

A. General:
   1. Provide telescopic valves with a floor stand mounted, rack and pinion operator with side mounted handwheel.
   2. Design to accommodate 4-inch and 6-inch receiving pipes and have 4-feet vertical travel.
   3. Valves shall have rack and pinion type operators with infinite position adjustment.
B. Operator and Floor Stand:

1. Floor stands shall be concentric, wall bracket mounted or offset as shown on the Drawings fabricated from 304 stainless steel.
2. Provide rack and pinion operator with operator housing, pinion gear and rack of 304 stainless steel construction.
3. Provide handwheels of cast aluminum construction.
4. Provide schedule 40, 304 stainless steel pipe extension stems connecting the rack to the slip tube such that it terminates at the slip tube bail with 6-inches of thread available for field adjustment.
5. Fasten the extension stems to the bail with double stainless-steel nuts and lock washers.
6. Provide a positive upward travel stop and a downward travel stop.
7. Provide stainless steel assembly bolts and anchor bolts.

C. Slip Tubes

1. Provide slip tube manufactured from 12-gauge, 304 stainless steel, rolled and smooth seam welded.
2. Provide two 90-degree V-notches at the top of each slip tube.
3. Tubes shall be a minimum of 6-inches longer than the required travel.
4. Fabricate the bail that connects the slip tube to the extension stem of 304 stainless steel channel.

D. Provide a travel indicator on telescoping valves with numerals stamped on the rack in ½-inch increments.

2.17 VALVE OPERATORS

A. Manual Operator:

1. The force in a manual operator shall not exceed 39.3 pounds under any operating condition.
2. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc., as shown on drawings.
3. Valves 6" and larger shall be equipped with gear actuators:
   a. Gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator.
   b. The actuator shaft and the position indicator shall be supported on permanently lubricated bronze bearings.
   c. Actuators shall indicate valve position and an adjustable stop shall be provided to set closing torque.
   d. All exposed nuts, bolts, and washers shall be cadmium plated:
4. Valve and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator cover to prevent the entry of water:
   a. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals.
   b. All exposed nuts, bolts, springs and washers shall be stainless steel.
5. The operator shall be a self-locking type or equipped with a self-locking device.
6. Provide a position indicator on quarter-turn valves.
7. Traveling nut type operators shall have threaded steel reach rods with an internally threaded bronze nut.
8. Exposed Operators:
   a. Handwheels shall be galvanized and painted.
   b. Lever operators may be used on quarter-turn valves.
   c. Cranks shall be supplied on gear type operators.
   d. If located off floor, provide chain wheel operators with tiebacks, extension stem, floor stands, and other accessories required to operate the valves from a normal level.
   e. Valve handles and handwheels shall be capable of padlocking.
9. Underground Operators:
   a. Buried valves shall have an operating nut provided with a cross tee type valve operator.
   b. The moving parts of the valve and operator shall be enclosed in a housing to prevent contact with the soil.
   c. Buried valves shall have valve boxes.
B. Electric-Actuators for Valves:
   1. Operator shall include the motor, integral combination reversing starter, local control facilities, operator unit gearing, limit switch gearing, limit switches, torque switches, bored and key-wayed drive sleeve, declutch lever and auxiliary handwheel as a self-contained unit. The unit enclosure shall be rated NEMA 4 and 6 (21 feet of water for 72 hours submergence).
   2. The motor shall be specifically designed for valve operator service and shall be of high torque, totally enclosed, non-ventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.
      a. The motor shall be of sufficient size to open or close the valve against 20 psi maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.
      b. Motor shall be pre-lubricated, and all bearings shall be anti-friction type.
   3. The power gearing shall consist of generated helical gears of heat-treated steel and worm gearing.
a. The worm shall be of carburized and hardened alloy steel with the threads ground after heat treating.

b. The worm gear shall be of alloy bronze.

c. Power gearing shall be grease lubricated.

d. Ball or roller bearings shall be used throughout.

e. Torque and Tums Limitations:

1) Four contacts shall be provided that can be selected to indicate any position of the valve with each contact selectable as normally open or normally closed. The contacts shall be rated at 5A, 250VAC, 30VDC. In the event of power failure, the discrete contacts must continue to supply actuator position feedback and maintain interlock capabilities. The discrete contacts must be continuously updated regardless of the presence of power supply. As an alternative to providing valve position, any of the four above-specified contacts shall be selectable to signal one of the following:

   i) Valve opening or closing
   ii) Valve moving (continuous or pulsing)
   iii) Motor tripped on torque in mid-travel
   iv) Motor stalled
   v) Actuator being operated by handwheel

2) Torque and turns limitation to be adjustable as follows:

   i) Position setting range: 0.25 to 100,000 turns, with resolution to 15° of actuator output.

   ii) Torque setting: 40% to 100% rated torque.

   iii) Torque sensing must be affected purely electrically or electronically. Extrapolating torque from mechanically measured motor speed is not equivalent due to response time.

   iv) "Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during starting in mid-travel against high inertia loads.

   v) All seating of the torque and limits shall be set by the setting tool (see #5 below) and programmable to either NO or NC contacts.

f. The operator shall include digital position indicator with display from fully open to fully closed in 1 percent increments. Red, green and yellow lights corresponding to open, closed and intermediate positions and indication of torque overload, and actuator fault shall be included. The digital display shall be maintained even when the power to the actuator is isolated.

g. Provide hand held configuration and setting tool that allow non-intrusive infra-red communication with the valve operator. The setting tool shall provide access to the set-up, calibration and adjustment menus of the operator display giving the user access to the actuator configuration. Provide one setting tool for each valve.
h. Provide operator with Modbus DDS, Foundation Fieldbus H1, PROFIBUS DPVI, PROFIBUS PA, DeviceNet, and/or Hart network communication capability as specified in Divisions 26 and 40. All control, status and alarm parameters shall be available for remote access through the network communication. All valves shall communicate control, status and alarm parameters with the PLC for remote control and monitoring. Provide interface cards, power supplies, connectors required to integrate with the valve control system.

4. Manual Operation:
   a. Provide a handwheel for manual operation that does not rotate during electric operation, is operational at all other times.
   b. Handwheel shall not require more than 40 lbf under any operating condition.
   c. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation.
   d. When placed in the manual operating position, it shall remain in this position until motor is energized when the valve operator automatically returns to electric operation.
      1) The movement from motor operation to handwheel operation shall be by positive declutching lever which will disengage the motor and motor gearing mechanically but not electrically.
      2) When the motor is running, it shall be impossible to place the unit in manual operation.
   e. The valve control shall have a built-in lost motion device that travels a minimum of 135° and allows the motor to attain full speed before imparting a hammer blow to start valve in motion in either the closing or opening direction.
      1) The load is to be shared equally by two lugs cast integrally on the drive sleeve.
      2) Do not provide lost motion device for valves used in inching, throttling, regulating or modulating service.
      3) Valve operators shall be sized by the operator manufacturer to suit the torque requirements to operate the valve at a 15 to 30 second cycle time.
         i) Operators shall be supplied, and factory mounted on the valve by the valve manufacturer.
         ii) Electrical supply and control voltage shall be as shown on drawings.
         iii) Valve supplier shall furnish any required integral reversing controller, limit switch compartment heater, local or remote push button stations or power transformers.

5. Additional electric operator requirements are located elsewhere in Division 26 and Division 40.

2.18 OTHER VALVES
A. Foot Valves:
   1. Provide number, size, type and material of foot valves as shown on the Drawings.
B. Y-Pattern Valves:
   1. Provide number, size, type and material of foot valves as shown on the Drawings.

C. Gas Isolation Valves:
   1. Provide number, size, type and material of foot valves as shown on the Drawings.

D. Control Valves:
   1. Provide number, size, type and material of foot valves as shown on the Drawings.

E. Pressure Reducing Valve:
   1. Provide number, size, type and material of foot valves as shown on the Drawings.

2.19 VALVE ACCESSORIES

A. Valve Tags:
   1. Provide identification tags made of engraved laminated plastic indicating service and valve number shown on the valve schedule.
      a. Provide 2-inches in diameter with a 3/16-inch hole and a 1-inch diameter chrome plated ring.
      b. Numeral height 5/8-inch high and lettering shall be 1/4-inch high.
      c. Plastic tags to be black with white lettering.
         1) Tags fastened to valve stems using chrome-plated beaded or linked chain.

B. Floor Stand and Extension Stem:
   1. Floor stand and extension stem shall be nonrising, indicating type, complete with stem, handwheel, and stem guide brackets, yoke attachment and required anchors.
   2. Floor stand shall be cast iron with steel extension stems and brass sleeves.

C. Bench Stand and Stem:
   1. Bench stand shall be steel with brass sleeves complete with stem, handwheel and required anchors.

D. Floor Box and Stem:
   1. Floor box and stem shall be bushing type, for support of nonrising type stem, complete with stem, operating nut, stem guide brackets, and cover.
   2. Floor box shall be cast iron with bronze bushings.

E. Chain Wheels:
   1. Provide chain wheels on valves located higher than 6’ above the floor.
   2. The chain wheel and guide shall be the handwheel direct-mount type, complete with galvanized or cadmium-plated chain.

F. Valve Box:
   1. Provide cast iron, three-piece screw type, 5¼ inch shaft, round or oval base sized for valve.
   2. Threads shall be cast into top and bottom sections.
3. Cover shall be cast iron anti-rattle type marked for the type of valve service.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Exposed Valves:
   1. Install in accordance with the manufacturer's recommendation at location shown on the drawings or as required.
   2. Install valves to be accessible with valve operators at a convenient location for operation.
   3. Valve Orientation:
      a. Install the operating stem of a manual valve in a vertical position when the valve is in horizontal pipe runs having centerline elevations 4.5 feet or less above finished floor, unless otherwise shown on the valve schedule or the Drawings.
      b. Install the operating stem of a manual valve in the horizontal position when the valve is in horizontal pipe runs having a centerline elevation greater than 4.5 feet above finished floor, unless otherwise shown on the valve schedule or the Drawings.
      c. Automatic valves shall be installed at an orientation recommended by the manufacturer or as shown on the valve schedule or the Drawings.
   4. Install ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, for isolation during maintenance.
   5. Install an isolation valve on compressed air supplies located to provide accessibility for control and maintenance. If necessary, install access doors in finished walls and ceilings for valve access.

B. Buried Valves:
   1. Install in accordance with AWWA C600.
   2. Valves shall be supported on 6 inches of crushed rock pipe bedding material.
   3. Install valves in the closed position.
   4. Provide a valve box centered plumb over the operating nut of the valve and placed such that the box will not transmit shock or stress to the valve. Adjust the top of the valve box flush with finished grade.

C. Chain Wheel:
   1. Installed on valves where the pipe centerline is greater than six feet above finished floor or access platform.
   2. Where chains hang in normally traveled areas, provide "L" type tie-back anchors.

D. Drains and Air Release Vents:
   1. Provide drain valves for equipment (pumps, tanks, etc.) and piping systems at low points in the system for draining to prevent freezing and to rapidly drain the system for maintenance work.
2. Drain valves shall be located as close as possible to process lines to prevent dead legs.
3. Provide vent valves at the high point of piping systems to manually release air.
4. Drain and air release vent valves shall be 1" diameter minimum.

E. Valve Testing:
   1. Demonstrate in the presence of the Engineer that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications.
   2. Perform seat and shell-testing on all plug valves.
   3. Examine air and vacuum relief valves as the associated pipe is being filled to verify venting and seating is fully functional.
   4. Set, verify and record set pressures for all relief and regulating valves.

3.02 SCHEDULES
   A. See Drawings for numbers, type, and location of valves and type of operators.

END SECTION.
SECTION 40 72 76

LEVEL SWITCHES

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
   1. Float Switches

1.02 SUBMITTALS

A. Shop Drawings
   2. Submit drawings showing dimensions, and interconnections between equipment necessary to providing complete system.
   3. Submit manufacturer's installation and use recommendations.

B. Operation and Maintenance Data
   1. Submit operation and maintenance data for each product.
   2. Submit Manufacturer's calibration certification data.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General
   1. Deliver product to site. Perform receipt inspection including calibration check of all instrumentation.
   2. Store and protect product.
   3. After physical installation; protect from all other construction activity and potential damage.
   4. Handle in accordance with manufacturer's recommendations.

1.04 QUALITY ASSURANCE

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the equipment, the manufacturer shall meet all requirements listed herein.

B. No item of material or equipment will be considered by Engineer as an “or- equal” or substitute until after the Effective Date of the Contract.

PART 2 – PRODUCTS

2.01 FLOAT SWITCHES

A. Description
   1. Provide float switches as shown on the drawings. Each float shall have molded polyethylene body, internal redundant polyurethane foam flotation, potted switch and
cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the control panel. The floats shall operate on 24 volts DC.

B. Mounting:
   1. The direct acting float switch liquid level sensors shall be mounted to a common stainless-steel suspension mounting.

C. Acceptable Manufacture
   1. KwikSwitch by Primex
   2. Or Equal

PART 3 – EXECUTION – NOT USED

END SECTION.
PART 1 – GENERAL

1.01 DESCRIPTION

A. Contractor shall provide total six (6) explosion proof submersible centrifugal grinder pumps and all accessories as shown on the Drawings and as specified in this Section. Pumps shall be provided as follows:

1. Two (2) pumps at “3301 Fairway Pump Station.”
2. Two (2) pumps at “3410 Fairway Pump Station.”
3. Two (2) pumps at “Lake Ridge Pump Station.”

B. Work in this Section includes the provision and installation of wet well and valve vault structures, pumps, electrical supply and control, piping, valves, additional appurtenances and all other electrical, mechanical and site work required for a complete installation.

1.02 RELATED SECTIONS

A. 26 09 16 – Electric Controls and Relays
B. 27 26 33 – Network Integration Requirements
C. Others, as Applicable

1.03 QUALITY ASSURANCE

A. Provide manufacturer’s warranty as specified in this Section
B. Provide field test results in Start-up Certification Report as specified in this Section.
C. The pumping equipment and accessories shall be an integral package supplied by the pump manufacturer with local representation so as to provide undivided responsibility.
D. The pump(s) shall be manufactured by a company regularly engaged in the manufacture and assembly of similar units for a minimum of five (5) years.

1.04 SUBMITTALS

A. Submit the following:

1. Manufacturer’s Certificate of Compliance certifying compliance with the referenced specifications and standards.
2. Certified copies of pump curves.
3. Copy of manufacturer’s standard warranty for each type of equipment provided.
4. Shop drawings with performance data, descriptive literature, weights and dimensions and other physical characteristics verifying compliance with this Section; including certified pump curves, motor starting and full load amps, motor horse power and motor data.
5. Manufacturer’s installation instructions and recommended testing procedures.
6. Manufacturer’s operations and maintenance (O&M) manuals and materials.
7. Provide Start-Up Certification Reports specified in this Section.
8. Submit all electrical requirements for each piece of equipment; including voltage, phase and load data.

1.05 WARRANTY
A. Contractor shall provide the pump manufacturer’s warranty that the pumps being provided are free from defects in workmanship and materials, for a period of one (1) year from substantial completion date, under normal use, operation and service. A printed copy of this warranty statement shall be submitted with the shop drawings.

1.06 SPARE PARTS
A. The manufacturer shall furnish one (1) mechanical seal and one (1) cutter kit assembly

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING
A. The Contractor shall be responsible for the delivery, storage and handling of the products. Store the products in accordance with the manufacturer’s recommended procedures.
B. Load and unload all pumps, motors and appurtenances by hoists or skidding. Do not drop products. Do not skid or roll products on or against other products. Attach slings and hooks in such a manner to prevent damage to products.
C. The pumps furnished shall be packaged in such a manner as to provide ample protection from damage during handling, shipment and outdoor storage at the job site. All opening shall be capped with dustproof closures and all edges sealed or taped to provide a dust-tight closure.

1.08 OPERATION OF SYSTEM
A. Two (2) pumps shall be installed in each wet well at each of the four (4) pump stations included in this contract.
B. The water level in each wet well shall be monitored by four (4) level switches. The pump off level shall stop both pumps. As the water level in the wet well starts rising the lead pump will start first followed by the lag pump and subsequently the high-water level alarm shall sound before the sewer starts backing up. Both the pumps will alternate roles as lead and lag pump to avoid uneven wear.
C. Set point elevations for pumps off, lead pump on, lag pump on and high-water alarm shall be provided as shown on the Drawings

PART 2 – PRODUCTS

2.01 GENERAL:
A. A centrifugal submersible grinder pump shall be designed to reduce all material found in normal domestic and light industrial sewage, including plastics, rubber, sanitary napkins, and disposable diapers into a finely ground slurry. The resultant slurry shall then be pumped through small diameter piping into the downstream gravity interceptor or treatment facility as shown on the Drawings. The temperature limitation of the liquid being pumped shall be 104 degrees F continuous and shall be capable of running dry for extended periods.

2.02 APPROVED MANUFACTURERS
A. Barnes Blade XGVH Series Model
B. Or Engineer Approved equal

2.03 PERFORMANCE CHARACTERISTICS
A. Submersible Centrifugal Grinder Pumps

<table>
<thead>
<tr>
<th>Pump Characteristics</th>
<th>3301 Fairway</th>
<th>3410 Fairway</th>
<th>Lake Ridge</th>
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<td>2 (Duplex System)</td>
<td>2 (Duplex System)</td>
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<td>110-feet</td>
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<td>Design Operating Point</td>
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<td>50 gpm @ 79 feet TDH</td>
<td>55 gpm @ 100 feet TDH</td>
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<td>3600</td>
<td>3600</td>
</tr>
<tr>
<td>Nominal RPM</td>
<td>3450</td>
<td>3450</td>
<td>3450</td>
</tr>
<tr>
<td>Voltage</td>
<td>230</td>
<td>230</td>
<td>Dual; 230-460</td>
</tr>
<tr>
<td>Motor Wiring</td>
<td>(Wired for 230)</td>
<td>(Wired for 230)</td>
<td>(Wired for 460)</td>
</tr>
<tr>
<td>Phase</td>
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<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Hertz</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

2.04 PUMP CONSTRUCTION:
A. Each pump shall be CSA listed for Class I, Groups C & D, Division 1, hazardous locations. The volute, seal plates and motor housing shall be constructed of high-quality ASTM A-48 class 30 cast iron. The pump shall be painted with a water-based air-dry enamel of 2.0 mil minimum thickness (or amide amine modified polymer satin gloss epoxy with 10 mil minimum thickness). All exposed hardware shall be 300 series stainless steel. Discharge connection shall be a standard 2-inch NPT in the vertical position or 2/2.5/3-inch 125 pound slotted flanged to accommodate ANSI or ISO piping flange.

B. Impeller
1. The pump impeller shall be of the recessed vortex design. Pumps with standard centrifugal semi-open impeller designs shall not be acceptable. The impeller shall be of ASTM A-48 class 30 cast iron construction and machined for threading to the motor shaft. The impeller shall be capable of being trimmed to meet specific performance characteristics.

C. Grinder mechanism
1. The grinder mechanism shall consist of a radial cutter threaded and locked on the motor shaft by a washer in conjunction with a countersunk flat head cap screw, and a shredding ring containing a minimum of fifteen flow passages with cutting edges. The shredding ring shall be reversible to provide twice the cutting-edge life. Both the shredding ring and radial cutter shall be constructed of 440C stainless steel hardened to a min. Rockwell C55 and shall be finish ground for a fine cutting edge. Two-stage cutter mechanisms requiring external adjustment for proper clearance are not acceptable.

2. The unit shall utilize a tandem mechanical shaft seal arrangement and shall operate in an oil atmosphere. The materials of construction shall be carbon for the rotating face and ceramic for the stationary face, lapped and polished to a tolerance of one light band, 300 series stainless steel hardware, and all elastomer parts to be Buna-N. The seal shall be commercially available and not a proprietary design of the manufacturer.

D. Motor

1. Single phase motors shall be of the capacitor start, capacitor run design and three phase motors shall be of the dual-voltage 230/460 design. The pump shall be designed to be non-overloading throughout the entire pump curve. The rotor and stator assembly shall be of the standard frame design and secured to the pump seal plate by four threaded fasteners allowing for easy serviceability.

2. The motor shall be constructed with the windings operating in a sealed environment containing clean dielectric oil, making it capable of operating in a totally, partially or non-submerged condition for extended periods of time without damage due to the heat being generated.

3. Air-filled motors shall not be acceptable. The motor windings shall be spike resistant with of Class F insulation and Class H wire. The motor shall meet the standard NEMA design L for single phase, NEMA design B for three phase and be inverter duty rated per NEMA MG1 Part 31. The motor shaft shall be of 416 stainless steel. Protection against excessive temperature shall be provided by heat sensor thermostat attached to the stator windings and connected in series with the contactor coil in the control panel.

E. The lower bearing shall be of the double row ball type to accept radial and thrust loads, and the upper bearing of the single row ball type for radial loads. Bearings shall operate in an oil bath atmosphere for superior life. Permanently lubricated bearings are not acceptable.

F. Three Phase:

1. The pump shall be equipped with adequate length (without splicing) of a CSA-qualified submersible plug-n-play quick connect power cable constructed in accordance with type W guidelines and shall include the moisture and temperature sensor leads. The cable entry system shall consist of an expanding rubber plug held in place by a cast stainless steel plate indicating voltage and max amps.

G. Single Phase:

1. The pump shall be equipped with adequate length (without splicing) of a CSA-qualified submersible plug-n-play quick connect power cable constructed in accordance with Type W guidelines and shall include the moisture and temperature sensor leads. The cable entry system shall consist of an expanding rubber plug held in place by a cast stainless steel plate indicating voltage and max amps.
2.05 NON-SPARKING GUID RAIL SYSTEM

A. The Contractor shall provide a non-sparking guide rail system consisting of two galvanized or stainless-steel guide rails, cast bronze pump guide bracket, cast ductile iron discharge elbow with mounting feet and Class 125 flanges, 316 stainless steel upper guide rail mounting bracket, and 316 stainless steel intermediate guide rail stiffener bracket every 10 feet. System design shall prevent spark ignition of explosive gases during pump installation and removal.

B. Provide two (2) two-inch SCH40 pipe guide rails per pump. The upper guide rail holder shall be supplied with a break away fitting system. Provide intermediate guide rail support for guide rails over 13-feet long.

2.06 CONTROL SYSTEM

A. Incoming power requirements:
   1. 3301 Fairway Pump Station: 230 VAC, single phase
   2. 3410 Fairway Pump Station: 230 VAC, single phase
   3. Lake Ridge Pump Station: 480 VAC, 3-phase

B. The contractor shall furnish Two (2) PRIMEX Grinder Pump Control panels NEMA Type 4X and one (1) Primex Grinder Pump Traffic Enclosure for Lake Ridge.
   1. Stainless Steel
      a. The material to be 16-gauge Type 304 stainless-steel.
      b. Seams to be continuously welded and ground smooth.
      c. The enclosure shall come with mounting feet to allow for wall mounting.
      d. Entry shall be via a quarter-turn latch.
      e. A hasp shall be installed to allow for the ability to padlock the enclosure.

C. Inner Door
   1. The enclosure shall be provided with an aluminum inner door to provide mounting of the selector switches, indicators, and ETM’s. The door shall also provide cut-outs to allow access to the main breaker and combination starters.
   2. The inner door shall be connected via a continuous hinge.
   3. The inner door shall be provided with quarter turn latches to securely hold the door in a closed position against a doorstop.

D. Interior Panel Light
   1. The enclosure shall be provided with an LED service light, Hoffman LED24V15 or equal.

E. Power Entry
   1. The control panel shall include a thermal magnetic main circuit breaker to provide an incoming power disconnect means and short circuit/overcurrent protection for the control panel equipment
   2. The circuit breaker shall be operable through the operator’s door of the enclosure and shall have a trip rating to allow full voltage starting and continuous operation of the motors.
F. Emergency Power
   1. The control panel shall include a second circuit breaker mechanically interlocked with the main breaker to function as an emergency power interrupt and manual transfer switch. The breakers shall allow the control panel to be powered by either commercial power or the owner’s portable emergency power generator. The interlock shall be padlock-able with both breakers in the “off” position. The breakers shall be operable from the control panel operator’s door.
   2. A generator receptacle with angled backbox shall be provided and mounted on the side of the enclosure by the panel manufacture. The Generator receptacle shall be Crouse-Hinds Model AR1041S22 to match existing.

G. Surge Arrestor
   1. The Surge Arrestor shall come with a mounting bracket that can be aligned with pre-tapped holes on the back panel for field installation.
   2. Component shall be Square D, SDSA1175 – single phase and SDSA350 for 3-phase.

H. Alarm Light
   1. A Type 4X flashing Alarm Light shall be provided and should be mounted on the top center of the enclosure.
   2. The alarm light shall be a flashing 40watt Red light with an option of being Amber.

I. Indicators and switches.
   1. Indicator to be 22 mm LED industrial devices.
   2. There shall be a Green pump running light for each pump.
   3. There shall be a Red seal fail light for each pump.
   4. There shall be three position HAND-OFF-AUTO selector switch for each pump.
   5. All indicators and switches are to be labeled with a white legend plate with black lettering. Labels are to be mechanically fastened; labels with adhesive are not acceptable.
   6. Components shall be Square D, XB4 series.

J. ETM
   1. There shall be an individual elapsed time meter for each pump.
   2. The ETM’s shall have a 7 digit display which includes two decimal spaces and shall not be resettable.

K. Combination Starter
   1. The combination starter shall offer short circuit protection while being utilized as a motor starter with integrated overload protection in a single frame.
   2. Overload Modules
      a. The overload modules may be exchangeable to provide a large overload range. The overloads should offer a type Class 10 protection.
      b. Components shall be Square D, LUCA series.
3. The motor starter shall be sized to accommodate up to 10 HP maximum at 208 or 230 VAC, and 20 HP maximum at 460 VAC.

4. Combination Starter to be Square D, TeSys U Simple Motor Starter.

L. Control Transformer (3-phase power)
1. The control transformer shall have multiple taps to allow 208, 230 or 460 VAC primary operation. The secondary voltage shall be 115 VAC.
2. The control transformer shall be sized to supply the proper power requirements for the control circuit components.
3. Component shall be Square D, Class 9070T.

M. Start Run Capacitors (single phase power)
1. Start Run Capacitors shall be provided by the pump manufacturer for installation in the control panel. Start Run Capacitors shall be sized for the appropriate pump horsepower and FLA.

N. Alternating Relay
1. An alternating relay and circuitry shall be provided to cycle between pumps to allow for even pump use. The alternator shall index to the next pump as the lead pump is turned off.
2. Component shall be Diversified, ARA-120-ABA.

O. Control Relay
1. Control relays shall be plug-in style, SPDT.
2. Relay contacts should be rated for a minimum 12amp @ 250VAC or 28VDC.
3. Component shall be Square D, RSB1A120F7.

P. Timer Relay
1. The timer relay shall be plug-in style, 4 pole relay.
2. The time range shall be adjustable from .1 seconds to 100 hours
3. Relay contacts should be rated for a minimum 3amp @ 250VAC.
4. Component shall be Square D, REXL4TMF7.

Q. Flasher
1. The flasher shall be solid-state with totally encapsulated circuitry.
2. Timing range shall be factory set at 75 flashes per minute.
3. Component shall be Diversified, ETN-120-AFT-75

R. Intrinsically Safe Barriers
1. All float switches and transducers located in the wet well shall be provided with intrinsically safe barriers that meet UL 913 specification, 6th edition and are labeled as such. Each device shall be mounted in an intrinsically safe area that is mechanically protected from non-intrinsically safe wiring.

S. Seal Failure Monitor/Motor Overtemperature
1. Seal failure indication shall be provided for each pump on the operator display. Voltage or current sensing relays as required by the pump manufacturer shall be provided to sense seal failure.

2. Motor Over-temperature indication shall be provided for each pump on the operator display. The alarm light shall remain on and the pump shall not be allowed to restart until the motor has cooled and the reset button has been pressed.

3. Provide PRIMEX PMR-1 Pump Control Relay for each pump.

T. SCADA System

1. Provide back panel space (12”x12”) to mount and wire Scadata hardware

2. Scadata RTU to be field mounted and wired

3. Auxiliary Dry Contact interface to Scadata System
   a. High Level Alarm – Float based
   b. Pump 1 Run
   c. Pump 1 Seal Fail
   d. Pump 1 Over-Temp
   e. Pump 2 Run
   f. Pump 2 Seal Fail
   g. Pump 2 Over-Temp

U. The control system shall be controlled via four floats.

1. Pumps off float

2. Lead pump on float

3. Lag pump on float

4. High level float

V. The float switches shall be furnished with the control panel. They shall be a standard product of the control panel manufacturer.

W. Sequence of Operation

1. When the HAND-OFF-AUTO switch is in the HAND position, the corresponding pump will run, bypassing the float control until the operator turns the switch to the OFF position. If the motor heat sensor is faulted or an overload is present, the motor will not be permitted to run.

2. When the HAND-OFF-AUTO switch is in the OFF position, the corresponding pump will be off and not permitted to run.

3. When both HAND-OFF-AUTO switches are in “Auto” position, the pumps shall be controlled via floats. When the water level rises to the “Lead Pump On” float, the lead pump shall be called, and shall run until the water level goes below the “Pumps Off Level” float. When the lead pump shuts down, the alternating relay shall index to the other pump for the next pumping cycle. If the water level continues to rise to the “Lag Pump On” float, the lag pump will be called, after a time delay, to run along with the lead pump. Both pumps will run until the water level reaches the “Pumps Off Level” float.
float. The “Lag Pump On” float shall override the “Lead Pump On” float in case of a lead float failure.

4. If the pump motor heat sensor fault and/or an overload is present, the corresponding motor will not be permitted to run.

5. If the water level rises to the “High Level” float, a flashing alarm beacon shall be activated. The beacon shall remain active until the water level goes below the “High Level” float.

X. APPROVED MANUFACTURERS

1. Primex Controls
2. Or Engineer Approved Equal

2.07 Telemetry

A. The contractor shall furnish and install, as shown on the plans and described herein, the various pieces of equipment necessary for a complete monitoring system. A single manufacturer shall furnish all equipment to the contractor to ensure system responsibility. The complete system shall be provided with all programming, hardware such as remote telemetry units (RTU), cabling and antennas, manuals and documentation required for complete system configuration, communication, data acquisition and reporting. The RTU must be capable of communicating with the City of Danville’s existing SCADATA system.

B. The principal items of equipment shall include, but not be limited to, the following:

1. Remote Telemetry Units (RTU)
   a. Lift Station “3301 Fairway Pump Station.”
   b. Lift Station “3410 Fairway Pump Station.”
   c. Lift Station “Lake Ridge Pump Station.”
2. Programming Time – Modification of Existing Scadata Software
3. Antennas
4. Antenna Cables
5. Surge Suppressors
6. Rechargeable Batteries

C. RTU Requirements:

1. In order to expedite replacement equipment and reduce spare components, RTU's shall be manufactured as a complete unit. RTU's that are assembled by system integrators consisting of various catalog parts as a custom design specific for this project will not be considered equal.

2. Each RTU shall consist of the minimum following quantities and features for the Input/Output (I/O) at each site.
   a. Qty. 4 – Digital / Discretionary Inputs
   b. Qty. 4 – Analog Inputs
   c. Qty. 2 – Digital / Discretionary Outputs
d. Qty. 2 – Analog Outputs

e. RTU to be capable of switching analog inputs to digital inputs in any number combination totaling the total number of inputs per RTU.

f. Digital Inputs shall be normally open dry contacts.

g. Analog inputs shall be capable of receiving either 4 – 20 mA, 0 – 5 VDC, or 1 – 5 VDC inputs.

h. Power failure and low battery must be included on the RTU and will not require the use of any inputs listed above.

3. While analog and digital outputs are not required for this project, the RTU must be supplied with the quantities noted above for future expansion of the system to include remote control of equipment within the system.

4. Each RTU shall be capable of expansion to an unlimited number of inputs and outputs as required by the job site. Expansion of the I/O will be accomplished through the addition of expansion boards with the same number of inputs and outputs as listed above. Designs which limit future expansion without the replacement of major components are not acceptable.

5. RTU shall be capable of accepting either 120/1/60 AC or up to 10 – 30 VDC power supply. Within the RTU shall be the capabilities of charging and / or operating off of a standby battery, in the event of a power outage. The RTU shall also be capable of operating a 12-volt 0.5 amp loop powered device whether on AC, DC, or battery power supply.

6. RTU input board shall be equipped with easily visible light emitting diodes (LED’s) indicating open or closed contact for all digital connections (input and output) for quick immediate detection of circuit status by operator. LED’s shall also be supplied to indicate Communication, Communication Transmit, Communication Receive, and Battery Charge.

7. RTU communication shall be via user selectable Modbus, SCIP, or SCIP/Ethernet. Transmission shall be continuous providing operator with real time information of each site. Each over the air transmission between the RTU shall not exceed 41 Bytes per packet. Each packet sent shall include site specific information related to the status of the remote site. Each RTU shall recognize a busy channel and delay broadcast as required. All RTU’s within the network will complete the transmission of their data in 30 seconds or less. Systems that require more time will not be considered equal. Each transmission shall require a positive acknowledgement from the recipient, or the transmission shall be reinitiated.

8. The RTU must have the ability to time and date stamp all collected inputs.

9. Communication shall be (902-928MHZ) and be programmed to Danville’s radio network

10. Each RTU shall be supplied with the following accessories:

   a. One (1) minimum four (4) hour gel cell battery for connection to RTU battery input. Battery to be shipped loose for field installation.

D. ANTENNA REQUIREMENTS:
1. A Yagi directional type antenna is to be supplied for sites as noted in the plan sheets for each site. The Minimum gain for this antenna shall be 11dBi. Antenna shall be equipped with a short pigtail cable and N-style jack connector. The Antenna shall be constructed of aluminum and be capable of 120 mph wind loading. Mounting hardware for connection to a 1.25 in. diameter antenna mast shall be included. The Supplier shall provide LMR-400 coaxial cable in sufficient length to connect the surge suppressor within the RTU to the antenna in a single piece, no splicing or joints will be allowed. See Table 1 for specific details regarding the antenna to be supplied for each site. Sites that require total antenna cable lengths greater than 50 ft. are required to substitute the LMR-400 cable specified with LMR-600 for reduced signal loss through the coaxial cable. All other requirements remain the same.

2. An antenna mast a minimum of 20 ft. tall shall be supplied per site, as required. Diameter shall be minimum 1.25 in. Mast shall be schedule 40 aluminum minimums.

E. APPROVED MANUFACTURERS

1. Scadata
2. Or Engineer Approved Equal

PART 3 – EXECUTION

3.01 INSTALLATION

A. All equipment shall be installed as shown on the Drawings, in accordance with the manufacturer’s published instructions, and in accordance with all state and local codes, ordinances, and regulations.

B. The Contractor shall adjust, lubricate, and leave the pumping systems in proper working condition.

C. The Contractor shall provide the spare parts to the Owner as per the manufacturer’s instructions and as described herein.

3.02 FIELD TESTING

A. The Contractor shall arrange for the manufacturer’s technician stie visit to perform a pumping test of each new pump after the pumping equipment is installed. The Contractor shall be responsible for coordinating the testing of the pumps. Submit all “as-installed” test data and pump curves in the Start-Up Certification Report.

B. Pump Test:

1. The pump manufacturer shall perform the following inspections and tests:

   a. A check of the motor voltage and frequency shall be made as shown on the name plate.

   b. A motor and cable insulation test for moisture content or insulation defects shall be made per UL/ CSA criteria.

   c. The pump shall be completely submerged and run to determine that the unit meets three pre-determined hydraulic performance points.

2. The manufacturer shall perform certified tests in accordance with Grades B, E and U of Hydraulic Institute standards.
C. Any defects in the new equipment, or failure to meet the specified performance, shall be corrected by the Contractor. The Owner reserves the right to reject any pump if the Contractor fails or refuses to make the corrections required to meet the specified performance; or the improved pumping units, when tested, fail to meet the specified performance.

3.03 MANUFACTURER’S SERVICES AND START-UP CERTIFICATION REPORT

A. The Contractor shall provide the services of a qualified technician of the pump manufacturer for a minimum of one day each to perform the following tasks:

1. Inspect the installation of the equipment.
2. Place the equipment in operation and make any necessary adjustments.
3. Perform Field Tests specified above.
4. Perform tests specified in this Section and recommended by the equipment manufacturer.
5. Instruct the Owner’s personnel in the proper operations and maintenance of the equipment (training).

B. If the equipment is not completed for proper start-up and training procedures, the Contractor shall reschedule another site visit by the pump manufacturer at no additional cost to the Owner. Training shall not be permitted without proper start-up and testing tasks. An abstract or outline of the start-up, testing, and training procedures shall be provided to the Engineer and Owner at least five days prior to the scheduled visit.

C. The manufacturer’s operation and maintenance manuals and materials shall be incorporated in the training procedures, with an emphasis on items or materials of greatest importance.

D. A typed, bound report covering the manufacturer’s technician’s findings shall be submitted to the Engineer for review and approval. The report shall:

1. Describe the start-up procedures taken;
2. Include any inspections performed;
3. Outline in detail any deficiencies observed along with the corrective measures taken;
4. Include the results of all field tests, including necessary graphs, charts, tables, etc., specified in this Section or required by the referenced standards, and
5. Certify that the equipment is properly installed and functioning for the purpose intended.

E. The Contractor shall bear all expenses associated with the start-up, testing, and training procedures and report described above; including labor, transportation, lodging, and material costs. The cost of this work shall be considered incidental to the Contract price for the project.

END SECTION.