

**If you plan to submit a bid directly to the Department of Transportation**

**PREQUALIFICATION**

Any contractor who desires to become pre-qualified to bid on work advertised by IDOT must submit the properly completed pre-qualification forms to the Bureau of Construction no later than 4:30 p.m. prevailing time twenty-one days prior to the letting of interest. This pre-qualification requirement applies to first time contractors, contractors renewing expired ratings, contractors maintaining continuous pre-qualification or contractors requesting revised ratings. To be eligible to bid, existing pre-qualification ratings must be effective through the date of letting.

**REQUESTS FOR AUTHORIZATION TO BID**

Contractors wanting to bid on items included in a particular letting must submit the properly completed "Request for Authorization to Bid/or Not For Bid Status" (BDE 124INT) and the ORIGINAL "Affidavit of Availability" (BC 57) to the proper office no later than 4:30 p.m. prevailing time, three (3) days prior to the letting date.

**WHO CAN BID ?**

Bids will be accepted from only those companies that request and receive written **Authorization to Bid** from IDOT's Central Bureau of Construction.

**WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?:** When a prospective prime bidder submits a "Request for Authorization to Bid/or Not For Bid Status"(BDE 124INT) he/she must indicate at that time which items are being requested For Bidding purposes. Only those items requested For Bidding will be analyzed. After the request has been analyzed, the bidder will be issued an **Authorization to Bid or Not for Bid Report**, approved by the Central Bureau of Construction that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Authorization to Bid or Not for Bid Report** will indicate the reason for denial.

**ABOUT AUTHORIZATION TO BID:** Firms that have not received an authorization form within a reasonable time of complete and correct original document submittal should contact the department as to status. This is critical in the week before the letting. These documents must be received three days before the letting date. Firms unsure as to authorization status should call the Prequalification Section of the Bureau of Construction at the number listed at the end of these instructions.

**ADDENDA AND REVISIONS:** It is the contractor's responsibility to determine which, if any, addenda or revisions pertain to any project they may be bidding. Failure to incorporate all relevant addenda or revisions may cause the bid to be declared unacceptable.

Each addendum will be placed with the contract number. Addenda and revisions will also be placed on the Addendum/Revision Checklist and each subscription service subscriber will be notified by e-mail of each addendum and revision issued.

The Internet is the Department's primary way of doing business. The subscription server e-mails are an added courtesy the Department provides. It is suggested that bidders check IDOT's website at <http://www.dot.il.gov/desenv/delett.html> before submitting final bid information.

***IDOT IS NOT RESPONSIBLE FOR ANY E-MAIL FAILURES.***

Addenda Questions may be directed to the Contracts Office at (217)782-7806 or [D&Econtracts@dot.il.gov](mailto:D&Econtracts@dot.il.gov)

Technical Questions about downloading these files may be directed to Tim Garman (217)524-1642 or [Timothy.Garman@illinois.gov](mailto:Timothy.Garman@illinois.gov).

**WHAT MUST BE INCLUDED WHEN BIDS ARE SUBMITTED?:** Bidders need not return the entire proposal when bids are submitted. That portion of the proposal that must be returned includes the following:

1. All documents from the Proposal Cover Sheet through the Proposal Bid Bond
2. Other special documentation and/or information that may be required by the contract special provisions

All proposal documents, including Proposal Guaranty Checks or Proposal Bid Bonds, should be stapled together to prevent loss when bids are processed by IDOT personnel.

**ABOUT SUBMITTING BIDS:** It is recommended that bidders deliver bids in person to insure they arrive at the proper location prior to the time specified for the receipt of bids. Any bid received at the place of letting after the time specified will not be accepted.

**WHO SHOULD BE CALLED IF ASSISTANCE IS NEEDED?**

<b>Questions Regarding</b>	<b>Call</b>
Prequalification and/or Authorization to Bid	217/782-3413
Preparation and submittal of bids	217/782-7806
Mailing of plans and proposals	217/782-7806

**ADDENDUMS AND REVISIONS TO THE PROPOSAL FORMS**

Planholders should verify that they have received and incorporated any addendum and/or revision prior to submitting their bid. Failure by the bidder to include an addendum or revision could result in a bid being rejected as irregular.

# 312

RETURN WITH BID

Proposal Submitted By
Name
Address
City

## Letting June 11, 2010

**BIDDERS NEED NOT RETURN THE ENTIRE PROPOSAL**  
(See instructions inside front cover)

### NOTICE TO PROSPECTIVE BIDDERS

This proposal can be used for bidding purposes by only those companies that request and receive written AUTHORIZATION TO BID from IDOT's Central Bureau of Construction.  
(SEE INSTRUCTIONS ON THE INSIDE OF COVER)

# Notice to Bidders, Specifications, Proposal, Contract and Contract Bond



**Illinois Department  
of Transportation**

Springfield, Illinois 62764

**Contract No. 60799  
COOK County  
Section 1213.4 A-T  
District 1 Construction Funds  
Route FAI 94**

PLEASE MARK THE APPROPRIATE BOX BELOW:

- A Bid Bond is included.
- A Cashier's Check or a Certified Check is included.

Prepared by

S

Checked by

(Printed by authority of the State of Illinois)

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## INSTRUCTIONS

**ABOUT IDOT PROPOSALS:** All proposals issued by IDOT are potential bidding proposals. Each proposal contains all Certifications and Affidavits, a Proposal Signature Sheet and a Proposal Bid Bond required for Prime Contractors to submit a bid after written **Authorization to Bid** has been issued by IDOT's Central Bureau of Construction. In addition, this proposal contains new statutory requirements applicable to the use of subcontractors and, in particular, includes the State Required Ethical Standards Governing Subcontractors to be signed and incorporated into all subcontracts.

**WHO CAN BID?:** Bids will be accepted from only those companies that request and receive written **Authorization to Bid** from IDOT's Central Bureau of Construction. To request authorization, a potential bidder must complete and submit Part B of the Request for Authorization to Bid/or Not For Bid Status form (BDE 124 INT) and submit an original Affidavit of Availability (BC 57).

**WHAT CONSTITUTES WRITTEN AUTHORIZATION TO BID?:** When a prospective prime bidder submits a "**Authorization to Bid or Not for Bid**" form, he/she must indicate at that time which items are being requested For Bidding purposes. Only those items requested For Bidding will be analyzed. After the request has been analyzed, the bidder will be issued a **Authorization to Bid or Not for Bid Report**, approved by the Central Bureau of Construction, that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Authorization to Bid or Not for Bid Report** will indicate the reason for denial. If a contractor has requested to bid but has not received a **Authorization to Bid or Not for Bid Report**, they should contact the Central Bureau of Construction in advance of the letting date.

**WHAT MUST BE INCLUDED WHEN BIDS ARE SUBMITTED?:** Bidders need not return the entire proposal when bids are submitted. That portion of the proposal that must be returned includes the following:

1. All documents from the Proposal Cover Sheet through the Proposal Bid Bond
2. Other special documentation and/or information that may be required by the contract special provisions

All proposal documents, including Proposal Guaranty Checks or Proposal Bid Bonds, should be stapled together to prevent loss when bids are processed by IDOT personnel.

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### WHO SHOULD BE CALLED IF ASSISTANCE IS NEEDED?

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Prequalification and/or Authorization to Bid	217/782-3413
Preparation and submittal of bids	217/782-7806

RETURN WITH BID



PROPOSAL

TO THE DEPARTMENT OF TRANSPORTATION

1. Proposal of \_\_\_\_\_

\_\_\_\_\_

Taxpayer Identification Number (Mandatory) \_\_\_\_\_ a

for the improvement identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60799  
COOK County  
Section 1213.4 A-T  
Route FAI 94  
District 1 Construction Funds**

**Complete rehabilitation of the existing IDOT pumping station number 27 located at the east side of Doty Avenue at 110th Street along I-94/Bishop Ford Expressway) including electrical, mechanical, structural, architectural and civil disciplines.**

2. The undersigned bidder will furnish all labor, material and equipment to complete the above described project in a good and workmanlike manner as provided in the contract documents provided by the Department of Transportation. This proposal will become part of the contract and the terms and conditions contained in the contract documents shall govern performance and payments.

**RETURN WITH BID**

3. **ASSURANCE OF EXAMINATION AND INSPECTION/WAIVER.** The undersigned further declares that he/she has carefully examined the proposal, plans, specifications, addenda, form of contract and contract bond, and special provisions, and that he/she has inspected in detail the site of the proposed work, and that he/she has familiarized themselves with all of the local conditions affecting the contract and the detailed requirements of construction, and understands that in making this proposal he/she waives all right to plead any misunderstanding regarding the same.
4. **EXECUTION OF CONTRACT AND CONTRACT BOND.** The undersigned further agrees to execute a contract for this work and present the same to the department within fifteen (15) days after the contract has been mailed to him/her. The undersigned further agrees that he/she and his/her surety will execute and present within fifteen (15) days after the contract has been mailed to him/her contract bond satisfactory to and in the form prescribed by the Department of Transportation, in the penal sum of the full amount of the contract, guaranteeing the faithful performance of the work in accordance with the terms of the contract.
5. **PROPOSAL GUARANTY.** Accompanying this proposal is either a bid bond on the department form, executed by a corporate surety company satisfactory to the department, or a proposal guaranty check consisting of a bank cashier's check or a properly certified check for not less than 5 per cent of the amount bid or for the amount specified in the following schedule:

<u>Amount of Bid</u>		<u>Proposal Guaranty</u>	<u>Amount of Bid</u>		<u>Proposal Guaranty</u>	
Up to	\$5,000	\$150	\$2,000,000	to	\$3,000,000	\$100,000
\$5,000	to	\$10,000	\$3,000,000	to	\$5,000,000	\$150,000
\$10,000	to	\$50,000	\$5,000,000	to	\$7,500,000	\$250,000
\$50,000	to	\$100,000	\$7,500,000	to	\$10,000,000	\$400,000
\$100,000	to	\$150,000	\$10,000,000	to	\$15,000,000	\$500,000
\$150,000	to	\$250,000	\$15,000,000	to	\$20,000,000	\$600,000
\$250,000	to	\$500,000	\$20,000,000	to	\$25,000,000	\$700,000
\$500,000	to	\$1,000,000	\$25,000,000	to	\$30,000,000	\$800,000
\$1,000,000	to	\$1,500,000	\$30,000,000	to	\$35,000,000	\$900,000
\$1,500,000	to	\$2,000,000	over		\$35,000,000	\$1,000,000

Bank cashier's checks or properly certified checks accompanying proposals shall be made payable to the Treasurer, State of Illinois, when the state is awarding authority; the county treasurer, when a county is the awarding authority; or the city, village, or town treasurer, when a city, village, or town is the awarding authority.

If a combination bid is submitted, the proposal guaranties which accompany the individual proposals making up the combination will be considered as also covering the combination bid.

The amount of the proposal guaranty check is \_\_\_\_\_ \$( \_\_\_\_\_ ). If this proposal is accepted and the undersigned shall fail to execute a contract bond as required herein, it is hereby agreed that the amount of the proposal guaranty shall become the property of the State of Illinois, and shall be considered as payment of damages due to delay and other causes suffered by the State because of the failure to execute said contract and contract bond; otherwise, the bid bond shall become void or the proposal guaranty check shall be returned to the undersigned.

**Attach Cashier's Check or Certified Check Here**

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 guaranty check is placed in another proposal, state below where it may be found.

The proposal guaranty check will be found in the proposal for:

Item \_\_\_\_\_

Section No. \_\_\_\_\_

County \_\_\_\_\_

**Mark the proposal cover sheet as to the type of proposal guaranty submitted.**

**RETURN WITH BID**

6. **COMBINATION BIDS.** The undersigned further agrees that if awarded the contract for the sections contained in the following combination, he/she will perform the work in accordance with the requirements of each individual proposal comprising the combination bid specified in the schedule below, and that the combination bid shall be prorated against each section in proportion to the bid submitted for the same. If an error is found to exist in the gross sum bid for one or more of the individual sections included in a combination, the combination bid shall be corrected as provided in the specifications.

**When a combination bid is submitted, the schedule below must be completed in each proposal comprising the combination.**

**If alternate bids are submitted for one or more of the sections comprising the combination, a combination bid must be submitted for each alternate.**

**Schedule of Combination Bids**

Combination No.	Sections Included in Combination	Combination Bid	
		Dollars	Cents

7. **SCHEDULE OF PRICES.** The undersigned bidder submits herewith, in accordance with the rules and instructions, a schedule of prices for the items of work for which bids are sought. The unit prices bid are in U.S. dollars and cents, and all extensions and summations have been made. The bidder understands that the quantities appearing in the bid schedule are approximate and are provided for the purpose of obtaining a gross sum for the comparison of bids. If there is an error in the extension of the unit prices, the unit prices shall govern. Payment to the contractor awarded the contract will be made only for 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 provided elsewhere in the contract.

8. **AUTHORITY TO DO BUSINESS IN ILLINOIS.** Section 20-43 of the Illinois Procurement Code (30 ILCS 500/20-43) provides that a person (other than an individual acting as a sole proprietor) must be a legal entity authorized to do business in the State of Illinois prior to submitting the bid.

ILLINOIS DEPARTMENT OF TRANSPORTATION  
 SCHEDULE OF PRICES  
 CONTRACT  
 NUMBER - 60799

State Job # - C-91-322-99  
 PPS NBR - 1-75785-0100  
 County Name - COOK- -  
 Code - 31 - -  
 District - 1 - -  
 Section Number - 1213.4A-T

Project Number

Route  
 FAI 94

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
XX007787	CLASS SI CONC	CU YD	40.000				
X0301028	PUMP STA SCADA EQUIP	L SUM	1.000				
X0323880	COMP SPARE M-PUMP ASM	L SUM	1.000				
X0323881	COMP SPARE LF PMP ASM	L SUM	1.000				
X0325156	REM & DISP LEAD PAINT	SQ FT	1,740.000				
X0335700	P.S. GENERAL WORK	L SUM	1.000				
X0783300	P.S. ELECTRICAL WORK	L SUM	1.000				
X0783500	P.S. MECHANICAL WORK	L SUM	1.000				
X4020500	AGG SURF CSE B 6	SQ YD	170.000				
X8040305	ELECT SERV CONNECT	L SUM	1.000				
20200100	EARTH EXCAVATION	CU YD	765.000				
35100500	AGG BASE CSE A 6	SQ YD	170.000				
35102400	AGG BASE CSE B 12	SQ YD	1,830.000				
40600100	BIT MATLS PR CT	GALLON	920.000				
40603080	HMA BC IL-19.0 N50	TON	160.000				



ILLINOIS DEPARTMENT OF TRANSPORTATION  
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 CONTRACT  
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 County Name - COOK- -  
 Code - 31 - -  
 District - 1 - -  
 Section Number - 1213.4A-T

Project Number

Route  
 FAI 94

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
40603310	HMA SC "C" N50	TON	160.000				
50102400	CONC REM	CU YD	20.000				
50500405	F & E STRUCT STEEL	POUND	108,000.000				
50800205	REINF BARS, EPOXY CTD	POUND	6,600.000				
66400570	CH LK FENCE 8 SPL	FOOT	650.000				
66404600	CH LK GATE 8X3 SINGL	EACH	1.000				
66409800	CH LK GATES 8X20 DBL	EACH	2.000				
67000400	ENGR FIELD OFFICE A	CAL MO	24.000				
67100100	MOBILIZATION	L SUM	1.000				
70101700	TRAF CONT & PROT	L SUM	1.000				

**CONTRACT NUMBER**

**60799**

**THIS IS THE TOTAL BID**

**\$ \_\_\_\_\_**

**NOTES:**

1. Each PAY ITEM should have a UNIT PRICE and a TOTAL PRICE.
2. The UNIT PRICE shall govern if no TOTAL PRICE is shown or if there is a discrepancy between the product of the UNIT PRICE multiplied by the QUANTITY.
3. If a UNIT PRICE is omitted, the TOTAL PRICE will be divided by the QUANTITY in order to establish a UNIT PRICE.
4. A bid may be declared UNACCEPTABLE if neither a unit price nor a total price is shown.

## RETURN WITH BID

### **STATE REQUIRED ETHICAL STANDARDS GOVERNING CONTRACT PROCUREMENT: ASSURANCES, CERTIFICATIONS AND DISCLOSURES**

#### **I. GENERAL**

**A.** Article 50 of the Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

**B.** In order to comply with the provisions of Article 50 and to carry out the duty established therein, all bidders are to adhere to ethical standards established for the procurement process, and to make such assurances, disclosures and certifications required by law. Except as otherwise required in subsection III, paragraphs J-N, by execution of the Proposal Signature Sheet, the bidder indicates that each of the mandated assurances have been read and understood, that each certification is made and understood, and that each disclosure requirement has been understood and completed.

**C.** In addition to all other remedies provided by law, failure to comply with any assurance, failure to make any disclosure or the making of a false certification shall be grounds for the chief procurement officer to void the contract, or subcontract, and may result in the suspension or debarment of the bidder or subcontractor.

#### **II. ASSURANCES**

The assurances hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder.

##### **A. Conflicts of Interest**

1. The Illinois Procurement Code provides in pertinent part:

Section 50-13. Conflicts of Interest.

(a) Prohibition. It is unlawful for any person holding an elective office in this State, holding a seat in the General Assembly, or appointed to or employed in any of the offices or agencies of state government and who receives compensation for such employment in excess of 60% of the salary of the Governor of the State of Illinois, or who is an officer or employee of the Capital Development Board or the Illinois Toll Highway Authority, or who is the spouse or minor child of any such person to have or acquire any contract, or any direct pecuniary interest in any contract therein, whether for stationery, printing, paper, or any services, materials, or supplies, that will be wholly or partially satisfied by the payment of funds appropriated by the General Assembly of the State of Illinois or in any contract of the Capital Development Board or the Illinois Toll Highway authority.

(b) Interests. It is unlawful for any firm, partnership, association or corporation, in which any person listed in subsection (a) is entitled to receive (i) more than 7 1/2% of the total distributable income or (ii) an amount in excess of the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(c) Combined interests. It is unlawful for any firm, partnership, association, or corporation, in which any person listed in subsection (a) together with his or her spouse or minor children is entitled to receive (i) more than 15%, in the aggregate, of the total distributable income or (ii) an amount in excess of 2 times the salary of the Governor, to have or acquire any such contract or direct pecuniary interest therein.

(d) Securities. Nothing in this Section invalidates the provisions of any bond or other security previously offered or to be offered for sale or sold by or for the State of Illinois.

(e) Prior interests. This Section does not affect the validity of any contract made between the State and an officer or employee of the State or member of the General Assembly, his or her spouse, minor child or any combination of those persons if that contract was in existence before his or her election or employment as an officer, member, or employee. The contract is voidable, however, if it cannot be completed within 365 days after the officer, member, or employee takes office or is employed.

The current salary of the Governor is \$177,412.00. Sixty percent of the salary is \$106,447.20.

## RETURN WITH BID

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-13, or that an effective exemption has been issued by the Board of Ethics to any individual subject to the Section 50-13 prohibitions pursuant to the provisions of Section 50-20 of the Code and Executive Order Number 3 (1998). Information concerning the exemption process is available from the Department upon request.

### **B. Negotiations**

1. The Illinois Procurement Code provides in pertinent part:

Section 50-15. Negotiations.

(a) It is unlawful for any person employed in or on a continual contractual relationship with any of the offices or agencies of State government to participate in contract negotiations on behalf of that office or agency with any firm, partnership, association, or corporation with whom that person has a contract for future employment or is negotiating concerning possible future employment.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-15, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

### **C. Inducements**

1. The Illinois Procurement Code provides:

Section 50-25. Inducement. Any person who offers or pays any money or other valuable thing to any person to induce him or her not to bid for a State contract or as recompense for not having bid on a State contract is guilty of a Class 4 felony. Any person who accepts any money or other valuable thing for not bidding for a State contract or who withholds a bid in consideration of the promise for the payment of money or other valuable thing is guilty of a Class 4 felony.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-25, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

### **D. Revolving Door Prohibition**

1. The Illinois Procurement Code provides:

Section 50-30. Revolving door prohibition. Chief procurement officers, State purchasing officers, procurement compliance monitors, their designees whose principal duties are directly related to State procurement, and executive officers confirmed by the Senate are expressly prohibited for a period of 2 years after terminating an affected position from engaging in any procurement activity relating to the State agency most recently employing them in an affected position for a period of at least 6 months. The prohibition includes, but is not limited to: lobbying the procurement process; specifying; bidding; proposing bid, proposal, or contract documents; on their own behalf or on behalf of any firm, partnership, association, or corporation. This Section applies only to persons who terminate an affected position on or after January 15, 1999.

2. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-30, and that the bidder has no knowledge of any facts relevant to the kinds of acts prohibited therein.

### **E. Reporting Anticompetitive Practices**

1. The Illinois Procurement Code provides:

Section 50-40. Reporting anticompetitive practices. When, for any reason, any vendor, bidder, contractor, chief procurement officer, State purchasing officer, designee, elected official, or State employee suspects collusion or other anticompetitive practice among any bidders, offerors, contractors, proposers, or employees of the State, a notice of the relevant facts shall be transmitted to the Attorney General and the chief procurement officer.

2. The bidder assures the Department that it has not failed to report any relevant facts concerning the practices addressed in Section 50-40 which may involve the contract for which the bid is submitted.

### **F. Confidentiality**

1. The Illinois Procurement Code provides:

Section 50-45. Confidentiality. Any chief procurement officer, State purchasing officer, designee, or executive officer who willfully uses or allows the use of specifications, competitive bid documents, proprietary competitive information, proposals, contracts, or selection information to compromise the fairness or integrity of the procurement, bidding, or contract process shall be subject to immediate dismissal, regardless of the Personnel code, any contract, or any collective bargaining agreement, and may in addition be subject to criminal prosecution.

2. The bidder assures the Department that it has no knowledge of any fact relevant to the practices addressed in Section 50-45 which may involve the contract for which the bid is submitted.

## RETURN WITH BID

### **G. Insider Information**

1. The Illinois Procurement Act provides:

Section 50-50. Insider information. It is unlawful for any current or former elected or appointed State official or State employee to knowingly use confidential information available only by virtue of that office or employment for actual or anticipated gain for themselves or another person.

2. The bidder assures the Department that it has no knowledge of any facts relevant to the practices addressed in Section 50-50 which may involve the contract for which the bid is submitted.

### **III. CERTIFICATIONS**

The certifications hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. Section 50-2 of the Illinois Procurement Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible chief procurement officer whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

#### **A. Bribery**

1. The Illinois Procurement Code provides:

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 1961.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

2. The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

#### **B. Felons**

1. The Illinois Procurement Code provides:

Section 50-10. Felons. Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

2. Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any of the certifications required by this Section are false.

## RETURN WITH BID

### **C. Debt Delinquency**

1. The Illinois Procurement Code provides:

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Procurement Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the chief procurement officer may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

### **D. Prohibited Bidders, Contractors and Subcontractors**

1. The Illinois Procurement Code provides:

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

### **E. Section 42 of the Environmental Protection Act**

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-12 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Procurement Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the chief procurement officer may declare the contract void if this certification is false.

### **F. Educational Loan**

1. Section 3 of the Educational Loan Default Act provides:

§ 3. No State agency shall contract with an individual for goods or services if that individual is in default, as defined in Section 2 of this Act, on an educational loan. Any contract used by any State agency shall include a statement certifying that the individual is not in default on an educational loan as provided in this Section.

2. The bidder, if an individual as opposed to a corporation, partnership or other form of business organization, certifies that the bidder is not in default on an educational loan as provided in Section 3 of the Act.

### **G. Bid-Rigging/Bid Rotating**

1. Section 33E-11 of the Criminal Code of 1961 provides:

§ 33E-11. (a) Every bid submitted to and public contract executed pursuant to such bid by the State or a unit of local government shall contain a certification by the prime contractor that the prime contractor is not barred from contracting with any unit of State or local government as a result of a violation of either Section 33E-3 or 33E-4 of this Article. The State and units of local government shall provide the appropriate forms for such certification.

- (b) A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

A violation of Section 33E-3 would be represented by a conviction of the crime of bid-rigging which, in addition to Class 3 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be barred for 5 years from the date of conviction from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

## RETURN WITH BID

A violation of Section 33E-4 would be represented by a conviction of the crime of bid-rotating which, in addition to Class 2 felony sentencing, provides that any person convicted of this offense or any similar offense of any state or the United States which contains the same elements as this offense shall be permanently barred from contracting with any unit of State or local government. No corporation shall be barred from contracting with any unit of State or local government as a result of a conviction under this Section of any employee or agent of such corporation if the employee so convicted is no longer employed by the corporation and: (1) it has been finally adjudicated not guilty or (2) if it demonstrates to the governmental entity with which it seeks to contract and that entity finds that the commission of the offense was neither authorized, requested, commanded, nor performed by a director, officer or a high managerial agent in behalf of the corporation.

2. The bidder certifies that it is not barred from contracting with the Department by reason of a violation of either Section 33E-3 or Section 33E-4.

### **H. International Anti-Boycott**

1. Section 5 of the International Anti-Boycott Certification Act provides:

§ 5. State contracts. Every contract entered into by the State of Illinois for the manufacture, furnishing, or purchasing of supplies, material, or equipment or for the furnishing of work, labor, or services, in an amount exceeding the threshold for small purchases according to the purchasing laws of this State or \$10,000.00, whichever is less, shall contain certification, as a material condition of the contract, by which the contractor agrees that neither the contractor nor any substantially-owned affiliated company is participating or shall participate in an international boycott in violation of the provisions of the U.S. Export Administration Act of 1979 or the regulations of the U.S. Department of Commerce promulgated under that Act.

2. The bidder makes the certification set forth in Section 5 of the Act.

### **I. Drug Free Workplace**

1. The Illinois "Drug Free Workplace Act" applies to this contract and it is necessary to comply with the provisions of the "Act" if the contractor is a corporation, partnership, or other entity (including a sole proprietorship) which has 25 or more employees.

2. The bidder certifies that if awarded a contract in excess of \$5,000 it will provide a drug free workplace by:

(a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance, including cannabis, is prohibited in the contractor's workplace; specifying the actions that will be taken against employees for violations of such prohibition; and notifying the employee that, as a condition of employment on such contract, the employee shall abide by the terms of the statement, and notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction.

(b) Establishing a drug free awareness program to inform employees about the dangers of drug abuse in the workplace; the contractor's policy of maintaining a drug free workplace; any available drug counseling, rehabilitation, and employee assistance programs; and the penalties that may be imposed upon employees for drug violations.

(c) Providing a copy of the statement required by subparagraph (1) to each employee engaged in the performance of the contract and to post the statement in a prominent place in the workplace.

(d) Notifying the Department within ten (10) days after receiving notice from an employee or otherwise receiving actual notice of the conviction of an employee for a violation of any criminal drug statute occurring in the workplace.

(e) Imposing or requiring, within 30 days after receiving notice from an employee of a conviction or actual notice of such a conviction, an appropriate personnel action, up to and including termination, or the satisfactory participation in a drug abuse assistance or rehabilitation program approved by a federal, state or local health, law enforcement or other appropriate agency.

(f) Assisting employees in selecting a course of action in the event drug counseling, treatment, and rehabilitation is required and indicating that a trained referral team is in place.

(g) Making a good faith effort to continue to maintain a drug free workplace through implementation of the actions and efforts stated in this certification.

## RETURN WITH BID

### **J. Disclosure of Business Operations in Iran**

Section 50-36 of the Illinois Procurement Code, 30ILCS 500/50-36 provides that each bid, offer, or proposal submitted for a State contract shall include a disclosure of whether or not the Company acting as the bidder, offeror, or proposing entity, or any of its corporate parents or subsidiaries, within the 24 months before submission of the bid, offer, or proposal had business operations that involved contracts with or provision of supplies or services to the Government of Iran, companies in which the Government of Iran has any direct or indirect equity share, consortiums or projects commissioned by the Government of Iran, or companies involved in consortiums or projects commissioned by the Government of Iran and either of the following conditions apply:

- (1) More than 10% of the Company's revenues produced in or assets located in Iran involve oil-related activities or mineral-extraction activities; less than 75% of the Company's revenues produced in or assets located in Iran involve contracts with or provision of oil-related or mineral-extraction products or services to the Government of Iran or a project or consortium created exclusively by that government; and the Company has failed to take substantial action.
- (2) The Company has, on or after August 5, 1996, made an investment of \$20 million or more, or any combination of investments of at least \$10 million each that in the aggregate equals or exceeds \$20 million in any 12-month period, which directly or significantly contributes to the enhancement of Iran's ability to develop petroleum resources of Iran.

The terms "Business operations", "Company", "Mineral-extraction activities", "Oil-related activities", "Petroleum resources", and "Substantial action" are all defined in the Code.

Failure to make the disclosure required by the Code shall cause the bid, offer or proposal to be considered not responsive. The disclosure will be considered when evaluating the bid, offer, or proposal or awarding the contract. The name of each Company disclosed as doing business or having done business in Iran will be provided to the State Comptroller.

Check the appropriate statement:

Company has no business operations in Iran to disclose.

Company has business operations in Iran as disclosed the attached document.

### **K. Apprenticeship and Training Certification (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 as reported on the Construction Employee Workforce Projection (Form BC-1256) and returned with the bid is accounted for and listed.**

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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.



**TO BE RETURNED WITH BID**

**L. Political Contributions and Registration with the State Board of Elections**

Sections 20-160 and 50-37 of the Illinois Procurement Code regulate political contributions from business entities and any affiliated entities or affiliated persons bidding on or contracting with the state. Generally under Section 50-37, any business entity, and any affiliated entity or affiliated person of the business entity, whose current year contracts with all state agencies exceed an awarded value of \$50,000, are prohibited from making any contributions to any political committees established to promote the candidacy of the officeholder responsible for the awarding of the contracts or any other declared candidate for that office for the duration of the term of office of the incumbent officeholder or a period 2 years after the termination of the contract, whichever is longer. Any business entity and affiliated entities or affiliated persons whose state contracts in the current year do not exceed an awarded value of \$50,000, but whose aggregate pending bids and proposals on state contracts exceed \$50,000, either alone or in combination with contracts not exceeding \$50,000, are prohibited from making any political contributions to any political committee established to promote the candidacy of the officeholder responsible for awarding the pending contract during the period beginning on the date the invitation for bids or request for proposals is issued and ending on the day after the date of award or selection if the entity was not awarded or selected. Section 20-160 requires certification of registration of affected business entities in accordance with procedures found in Section 9-35 of The Election Code.

By submission of a bid, the contractor business entity acknowledges and agrees that it has read and understands Sections 20-160 and 50-37 of the Illinois Procurement Code, and that it makes the following certification:

**The undersigned business entity certifies that it has registered as a business with the State Board of Elections and acknowledges a continuing duty to update the registration in accordance with the above referenced statutes. A copy of the certificate of registration shall be submitted with the bid. The bidder is cautioned that the Department will not award a contract without submission of the certificate of registration.**

These requirements and compliance with the above referenced statutory sections are a material part of the contract, and any breach thereof shall be cause to void the contract under Section 50-60 of the Illinois Procurement Code. This provision does not apply to Federal-aid contracts.

**M. Lobbyist Disclosure**

Section 50-38 of the Illinois Procurement Code requires that any bidder or offeror on a State contract that hires a person required to register under the Lobbyist Registration Act to assist in obtaining a contract shall:

- (i) Disclose all costs, fees, compensation, reimbursements, and other remunerations paid or to be paid to the lobbyist related to the contract,
- (ii) Not bill or otherwise cause the State of Illinois to pay for any of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration, and
- (iii) Sign a verification certifying that none of the lobbyist's costs, fees, compensation, reimbursements, or other remuneration were billed to the State.

This information, along with all supporting documents, shall be filed with the agency awarding the contract and with the Secretary of State. The chief procurement officer shall post this information, together with the contract award notice, in the online Procurement Bulletin.

Pursuant to Subsection (c) of this Section, no person or entity shall retain a person or entity to attempt to influence the outcome of a procurement decision made under the Procurement Code for compensation contingent in whole or in part upon the decision or procurement. Any person who violates this subsection is guilty of a business offense and shall be fined not more than \$10,000.

Bidder acknowledges that it is required to disclose the hiring of any person required to register pursuant to the Illinois Lobbyist Registration Act (25 ILCS 170) in connection with this contract.

Bidder has not hired any person required to register pursuant to the Illinois Lobbyist Registration Act in connection with this contract.

Or

Bidder has hired the following persons required to register pursuant to the Illinois Lobbyist Registration Act in connection with the contract:

Name and address of person: \_\_\_\_\_  
All costs, fees, compensation, reimbursements and other remuneration paid to said person: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## RETURN WITH BID

### IV. DISCLOSURES

- A. The disclosures hereinafter made by the bidder are each a material representation of fact upon which reliance is placed should the Department enter into the contract with the bidder. The bidder further certifies that the Department has received the disclosure forms for each bid.

The chief procurement officer may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Procurement Code. Furthermore, the chief procurement officer may void the contract and the surety providing the performance bond shall be responsible for completion of the contract.

### B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Illinois Procurement Code provides that all bids of more than \$10,000 shall be accompanied by disclosure of the financial interests of the bidder. This disclosed information for the successful bidder, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the contract. Furthermore, pursuant to Section 5-5, the Procurement Policy Board may review a proposal, bid, or contract and issue a recommendation to void a contract or reject a proposal or bid based on any violation of the Procurement Code or the existence of a conflict of interest as provided in subsections (b) and (d) of Section 50-35.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the bidding entity or its parent entity, whichever is less, unless the contractor or bidder is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 400 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.

In addition, all disclosures shall indicate any other current or pending contracts, proposals, leases, or other ongoing procurement relationships the bidding entity has with any other unit of state government and shall clearly identify the unit and the contract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. Subject individuals should be covered each by one form. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies. **The forms must be included with each bid or incorporated by reference.**

### C. Disclosure Form Instructions

#### Form A Instructions for Financial Information & Potential Conflicts of Interest

If the bidder is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a bidder is a privately held entity that is exempt from Federal 10K reporting, but has more than 400 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a bidder is not subject to Federal 10K reporting, the bidder must determine if any individuals are required by law to complete a financial disclosure form. To do this, the bidder should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the NOT APPLICABLE STATEMENT on Form A must be signed and dated by a person that is authorized to execute contracts for the bidding company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES \_\_\_ NO \_\_\_
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than \$106,447.20? YES \_\_\_ NO \_\_\_
3. Does anyone in your organization receive more than \$106,447.20 of the bidding entity's or parent entity's distributive income? (Note: Distributive income is, for these purposes, any type of distribution of profits. An annual salary is not distributive income.) YES \_\_\_ NO \_\_\_
4. Does anyone in your organization receive greater than 5% of the bidding entity's or parent entity's total distributive income, but which is less than \$106,447.20? YES \_\_\_ NO \_\_\_

(Note: Only one set of forms needs to be completed per person per bid even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The bidder must determine each individual in the bidding entity or the bidding entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The bidder is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the NOT APPLICABLE STATEMENT of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

## RETURN WITH BID

### **Form B: Instructions for Identifying Other Contracts & Procurement Related Information**

Disclosure Form B must be completed for each bid submitted by the bidding entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the bidder to ignore Form B. Form B must be completed, checked, and dated or the bidder may be considered nonresponsive and the bid will not be accepted.*

The Bidder shall identify, by checking Yes or No on Form B, whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the bidder only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the bidder must do one of the following:

Option I: If the bidder did not submit an Affidavit of Availability to obtain authorization to bid, the bidder must list all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Do not include IDOT contracts. Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included. Bidders who submit Affidavits of Availability are suggested to use Option II.

Option II: If the bidder is required and has submitted an Affidavit of Availability in order to obtain authorization to bid, the bidder may write or type "See Affidavit of Availability" which indicates that the Affidavit of Availability is incorporated by reference and includes all non-IDOT State of Illinois agency pending contracts, leases, bids, proposals, and other ongoing procurement relationships. For any contracts that are not covered by the Affidavit of Availability, the bidder must identify them on Form B or on an attached sheet(s). These might be such things as leases.

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form A Financial Information & Potential Conflicts of Interest Disclosure

Contractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Code (30 ILCS 500). Vendors desiring to enter into a contract with the State of Illinois must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form.

DISCLOSURE OF FINANCIAL INFORMATION

1. Disclosure of Financial Information. The individual named below has an interest in the BIDDER (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than \$106,447.20 (60% of the Governor's salary as of 7/1/07).

FOR INDIVIDUAL (type or print information) NAME: ADDRESS Type of ownership/distributable income share: stock sole proprietorship Partnership other: (explain on separate sheet): % or \$ value of ownership/distributable income share:

2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes \_\_\_ No \_\_\_

If your answer is yes, please answer each of the following questions.

1. Are you currently an officer or employee of either the Capitol Development Board or the Illinois Toll Highway Authority? Yes \_\_\_ No \_\_\_

2. Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) provide the name the State agency for which you are employed and your annual salary.

**RETURN WITH BID/OFFER**

- 3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of the salary of the Governor? Yes \_\_\_ No \_\_\_
  
- 4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 2 times the salary of the Governor? Yes \_\_\_ No \_\_\_

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(b) State employment of spouse, father, mother, son, or daughter, including contractual employment services in the previous 2 years.

Yes \_\_\_ No \_\_\_

If your answer is yes, please answer each of the following questions.

- 1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois Toll Highway Authority? Yes \_\_\_ No \_\_\_
  
- 2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60 % of the Governor's salary as of 7/1/07) provide the name of your spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. \_\_\_\_\_  
\_\_\_\_\_
  
- 3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60% of the salary of the Governor as of 7/1/07) are you entitled to receive (i) more then 71/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of the salary of the Governor? Yes \_\_\_ No \_\_\_
  
- 4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 2 times the salary of the Governor? Yes \_\_\_ No \_\_\_

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(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years. Yes \_\_\_ No \_\_\_

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(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

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(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United States of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years. Yes \_\_\_ No \_\_\_

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(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

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(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government. Yes \_\_\_ No \_\_\_

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**RETURN WITH BID/OFFER**

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes \_\_\_ No \_\_\_

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes \_\_\_ No \_\_\_

**2. Communication Disclosure.**

Disclose the name and address of each lobbyist and other agent of the bidder or offeror who is not identified in Section 2 of this form, who is has communicated, is communicating, or may communicate with any State officer or employee concerning the bid or offer. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the process and throughout the term of the contract. If no person is identified, enter "None" on the line below:

Name and address of person(s): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**4. Debarment Disclosure.** For each of the persons identified under Sections 2 and 3 of this form, disclose whether any of the following has occurred within the previous 10 years: debarment from contracting with any governmental entity; professional licensure discipline; bankruptcies; adverse civil judgments and administrative findings; and criminal felony convictions. This disclosure is a continuing obligation and must be promptly supplemented for accuracy throughout the procurement process and term of the contract. If no person is identified, enter "None" on the line below:

Name of person(s): \_\_\_\_\_

Nature of disclosure: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**APPLICABLE STATEMENT**

**This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.**

Completed by:  \_\_\_\_\_ Date \_\_\_\_\_  
Signature of Individual or Authorized Representative

**NOT APPLICABLE STATEMENT**

**Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.**

**This Disclosure Form A is submitted on behalf of the CONTRACTOR listed on the previous page.**

\_\_\_\_\_ Date \_\_\_\_\_  
Signature of Authorized Representative

**The bidder has a continuing obligation to supplement these disclosures under Sec. 50-35 of the Procurement Code.**

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form B Other Contracts & Procurement Related Information Disclosure

Contractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Act (30 ILCS 500). This information shall become part of the publicly available contract file. This Form B must be completed for bids in excess of \$10,000, and for all open-ended contracts.

DISCLOSURE OF OTHER CONTRACTS AND PROCUREMENT RELATED INFORMATION

1. Identifying Other Contracts & Procurement Related Information. The BIDDER shall identify whether it has any pending contracts (including leases), bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes \_\_\_ No \_\_\_

If "No" is checked, the bidder only needs to complete the signature box on the bottom of this page.

2. If "Yes" is checked. Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

THE FOLLOWING STATEMENT MUST BE CHECKED

Signature of Authorized Representative, Date



## **RETURN WITH BID**

### **SPECIAL NOTICE TO CONTRACTORS**

The following requirements of the Illinois Department of Human Rights' Rules and Regulations are applicable to bidders on all construction contracts advertised by the Illinois Department of Transportation:

#### **CONSTRUCTION EMPLOYEE UTILIZATION PROJECTION**

- (a) All bidders on construction contracts shall complete and submit, along with and as part of their bids, a Bidder's Employee Utilization Form (Form BC-1256) setting forth a projection and breakdown of the total workforce intended to be hired and/or allocated to such contract work by the bidder including a projection of minority and female employee utilization in all job classifications on the contract project.
- (b) The Department of Transportation shall review the Employee Utilization Form, and workforce projections contained therein, of the contract awardee to determine if such projections reflect an underutilization of minority persons and/or women in any job classification in accordance with the Equal Employment Opportunity Clause and Section 7.2 of the Illinois Department of Human Rights' Rules and Regulations for Public Contracts adopted as amended on September 17, 1980. If it is determined that the contract awardee's projections reflect an underutilization of minority persons and/or women in any job classification, it shall be advised in writing of the manner in which it is underutilizing and such awardee shall be considered to be in breach of the contract unless, prior to commencement of work on the contract project, it submits revised satisfactory projections or an acceptable written affirmative action plan to correct such underutilization including a specific timetable geared to the completion stages of the contract.
- (c) The Department of Transportation shall provide to the Department of Human Rights a copy of the contract awardee's Employee Utilization Form, a copy of any required written affirmative action plan, and any written correspondence related thereto. The Department of Human Rights may review and revise any action taken by the Department of Transportation with respect to these requirements.



**RETURN WITH BID**

**Contract No. 60799  
COOK County  
Section 1213.4 A-T  
Route FAI 94  
District 1 Construction Funds**

**PART II. WORKFORCE PROJECTION - continued**

- B. Included in "Total Employees" under Table A is the total number of **new hires** that would be employed in the event the undersigned bidder is awarded this contract.

The undersigned bidder projects that: (number) \_\_\_\_\_ new hires would be recruited from the area in which the contract project is located; and/or (number) \_\_\_\_\_ new hires would be recruited from the area in which the bidder's principal office or base of operation is located.

- C. Included in "Total Employees" under Table A is a projection of numbers of persons to be employed directly by the undersigned bidder as well as a projection of numbers of persons to be employed by subcontractors.

The undersigned bidder estimates that (number) \_\_\_\_\_ persons will be directly employed by the prime contractor and that (number) \_\_\_\_\_ persons will be employed by subcontractors.

**PART III. AFFIRMATIVE ACTION PLAN**

- A. The undersigned bidder understands and agrees that in the event the foregoing minority and female employee utilization projection included under **PART II** is determined to be an underutilization of minority persons or women in any job category, and in the event that the undersigned bidder is awarded this contract, he/she will, prior to commencement of work, develop and submit a written Affirmative Action Plan including a specific timetable (geared to the completion stages of the contract) whereby deficiencies in minority and/or female employee utilization are corrected. Such Affirmative Action Plan will be subject to approval by the contracting agency and the **Department of Human Rights**.
- B. The undersigned bidder understands and agrees that the minority and female employee utilization projection submitted herein, and the goals and timetable included under an Affirmative Action Plan if required, are deemed to be part of the contract specifications.

Company \_\_\_\_\_ Telephone Number \_\_\_\_\_  
\_\_\_\_\_  
Address \_\_\_\_\_

**NOTICE REGARDING SIGNATURE**

The Bidder's signature on the Proposal Signature Sheet will constitute the signing of this form. The following signature block needs to be completed if revisions are required.

Signature:  \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

- Instructions: All tables must include subcontractor personnel in addition to prime contractor personnel.
- Table A - Include both the number of employees that would be hired to perform the contract work and the total number currently employed (Table B) that will be allocated to contract work, and include all apprentices and on-the-job trainees. The "Total Employees" column should include all employees including all minorities, apprentices and on-the-job trainees to be employed on the contract work.
  - Table B - Include all employees currently employed that will be allocated to the contract work including any apprentices and on-the-job trainees currently employed.
  - Table C - Indicate the racial breakdown of the total apprentices and on-the-job trainees shown in Table A.

**RETURN WITH BID**

**Contract No. 60799**

**COOK County**

**Section 1213.4 A-T**

**Route FAI 94**

**District 1 Construction Funds**

PROPOSAL SIGNATURE SHEET

The undersigned bidder hereby makes and submits this bid on the subject Proposal, thereby assuring the Department that all requirements of the Invitation for Bids and rules of the Department have been met, that there is no misunderstanding of the requirements of paragraph 3 of this Proposal, and that the contract will be executed in accordance with the rules of the Department if an award is made on this bid.

(IF AN INDIVIDUAL) Firm Name \_\_\_\_\_  
Signature of Owner \_\_\_\_\_  
Business Address \_\_\_\_\_  
\_\_\_\_\_

(IF A CO-PARTNERSHIP) Firm Name \_\_\_\_\_  
By \_\_\_\_\_  
Business Address \_\_\_\_\_  
Name and Address of All Members of the Firm:  
\_\_\_\_\_  
\_\_\_\_\_

(IF A CORPORATION)  
(IF A JOINT VENTURE, USE THIS SECTION FOR THE MANAGING PARTY AND THE SECOND PARTY SHOULD SIGN BELOW)  
Corporate Name \_\_\_\_\_  
By \_\_\_\_\_  
Signature of Authorized Representative \_\_\_\_\_  
Typed or printed name and title of Authorized Representative \_\_\_\_\_  
Attest \_\_\_\_\_  
Signature \_\_\_\_\_  
Business Address \_\_\_\_\_  
\_\_\_\_\_

(IF A JOINT VENTURE)  
Corporate Name \_\_\_\_\_  
By \_\_\_\_\_  
Signature of Authorized Representative \_\_\_\_\_  
Typed or printed name and title of Authorized Representative \_\_\_\_\_  
Attest \_\_\_\_\_  
Signature \_\_\_\_\_  
Business Address \_\_\_\_\_  
\_\_\_\_\_

If more than two parties are in the joint venture, please attach an additional signature sheet.



Return with Bid

Division of Highways
Proposal Bid Bond
(Effective November 1, 1992)

Item No. \_\_\_\_\_

Letting Date \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, That We \_\_\_\_\_

as PRINCIPAL, and \_\_\_\_\_

\_\_\_\_\_ as SURETY, are held jointly, severally and firmly bound unto the STATE OF ILLINOIS in the penal sum of 5 percent of the total bid price, or for the amount specified in Article 102.09 of the "Standard Specifications for Road and Bridge Construction" in effect on the date of invitation for bids, whichever is the lesser sum, well and truly to be paid unto said STATE OF ILLINOIS, for the payment of which we bind ourselves, our heirs, executors, administrators, successors and assigns.

THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH, that whereas, the PRINCIPAL has submitted a bid proposal to the STATE OF ILLINOIS, acting through the Department of Transportation, for the improvement designated by the Transportation Bulletin Item Number and Letting Date indicated above.

NOW, THEREFORE, if the Department shall accept the bid proposal of the PRINCIPAL; and if the PRINCIPAL shall, within the time and as specified in the bidding and contract documents, submit a DBE Utilization Plan that is accepted and approved by the Department; and if, after award by the Department, the PRINCIPAL shall enter into a contract in accordance with the terms of the bidding and contract documents including evidence of the required insurance coverages and providing such bond as specified with good and sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof; or if, in the event of the failure of the PRINCIPAL to make the required DBE submission or to enter into such contract and to give the specified bond, the PRINCIPAL pays to the Department the difference not to exceed the penalty hereof between the amount specified in the bid proposal and such larger amount for which the Department may contract with another party to perform the work covered by said bid proposal, then this obligation shall be null and void, otherwise, it shall remain in full force and effect.

IN THE EVENT the Department determines the PRINCIPAL has failed to comply with any requirement as set forth in the preceding paragraph, then Surety shall pay the penal sum to the Department within fifteen (15) days of written demand therefor. If Surety does not make full payment within such period of time, the Department may bring an action to collect the amount owed. Surety is liable to the Department for all its expenses, including attorney's fees, incurred in any litigation in which it prevails either in whole or in part.

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

SURETY

\_\_\_\_\_  
(Company Name)

\_\_\_\_\_  
(Company Name)

By \_\_\_\_\_  
(Signature & Title)

By: \_\_\_\_\_  
(Signature of Attorney-in-Fact)

Notary Certification for Principal and Surety

STATE OF ILLINOIS,  
County of \_\_\_\_\_

I, \_\_\_\_\_, a Notary Public in and for said County, do hereby certify that

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

who are each personally known to me to be the same persons whose names are subscribed to the foregoing instrument on behalf of PRINCIPAL and SURETY, appeared before me this day in person and acknowledged respectively, that they signed and delivered said 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

In lieu of completing the above section of the Proposal Bid Form, the Principal may file an Electronic Bid Bond. By signing the proposal and marking the check box next to the Signature and Title line below, the Principal is ensuring the identified electronic bid bond has been executed and the Principal and Surety are firmly bound unto the State of Illinois under the conditions of the bid bond as shown above.

Electronic Bid Bond ID# \_\_\_\_\_

Company / Bidder Name \_\_\_\_\_



Signature and Title \_\_\_\_\_

# PROPOSAL ENVELOPE



## PROPOSALS

for construction work advertised for bids by the  
Illinois Department of Transportation

Item No.	Item No.	Item No.

Submitted By:

Name:
Address:
Phone No.

Bidders should use an IDOT proposal envelope or affix this form to the front of a 10" x 13" envelope for the submittal of bids. If proposals are mailed, they should be enclosed in a second or outer envelope addressed to:

Engineer of Design and Environment - Room 326  
Illinois Department of Transportation  
2300 South Dirksen Parkway  
Springfield, Illinois 62764

### **NOTICE**

**Individual bids, including Bid Bond and/or supplemental information if required, should be securely stapled.**

# CONTRACTOR OFFICE COPY OF CONTRACT SPECIFICATIONS

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## NOTICE

None of the following material needs to be returned with the bid package unless the special provisions require documentation and/or other information to be submitted.

**Contract No. 60799  
COOK County  
Section 1213.4 A-T  
Route FAI 94  
District 1 Construction Funds**



**Illinois Department of Transportation**

## **SUBCONTRACTOR DOCUMENTATION**

P.A. 96-0795, effective July 1, 2010, enacted substantial changes to the provisions of the Illinois Procurement Code (30 ILCS 500). Among the changes are provisions affecting subcontractors. The Contractor awarded this contract will be required as a material condition of the contract to implement and enforce the contract requirements applicable to subcontractors approved in accordance with article 108.01 of the Standard Specifications for Road and Bridge Construction.

If the Contractor seeks approval of subcontractors to perform a portion of the work, and approval is granted by the Department, the Contractor shall provide a copy of the subcontract to the Chief Procurement Officer within 20 calendar days after execution of the subcontract.

The subcontract shall contain the certifications required to be made by subcontractors pursuant to Article 50 of the Illinois Procurement Code. This Notice to Bidders includes a document incorporating all required subcontractor certifications and disclosures for use by the Contractor in compliance with this mandate. The document is entitled State Required Ethical Standards Governing Subcontractors.



## RETURN WITH SUBCONTRACT

### STATE ETHICAL STANDARDS GOVERNING SUBCONTRACTORS

Article 50 of the Illinois Procurement Code establishes the duty of all State chief procurement officers, State purchasing officers, and their designees to maximize the value of the expenditure of public moneys in procuring goods, services, and contracts for the State of Illinois and to act in a manner that maintains the integrity and public trust of State government. In discharging this duty, they are charged by law to use all available information, reasonable efforts, and reasonable actions to protect, safeguard, and maintain the procurement process of the State of Illinois.

The certifications hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed should the Department approve the subcontractor. The chief procurement officer may terminate or void the subcontract approval if it is later determined that the bidder or subcontractor rendered a false or erroneous certification.

Section 50-2 of the Illinois Procurement Code provides that every person that has entered into a multi-year contract and every subcontractor with a multi-year subcontract shall certify, by July 1 of each fiscal year covered by the contract after the initial fiscal year, to the responsible chief procurement officer whether it continues to satisfy the requirements of Article 50 pertaining to the eligibility for a contract award. If a contractor or subcontractor is not able to truthfully certify that it continues to meet all requirements, it shall provide with its certification a detailed explanation of the circumstances leading to the change in certification status. A contractor or subcontractor that makes a false statement material to any given certification required under Article 50 is, in addition to any other penalties or consequences prescribed by law, subject to liability under the Whistleblower Reward and Protection Act for submission of a false claim.

#### **A. Bribery**

1. The Illinois Procurement Code provides:

Section 50-5. Bribery.

(a) Prohibition. No person or business shall be awarded a contract or subcontract under this Code who:

(1) has been convicted under the laws of Illinois or any other state of bribery or attempting to bribe an officer or employee of the State of Illinois or any other state in that officer's or employee's official capacity; or

(2) has made an admission of guilt of that conduct that is a matter of record but has not been prosecuted for that conduct.

(b) Businesses. No business shall be barred from contracting with any unit of State or local government, or subcontracting under such a contract, as a result of a conviction under this Section of any employee or agent of the business if the employee or agent is no longer employed by the business and:

(1) the business has been finally adjudicated not guilty; or

(2) the business demonstrates to the governmental entity with which it seeks to contract, or which is signatory to the contract to which the subcontract relates, and that entity finds that the commission of the offense was not authorized, requested, commanded, or performed by a director, officer, or high managerial agent on behalf of the business as provided in paragraph (2) of subsection (a) of Section 5-4 of the Criminal Code of 1961.

(c) Conduct on behalf of business. For purposes of this Section, when an official, agent, or employee of a business committed the bribery or attempted bribery on behalf of the business and in accordance with the direction or authorization of a responsible official of the business, the business shall be chargeable with the conduct.

(d) Certification. Every bid submitted to and contract executed by the State, and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the contractor or the subcontractor, respectively, that the contractor or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any certifications required by this Section are false. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

2. The contractor or subcontractor certifies that it is not barred from being awarded a contract under Section 50.5.

#### **B. Felons**

1. The Illinois Procurement Code provides:

Section 50-10. Felons. Unless otherwise provided, no person or business convicted of a felony shall do business with the State of Illinois or any State agency, or enter into a subcontract, from the date of conviction until 5 years after the date of completion of the sentence for that felony, unless no person held responsible by a prosecutorial office for the facts upon which the conviction was based continues to have any involvement with the business.

2. Certification. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder or contractor or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer may declare the related contract void if any of the certifications required by this Section are false.

**RETURN WITH SUBCONTRACT**

**C. Debt Delinquency**

1. The Illinois Procurement Code provides:

Section 50-11 and 50-12. Debt Delinquency.

The contractor or bidder or subcontractor, respectively, certifies that it, or any affiliate, is not barred from being awarded a contract or subcontract under the Procurement Code. Section 50-11 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it knows or should know that it, or any affiliate, is delinquent in the payment of any debt to the State as defined by the Debt Collection Board. Section 50-12 prohibits a person from entering into a contract with a State agency, or entering into a subcontract, if it, or any affiliate, has failed to collect and remit Illinois Use Tax on all sales of tangible personal property into the State of Illinois in accordance with the provisions of the Illinois Use Tax Act. The bidder or contractor or subcontractor, respectively, further acknowledges that the chief procurement officer may declare the related contract void if this certification is false or if the bidder, contractor, or subcontractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

**D. Prohibited Bidders, Contractors and Subcontractors**

1. The Illinois Procurement Code provides:

Section 50-10.5 and 50-60(c). Prohibited bidders, contractors and subcontractors.

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-10.5 that no officer, director, partner or other managerial agent of the contracting business has been convicted of a felony under the Sarbanes-Oxley Act of 2002 or a Class 3 or Class 2 felony under the Illinois Securities Law of 1953 or if in violation of Subsection (c) for a period of five years from the date of conviction.. Every bid submitted to and contract executed by the State and every subcontract subject to Section 20-120 of the Procurement Code shall contain a certification by the bidder, contractor, or subcontractor, respectively, that the bidder, contractor, or subcontractor is not barred from being awarded a contract or subcontract under this Section and acknowledges that the chief procurement officer shall declare the related contract void if any of the certifications completed pursuant to this Section are false.

**E. Section 42 of the Environmental Protection Act**

The bidder or contractor or subcontractor, respectively, certifies in accordance with 30 ILCS 500/50-12 that the bidder, contractor, or subcontractor, is not barred from being awarded a contract or entering into a subcontract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency, or entering into any subcontract, that is subject to the Procurement Code by a person or business found by a court or the Pollution Control Board to have committed a willful or knowing violation of Section 42 of the Environmental Protection Act for a period of five years from the date of the order. The bidder or contractor or subcontractor, respectively, acknowledges that the chief procurement officer may declare the contract void if this certification is false.

**The undersigned, on behalf of the subcontracting company, has read and understands the above certifications and makes the certifications as required by law.**

<p>_____</p> <p style="text-align: center;">Name of Subcontracting Company</p> <p>_____</p> <p style="text-align: center;">Authorized Officer</p>	<p>_____</p> <p style="text-align: center;">Date</p>
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## RETURN WITH SUBCONTRACT

### SUBCONTRACTOR DISCLOSURES

#### I. DISCLOSURES

- A. The disclosures hereinafter made by the subcontractor are each a material representation of fact upon which reliance is placed. The subcontractor further certifies that the Department has received the disclosure forms for each subcontract.

The chief procurement officer may void the bid, contract, or subcontract, respectively, if it is later determined that the bidder or subcontractor rendered a false or erroneous disclosure. A contractor or subcontractor may be suspended or debarred for violations of the Procurement Code. Furthermore, the chief procurement officer may void the contract or subcontract.

#### B. Financial Interests and Conflicts of Interest

1. Section 50-35 of the Illinois Procurement Code provides that all subcontracts of more than \$10,000 shall be accompanied by disclosure of the financial interests of the subcontractor. This disclosed information for the subcontractor, will be maintained as public information subject to release by request pursuant to the Freedom of Information Act, filed with the Procurement Policy Board, and shall be incorporated as a material term of the Prime Contractor's contract. Furthermore, pursuant to this Section, the Procurement Policy Board may recommend to allow or void a contract or subcontract based on a potential conflict of interest.

The financial interests to be disclosed shall include ownership or distributive income share that is in excess of 5%, or an amount greater than 60% of the annual salary of the Governor, of the subcontracting entity or its parent entity, whichever is less, unless the subcontractor is a publicly traded entity subject to Federal 10K reporting, in which case it may submit its 10K disclosure in place of the prescribed disclosure. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 400 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. The disclosure shall include the names, addresses, and dollar or proportionate share of ownership of each person making the disclosure, their instrument of ownership or beneficial relationship, and notice of any potential conflict of interest resulting from the current ownership or beneficial interest of each person making the disclosure having any of the relationships identified in Section 50-35 and on the disclosure form.

In addition, all disclosures shall indicate any other current or pending contracts, subcontracts, proposals, leases, or other ongoing procurement relationships the subcontracting entity has with any other unit of state government and shall clearly identify the unit and the contract, subcontract, proposal, lease, or other relationship.

2. Disclosure Forms. Disclosure Form A is attached for use concerning the individuals meeting the above ownership or distributive share requirements. Subject individuals should be covered each by one form. In addition, a second form (Disclosure Form B) provides for the disclosure of current or pending procurement relationships with other (non-IDOT) state agencies. **The forms must be included with each bid or incorporated by reference.**

#### C. Disclosure Form Instructions

##### Form A Instructions for Financial Information & Potential Conflicts of Interest

If the subcontractor is a publicly traded entity subject to Federal 10K reporting, the 10K Report may be submitted to meet the requirements of Form A. If a subcontractor is a privately held entity that is exempt from Federal 10K reporting, but has more than 400 shareholders, it may submit the information that Federal 10K companies are required to report, and list the names of any person or entity holding any ownership share that is in excess of 5%. If a subcontractor is not subject to Federal 10K reporting, the subcontractor must determine if any individuals are required by law to complete a financial disclosure form. To do this, the subcontractor should answer each of the following questions. A "YES" answer indicates Form A must be completed. If the answer to each of the following questions is "NO", then the NOT APPLICABLE STATEMENT on the second page of Form A must be signed and dated by a person that is authorized to execute contracts for the subcontracting company. Note: These questions are for assistance only and are not required to be completed.

1. Does anyone in your organization have a direct or beneficial ownership share of greater than 5% of the bidding entity or parent entity? YES \_\_\_ NO \_\_\_
2. Does anyone in your organization have a direct or beneficial ownership share of less than 5%, but which has a value greater than \$106,447.20? YES \_\_\_ NO \_\_\_
3. Does anyone in your organization receive more than \$106,447.20 of the subcontracting entity's or parent entity's distributive income? (Note: Distributive income is, for these purposes, any type of distribution of profits. An annual salary is not distributive income.) YES \_\_\_ NO \_\_\_
4. Does anyone in your organization receive greater than 5% of the subcontracting entity's or parent entity's total distributive income, but which is less than \$106,447.20? YES \_\_\_ NO \_\_\_

(Note: Only one set of forms needs to be completed per person per subcontract even if a specific individual would require a yes answer to more than one question.)

A "YES" answer to any of these questions requires the completion of Form A. The subcontractor must determine each individual in the subcontracting entity or the subcontracting entity's parent company that would cause the questions to be answered "Yes". Each form must be signed and dated by a person that is authorized to execute contracts for your organization. **Photocopied or stamped signatures are not acceptable.** The person signing can be, but does not have to be, the person for which the form is being completed. The subcontractor is responsible for the accuracy of any information provided.

If the answer to each of the above questions is "NO", then the NOT APPLICABLE STATEMENT on page 2 of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

## RETURN WITH SUBCONTRACT

### **Form B: Instructions for Identifying Other Contracts & Procurement Related Information**

Disclosure Form B must be completed for each subcontract submitted by the subcontracting entity. *Note: Checking the NOT APPLICABLE STATEMENT on Form A does not allow the subcontractor to ignore Form B. Form B must be completed, checked, and dated or the subcontract will not be approved.*

The Subcontractor shall identify, by checking Yes or No on Form B, whether it has any pending contracts, subcontracts, leases, bids, proposals, or other ongoing procurement relationship with any other (non-IDOT) State of Illinois agency. If "No" is checked, the subcontractor only needs to complete the check box on the bottom of Form B. If "Yes" is checked, the subcontractor must list all non-IDOT State of Illinois agency pending contracts, subcontracts, leases, bids, proposals, and other ongoing procurement relationships. These items may be listed on Form B or on an attached sheet(s). Contracts with cities, counties, villages, etc. are not considered State of Illinois agency contracts and are not to be included. Contracts or subcontracts with other State of Illinois agencies such as the Department of Natural Resources or the Capital Development Board must be included.

ILLINOIS DEPARTMENT OF TRANSPORTATION

Form A Subcontractor: Financial Information & Potential Conflicts of Interest Disclosure

Subcontractor Name, Legal Address, City, State, Zip, Telephone Number, Email Address, Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Code (30 ILCS 500). Subcontractors desiring to enter into a subcontract of a State of Illinois contract must disclose the financial information and potential conflict of interest information as specified in this Disclosure Form. This information shall become part of the publicly available contract file. This Form A must be completed for bids in excess of \$10,000, and for all open-ended contracts. A publicly traded company may submit a 10K disclosure (or equivalent if applicable) in satisfaction of the requirements set forth in Form A. See Disclosure Form Instructions.

DISCLOSURE OF FINANCIAL INFORMATION

1. Disclosure of Financial Information. The individual named below has an interest in the SUBCONTRACTOR (or its parent) in terms of ownership or distributive income share in excess of 5%, or an interest which has a value of more than \$106,447.20 (60% of the Governor's salary as of 7/1/07). (Make copies of this form as necessary and attach a separate Disclosure Form A for each individual meeting these requirements)

FOR INDIVIDUAL (type or print information) NAME: ADDRESS Type of ownership/distributable income share: stock sole proprietorship Partnership other: (explain on separate sheet): % or \$ value of ownership/distributable income share:

2. Disclosure of Potential Conflicts of Interest. Check "Yes" or "No" to indicate which, if any, of the following potential conflict of interest relationships apply. If the answer to any question is "Yes", please attach additional pages and describe.

(a) State employment, currently or in the previous 3 years, including contractual employment of services. Yes \_\_\_ No \_\_\_

If your answer is yes, please answer each of the following questions.

1. Are you currently an officer or employee of either the Capitol Development Board or the Illinois Toll Highway Authority? Yes \_\_\_ No \_\_\_

2. Are you currently appointed to or employed by any agency of the State of Illinois? If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) provide the name the State agency for which you are employed and your annual salary.

**RETURN WITH SUBCONTRACT**

3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you entitled to receive (i) more than 7 1/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of the salary of the Governor? Yes \_\_\_ No \_\_\_
4. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 2 times the salary of the Governor? Yes \_\_\_ No \_\_\_

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(b) State employment of spouse, father, mother, son, or daughter, including contractual employment services in the previous 2 years.

Yes \_\_\_ No \_\_\_

If your answer is yes, please answer each of the following questions.

1. Is your spouse or any minor children currently an officer or employee of the Capitol Development Board or the Illinois Toll Highway Authority? Yes \_\_\_ No \_\_\_
2. Is your spouse or any minor children currently appointed to or employed by any agency of the State of Illinois? If your spouse or minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60 % of the Governor's salary as of 7/1/07) provide the name of your spouse and/or minor children, the name of the State agency for which he/she is employed and his/her annual salary. \_\_\_\_\_
3. If your spouse or any minor children is/are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60% of the salary of the Governor as of 7/1/07) are you entitled to receive (i) more then 71/2% of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of the salary of the Governor? Yes \_\_\_ No \_\_\_
4. If your spouse or any minor children are currently appointed to or employed by any agency of the State of Illinois, and his/her annual salary exceeds \$106,447.20, (60% of the Governor's salary as of 7/1/07) are you and your spouse or minor children entitled to receive (i) more than 15 % in the aggregate of the total distributable income of your firm, partnership, association or corporation, or (ii) an amount in excess of 2 times the salary of the Governor? Yes \_\_\_ No \_\_\_

---

(c) Elective status; the holding of elective office of the State of Illinois, the government of the United States, any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois currently or in the previous 3 years. Yes \_\_\_ No \_\_\_

---

(d) Relationship to anyone holding elective office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

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(e) Appointive office; the holding of any appointive government office of the State of Illinois, the United States of America, or any unit of local government authorized by the Constitution of the State of Illinois or the statutes of the State of Illinois, which office entitles the holder to compensation in excess of the expenses incurred in the discharge of that office currently or in the previous 3 years. Yes \_\_\_ No \_\_\_

---

(f) Relationship to anyone holding appointive office currently or in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

---

(g) Employment, currently or in the previous 3 years, as or by any registered lobbyist of the State government. Yes \_\_\_ No \_\_\_

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**RETURN WITH SUBCONTRACT**

(h) Relationship to anyone who is or was a registered lobbyist in the previous 2 years; spouse, father, mother, son, or daughter. Yes \_\_\_ No \_\_\_

(i) Compensated employment, currently or in the previous 3 years, by any registered election or reelection committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes \_\_\_ No \_\_\_

(j) Relationship to anyone; spouse, father, mother, son, or daughter; who was a compensated employee in the last 2 years by any registered election or re-election committee registered with the Secretary of State or any county clerk of the State of Illinois, or any political action committee registered with either the Secretary of State or the Federal Board of Elections. Yes \_\_\_ No \_\_\_

**APPLICABLE STATEMENT**

**This Disclosure Form A is submitted on behalf of the INDIVIDUAL named on previous page. Under penalty of perjury, I certify the contents of this disclosure to be true and accurate to the best of my knowledge.**

Completed by:  \_\_\_\_\_ Date \_\_\_\_\_  
Signature of Individual or Authorized Officer

**NOT APPLICABLE STATEMENT**

**Under penalty of perjury, I have determined that no individuals associated with this organization meet the criteria that would require the completion of this Form A.**

**This Disclosure Form A is submitted on behalf of the SUBCONTRACTOR listed on the previous page.**

\_\_\_\_\_ Date \_\_\_\_\_  
Signature of Authorized Officer

RETURN WITH SUBCONTRACT

ILLINOIS DEPARTMENT  
OF TRANSPORTATION

Form B  
Subcontractor: Other Contracts &  
Procurement Related Information  
Disclosure

Subcontractor Name		
Legal Address		
City, State, Zip		
Telephone Number	Email Address	Fax Number (if available)

Disclosure of the information contained in this Form is required by the Section 50-35 of the Illinois Procurement Act (30 ILCS 500). This information shall become part of the publicly available contract file. This Form B must be completed for bids in excess of \$10,000, and for all open-ended contracts.

**DISCLOSURE OF OTHER CONTRACTS, SUBCONTRACTS, AND PROCUREMENT RELATED INFORMATION**

**1. Identifying Other Contracts & Procurement Related Information.** The SUBCONTRACTOR shall identify whether it has any pending contracts, subcontracts, including leases, bids, proposals, or other ongoing procurement relationship with any other State of Illinois agency: Yes \_\_\_ No \_\_\_

If "No" is checked, the subcontractor only needs to complete the signature box on the bottom of this page.

**2. If "Yes" is checked.** Identify each such relationship by showing State of Illinois agency name and other descriptive information such as bid or project number (attach additional pages as necessary). SEE DISCLOSURE FORM INSTRUCTIONS:

**THE FOLLOWING STATEMENT MUST BE CHECKED**

<input type="checkbox"/>	_____	_____
	Signature of Authorized Officer	Date





- 1. TIME AND PLACE OF OPENING BIDS.** Sealed proposals for the improvement described herein will be received by the Department of Transportation at the Harry R. Hanley Building, 2300 South Dirksen Parkway, in Springfield, Illinois until 10:00 o'clock a.m., June 11, 2010. All bids will be gathered, sorted, publicly opened and read in the auditorium at the Department of Transportation's Harry R. Hanley Building shortly after the 10:00 a.m. cut off time.
- 2. DESCRIPTION OF WORK.** The proposed improvement is identified and advertised for bids in the Invitation for Bids as:

**Contract No. 60799  
COOK County  
Section 1213.4 A-T  
Route FAI 94  
District 1 Construction Funds**

**Complete rehabilitation of the existing IDOT pumping station number 27 located at the east side of Doty Avenue at 110th Street along I-94/Bishop Ford Expressway) including electrical, mechanical, structural, architectural and civil disciplines.**

- 3. INSTRUCTIONS TO BIDDERS.** (a) This Notice, the invitation for bids, proposal and letter of award shall, together with all other documents in accordance with Article 101.09 of the Standard Specifications for Road and Bridge Construction, become part of the contract. Bidders are cautioned to read and examine carefully all documents, to make all required inspections, and to inquire or seek explanation of the same prior to submission of a bid.  
  
(b) State law, and, if the work is to be paid wholly or in part with Federal-aid funds, Federal law requires the bidder to make various certifications as a part of the proposal and contract. By execution and submission of the proposal, the bidder makes the certification contained therein. A false or fraudulent certification shall, in addition to all other remedies provided by law, be a breach of contract and may result in termination of the contract.
- 4. AWARD CRITERIA AND REJECTION OF BIDS.** This contract will be awarded to the lowest responsive and responsible bidder considering conformity with the terms and conditions established by the Department in the rules, Invitation for Bids and contract documents. The issuance of plans and proposal forms for bidding based upon a prequalification rating shall not be the sole determinant of responsibility. The Department reserves the right to determine responsibility at the time of award, to reject any or all proposals, to readvertise the proposed improvement, and to waive technicalities.

By Order of the  
Illinois Department of Transportation

Gary Hannig,  
Secretary

INDEX  
 FOR  
 SUPPLEMENTAL SPECIFICATIONS  
 AND RECURRING SPECIAL PROVISIONS

Adopted January 1, 2010

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

ERRATA      Standard Specifications for Road and Bridge Construction (Adopted 1-1-07) (Revised 1-1-10)

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## **STATE OF ILLINOIS**

### **SPECIAL PROVISIONS**

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2007 and the "Supplemental Specifications and Recurring Special Provisions" indicated on the "Check Sheet" included herein which apply to and govern the rehabilitation of existing Pump Station 27, Section 1213.4 A-T located in Cook County and in case of conflict with any part or parts of said specifications, the said Special Provisions shall take precedence and shall govern.

#### **LOCATION OF IMPROVEMENT**

The Project is located at the existing State of Illinois Storm Water Pump Station No. 27 located east of I-94, Bishop Ford Expressway, at 110<sup>th</sup> Street and Doty Avenue, Chicago, Illinois, Cook County.

#### **DESCRIPTION OF IMPROVEMENT**

This improvement shall consist of the rehabilitation of the existing building including but not limited to partial demolition and material removal, concrete work, reinforcement bars, glass block and masonry work, doors and frame, metal works, single ply roofing, sheet metal work, painting and site work, as specified herein. Further, the improvement shall include mechanical work consisting of removal of existing pumps including motors, fabricated metal, bowls, and impellers and heating and ventilating equipment, piping for recirculation system and electrical distribution, control, instrumentation, intrusion, lighting, equipment, conduit and wiring, all in the existing pump station and a new electric service to the facility and modification of the existing Supervisory and Data Acquisition (SCADA) System.

#### **STAGING AND SEQUENCE OF CONSTRUCTION**

Construction Staging: The Contractor shall be responsible for and include all work for implementing and maintaining and construction staging as may be required and as described in the Contract Documents and indicated on the Drawings to maintain all pumping capabilities through the rehabilitation work under this Contract. Operation of pumps shall be maintained as described under Division 15, Mechanical, and Division 16, Electrical, and in order to complete all construction by the completion date specified in the Contract Document and as approved by the Engineer.

The Contractor shall confine his construction operations within the limits of work indicated on the Drawings. In the event the Contractor requires additional area or areas for his construction operations, he shall be responsible for leasing such additional area or areas. No additional payment will be made for leasing additional area or areas. This expense shall be deemed as included in prices in the Contract.



The Contractor shall obtain all permits, easements or other requirements and shall pay all fees, rent or other expense for easements for access to the work area or for storage of materials, equipment or construction operations. The contractor shall submit shop drawings or proposed access plan and for such additional areas, as he may require, to the Engineer for approval before commencing construction. No separate measurements or payment will be made for providing, maintaining and restoring any areas used for access or other construction operations.

In general, the work described herein and on the Drawings shall not be considered as all inclusive and will not be listed in order but only to give a brief description of the work required and which shall be executed concurrently under this Contract.

The Contractor shall prepare and submit to the Engineer for approval his proposed sequence of operations for the rehabilitation of the Pump Station. The submittal shall include all details and descriptions for the work under this Contract including, but not limited to, maintenance of electric service to existing and new pumps; maintenance of pumping capacity as specified in the Contract Documents; protection of existing and new equipment during all rehabilitation work; demolition sequence; reconstruction sequence; the proposed construction schedule indicating critical path the Contractor proposes to pursue on all work under this Contract; and all matters relating to this Contract. The submittal shall be a form acceptable to the State and shall be subject to approval by the State.

#### **COMPLETION DATE**

The Contractor shall schedule his operation so as to complete all work for the rehabilitation of Pump Station No. 27 on or before October 1, 2012. This completion is based upon an expedited work schedule.

#### **FAILURE TO COMPLETE THE WORK ON TIME**

Should the Contractor fail to complete the work on or before the specified completion date or within such extended time as may be allowed, the Contractor shall be liable to the Department in the amount of \$1,100.00, not as a penalty but as liquidated damages, for each calendar day or a portion thereof, of overrun in the Contract time or such extended time as may have been allowed.

A calendar day is every day on the calendar and starts at 12:00 midnight and ends at the following 12:00 midnight, twenty-four hours later.

#### **PRE-BID SITE INSPECTION OF PUMP STATION**

The Pump Station No. 27 will be open for Contractor's inspection on Friday, May 28, 2010 between 9:00 A.M. to 12:00 P.M. local time. A representative of the State will be on hand during this stated time period. In the event the date or time is not suitable, an alternative inspection date and time can be arranged with Mr. Naser Gholer of IDOT's Bureau of Electrical Operations, Maintenance Division, at (847) 221-3089.

## **CONTRACTOR COOPERATION**

The attention of the Contractor is directed to the fact that other contracts are or may be in force that adjoins the limits of this project. The Contractor shall cooperate with the other contractors in the phasing and performance of his work so as not to delay, interrupt or hinder the progress or completion of work being performed by the other contractors.

No additional compensation will be allowed this Contractor for compliance with the above requirements, nor for any delays or inconvenience resulting from the activities of the other contractors.

## **PROGRESS SCHEDULE**

Time is of the essence in this Contract. It may be necessary for the Contractor to work longer hours, use additional crews, and work during weekends in order to complete the work within the required time limit. The Contractor shall submit a Critical Path Method (CPM) Progress Schedule for the Engineer's approval before the work can be started.

In the event the Contractor falls more than three (3) days behind the approved progress schedule, the Contractor shall work seven (7) days a week at extended hours in order to meet the specified Completion Date.

The Contractor will not be allowed any extra compensation for working longer hours or using extra shifts; and working on weekends or during holidays; working during winter months, etc., to meet the specified Completion Date.

## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1A - SUMMARY OF WORK**

#### **GENERAL:**

#### **1.1 General Work**

1.1.1 The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all Pump Station General Work.

1.1.2 The Pump Station General Work shall include, but not be limited to, the following:

(a) All pump station maintenance during construction and continuous operation as described and specified in Division 1, General Requirements.

(b) All site work consisting of site clearing, new pavement, chain link fence and gate as indicated on the Drawings and as specified in Section 2A, Site Work.

(c) All general demolition work as indicated on the Drawings and as described in Section 2B, Demolition.

- (d) All building restoration work as indicated on the Drawings and as specified in Section 2C, Lift Pier Systems.
- (e) All grout as indicated on the Drawings and as specified in Section 3B, Grout.
- (f) All unit masonry work consisting of concrete block work, glass block work and glazed brickwork as indicated on the Drawings and as specified in Section 4A, Unit Masonry.
- (g) All miscellaneous metal work as indicated on the Drawings and as specified in Division 5, Metals.
- (h) All carpentry work as indicated on the Drawings and as specified in Section 6A, Rough Carpentry.
- (i) All board insulation work as indicated on the Drawings and as specified in Section 7A, Board Insulation.
- (j) All granular insulation in cells of concrete masonry walls work as indicated on the Drawings and as specified in Section 7B, Loose Fill Insulation.
- (k) All roofing work as indicated on the Drawings and as specified in Section 7C, Elastomeric Sheet Roofing- Fully Adhered/Ballasted Cover.
- (l) All sheet metal work at roofing as indicated on the Drawings and as specified in Section 7D, Sheet Metal Flashing and Trim.
- (m) All sealant work as indicated on the Drawings and as specified in Section 7E, Joint Sealers.
- (n) All doors and hardware as indicated on the Drawings and as specified in Division 8, Doors and Windows.
- (o) All painting as indicated on the Drawings and as specified in Section 9A, Painting.
- (p) The station identification plate, shop desk, pump dolly, bulletin board, staff gauges, first aid kit, and fire extinguishers, clock, trash can, fiberglass grating and ladder, and carbon fiber reinforced polymer laminate as indicated on the Drawings and as specified in Section 10A, Specialties, Section 10B, Fiberglass Reinforced Plastic Products and Fabrications and Section 10C, Carbon Fiber Reinforced Polymer (CFRP) Laminate.

1.1.3 All removal and disposal of existing lead based paint as indicated on the Drawings and as specified in Section 9B, Removal and Disposal of Lead Based Paint, shall be paid under pay item Removal and Disposal of Lead Based Paint.

1.1.4 The following items of general work at the Pump Station are indicated on the drawings and as specified under the respective Sections of the Standard Specifications with separate pay items included in the Contract.

(a)	Earth Excavation	Section 202
(b)	Concrete Removal	Section 501
(c)	Class SI Concrete	Section 503
(d)	Furnishing and Erecting Structural Steel	Section 505
(e)	Reinforcement Bars	Section 508
(f)	Aggregate Base Course	Section 351
(g)	Aggregate surface Course	Section 402
(h)	Bituminous Materials (Prime Coat)	Section 406
(i)	Bituminous Concrete Binder and Surface Course	Section 406
(j)	Engineer's Field Office, Type A	Section 670
(k)	Traffic Control and Protection	Section 700

1.1.5 Mobilization shall be paid for with a separate pay item and shall be in accordance with the requirements of Standard Specifications for Road and Bridge.

1.2 Description: Mechanical

1.2.1 The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all Pump Station Mechanical Work.

1.2.2 The Pump Station Mechanical Work shall be as shown on the Drawings and as specified and include, but not be limited to, furnishing and installing the following:

- (a) Removal of existing piping and appurtenances and replace with new piping and appurtenances as indicated on the Drawings and as specified in all contract Documents.
- (b) Removal of existing pumps, pump columns, pump motors, pump motor base plates and concrete curbs, piping and fittings as indicated on the Drawings.
- (c) Storm water pumps, complete with all appurtenances.
- (d) Removal of existing ventilation system including, but not limited to, exhaust fans, supply units, duct work and all appurtenances.
- (e) Ventilation system including, but not limited to, exhaust fans with louver/damper combination, supply units, duct work, louvers, controls and all appurtenances.
- (f) Removal and disposal of existing flap valves.
- (g) Flap check valves.
- (h) Flow recirculation system including, but not limited to, slide gate, knife gate valve, piping, actuator and all appurtenances.
- (i) Removal and disposal of miscellaneous mechanical items consisting of, stilling well, grating, handrail and ladder.
- (j) Miscellaneous mechanical items consisting of cable support, stilling wells and compression bells.

All demolition work as described in Section 2B.

Hoisting equipments as described in Section 14A.

1.2.3 Complete spare main pump assembly shall be paid under pay item Complete Spare Main Pump Assembly.

1.2.4 Complete spare low flow pump assembly shall be paid under pay item Complete Spare Low Flow Pump Assembly.

1.3 Description: Electrical

1.3.1 The requirements of the Special Provisions and Division 1, General Requirements, shall apply to all Pump Station Electrical Work.

1.3.2 The pump Station Electrical Work shall include, but not be limited to, furnishing and installing the following:

(a) All demolition work as described in Section 16A, and as indicated on the Contract Drawings.

(b) Disconnection and removal of existing electric service, including all metering as described in Section 2B.

(c) Installation and connection of a new electric service including all metering in accordance with Commonwealth Edison Requirements.

(d) Provide electric equipment for temporary service during construction for continuous operation requirements as described in Section 16A paragraph 3.4.

(e) New medium voltage switchgear, transformer and motor control center.

(f) Disconnect switches and motor starters.

(g) New control panel and modification of SCADA panel.

(h) New lighting fixtures, lighting panel board, lighting transformer and wiring devices.

(i) New power, lighting, control and signal wires and cables.

(j) New conduit and raceway system.

(k) New electric heaters, complete.

(l) Float type level sensing control system.

(m) Combustible gas detectors, smoke detectors and intrusion alarm system.

(n) Branch wiring and conduit for main pumps, low flow pumps, unit heaters, slide gate actuators, recirculation valve, ventilation system, SCADA panel and other electrical equipment as shown on the Drawings.

(o) Testing.

1.3.3 Electric service connection shall be paid under pay item Electric Service Connection.

1.3.4 Modification of the existing SCADA panel shall be paid under pay item Pump Station SCADA Equipment.

#### 1.4 Scope of Work

1.4.1 It is the intent of these Special Provisions, together with the Contract Drawings and referenced Standard Specifications, to define the work required for rehabilitation of the pump station and to maintain operations of the existing pump station facility during rehabilitation. No portion of the work required to provide a coordinated complete installation may be omitted even though not expressly specified or indicated.

1.4.2 These Special Provisions for work on Pump Station 27 are presented as various listed Divisions. In general, these Special Provisions (Divisions) address the requirements for work items which are listed as pay items and as described under the various Divisions.

#### 1.5 Pump Station Maintenance During Construction

1.5.1 From the first day the Contractor begins work at the site until the day of final acceptance by the Engineer, the Contractor shall be fully responsible for maintenance of the existing pump station. Maintenance shall be in full compliance with the District 1 Electrical Maintenance Contract, 2005/2006 or the most recent contract from the date of BID.

1.5.2 Prior to the starting of work, the Contractor shall notify the Engineer and arrange for a preconstruction inspection. At the preconstruction inspection, the facility and its equipment shall be examined and defective or missing items shall be repaired by the State's Electrical Maintenance Contractor or shall otherwise be noted. A record of inspection shall be furnished to the Engineer.

#### 1.5.3 Emergency Service Requirements:

The Contractor shall be responsible for providing 24-hour, 7 days a week emergency response to pumping station alarms. Upon notification of a pump station alarm, the Contractor shall dispatch emergency service personnel to the station immediately and shall arrive at the station within one (1) hour of the receipt of the alarm. All necessary emergency repairs required to restore the pump station to its normal operating condition shall be done by the Contractor immediately. Emergency service personnel shall remain at the station to monitor the situation until the alarm(s) are cleared or otherwise notified by the IDOT engineer.

The IDOT COMCENTER shall be immediately notified by the Contractor whenever an "Entry Alarm", "Water on Pavement Alarm" or "High Water on Pavement Alarm" are received, the IDOT COMCENTER shall be notified with the following information: number of pumps running, water depth in wet well, depth of water on pavement and if the drainage inlets are clogged.

Failure to respond or meet the emergency service requirements of a pumping station alarm, the Contractor shall be liable to the Department in the amount paid to other subcontractors hired by the State to perform the necessary alarm response.

#### 1.5.4 Routine Maintenance Requirements:

Ongoing maintenance activities are required to maintain the existing pumping station for proper roadway drainage. Routine maintenance inspections of all equipment (existing or new installation) shall be conducted by the Contractor. Routine maintenance items shall be done at intervals and as outlined in the District 1 Electrical Maintenance Contract, Article 15.0 "Routine Patrol Requirements".

(a) Failure to meet the routine maintenance requirements of the pumping station, the Contractor shall be liable to the Department in the amount paid to other subcontractors hired by the State to perform the necessary routing maintenance.

1.5.5 The Contractor shall ensure that two sets of construction lock and entry keys for all construction facilities are provided to the IDOT engineer and IDOT Bureau of Electrical Operations (two sets each).

1.5.6 All surrounding landscaping shall be maintained by the Contractor during construction. All grass areas shall be mowed and maintained at a maximum two (2) inch height. Snow plowing of the facility shall be provided no more than two working days after a snow fall of one (1) inch or more.

1.5.7 All maintenance requirements listed above and within apply to the existing pumping station and all new facilities installed under this contract and specified herein.

1.5.8 Should it become necessary to perform maintenance work beyond the scope of the Contract or routine maintenance/patrol, as outlined in the Electrical Maintenance Contract, the Contractor shall be reimbursed the exact amount of the pay item as outlined in the Electrical Maintenance Contract plus an additional administrative cost equal to five (5) percent of the first \$10,000 and one (1) percent of any amount over \$10,000 of the total approved costs of such work. If the item is not covered under the Electrical Maintenance Contract, extra work shall be paid as outlined in the Standard Specifications for Road and Bridge Construction.

1.5.9 This work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK, which shall be payment in full for the work described herein.

#### 1.6 Continuous Operation

1.6.1 The existing pump station facility shall remain in continuous operation during construction. Brief shut-down periods may be permitted to facilitate construction needs when approved by the Engineer.

The Contractor shall submit, to the Engineer, all requests for a brief shut-down indicating detailed written description of all particulars such as date, time of day, length of shut-down and all related details. The work required to meet this requirement shall be included at no additional cost.

1.6.2 Continuous operating integrity shall require coordination of construction activities and the need for temporary arrangements. Prior to starting work, the Contractor shall submit a detailed sequenced plan of work, for review and approval by the Engineer.

1.6.3 Continuous operation shall require temporary pumping arrangements. Existing station specified firm pumping capacity 210,000 gpm shall be maintained. All necessary temporary pumping provisions and arrangements shall be made to maintain the above specified pumping capacity of the pumping station. There are seven (7) existing 30,000 gpm main pumps and one (1) existing 30,000 gpm standby pump. The total installed pumping capacity is 240,000 gpm. The low flow pump capacity may be included in the calculations for providing temporary pumping provisions for continuous operation requirement. A possible pumping sequences for Contractor's consideration to satisfy the continuous operation is described in subsection 1.22 of this Section.

1.6.4 Continuous operation will require that new pumps and piping be installed sequentially. The new pumps shall not be installed until the entire above grade building structure, which shall include but not be limited to the roofing and the 5kv switchgear and medium voltage solid state motor controllers, are completed and accepted for pump installation by the Engineer. In addition, the wet pit shall be thoroughly cleaned to the satisfaction of the Engineer prior to the installation of the new pumps. Temporary pumping provisions, if any, shall not be removed until the new pumps are installed and accepted by the Engineer or otherwise approved for removal by the Engineer.

1.6.5 This work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK, which shall be payment in full for the work described herein.

## 1.7 Protection of Drainage Facilities During Construction

1.7.1 Unless otherwise noted in the Contract Drawings, the existing drainage facilities shall remain in use during the period of rehabilitation.

1.7.2 Locations of existing drainage structures and sewers as indicated on the Contract Drawings are approximate. Prior to commencing work, the Contractor, at his own expense, shall determine the exact location of the existing structures which are within the proposed construction site.

1.7.3 All drainage structures are to be kept free from any debris resulting from construction operations. All work and material necessary to prevent accumulation of debris in the drainage structures will be considered as incidental to the Contract. Any accumulation of debris in the drainage structure resulting from construction operations shall be removed at the Contractor's expense and no extra compensation will be allowed.



## 1.8 Submittals

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

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

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

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

### 1.8.5 Work-Related Submittals

(a) Substitution or "Or Equal" Items include material or equipment CONTRACTOR requests ENGINEER to accept, after Bids are received, as substitute for items specified or described in Specifications by using name of a proprietary item or name of particular supplier.

(b) Shop Drawings include technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, actual performance curves, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form. Standard information prepared without specific reference to the Project is not considered a Shop Drawing.

(c) Product Data include standard printed information on manufactured products and systems that has not been specially prepared for this Project, including manufacturer's product specifications and installation instructions, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

(d) Samples include both fabricated and manufactured physical examples of materials, products, and units of work, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing. Mock-ups are special forms of samples which are too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.

(e) Miscellaneous Submittals are work-related submittals that do not fit in the previous categories, such as guarantees, warranties, certifications, experience records, maintenance agreements, Operating and Maintenance Manuals, workmanship bonds, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, and similar information, devices, and materials applicable to the Work.

#### 1.8.6 Scheduling

(a) A preliminary schedule of shop drawings and samples submittals shall be submitted for approval, in duplicate.

(b) Each submittal shall be prepared and transmitted to ENGINEER sufficiently in advance of scheduled performance of related work and other applicable activities.

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

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

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

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

#### 1.8.8 Exceptions, Deviations, and Substitutions

(a) In general, exceptions to and deviations from the requirements of the Contract Documents will not be allowed. It is the Contractor's responsibility to note any deviations from Contract requirements at the time of submittal and to make any requests for deviations in writing. In general, substitutions must demonstrate that the proposed substitution is superior to the equipment or material required by the Contract Documents. No exceptions, deviations, or substitutions will be permitted without approval.

(b) Data for items to be submitted for review as substitution shall be collected into one submittal for each item of material or equipment.

(c) Request shall be submitted with other scheduled submittals for the material or equipment allowing time for ENGINEER to evaluate the additional information required to be submitted. If CONTRACTOR requests to substitute for material or equipment specified but not identified in Specifications as requiring submittals, substitution submittal request shall be included in Submittal schedule and submitted as scheduled.

#### 1.8.9 Shop Drawings

(a) Shop drawing information shall be newly prepared and submitted with graphic information at accurate scale. The name of manufacturer or supplier (firm name) shall be indicated. Dimensions shall be shown and clearly noted which are based on field measurement; materials and products which are included in the Work shall be identified; revision shall be identified. Compliance with standards and notation of coordination requirements with other work shall be indicated. Variations from Contract Documents or previous submittals shall be highlighted, encircled or otherwise indicated.

(b) The following information shall be included on each drawing or page:

- 1) Submittal date and revision dates.
- 2) Project name, division number and descriptions.
- 3) Detailed specifications section number and page number.
- 4) Identification of equipment, product or material.
- 5) Name of CONTRACTOR and Subcontractor.
- 6) Name of Supplier and Manufacturer.
- 7) Relation to adjacent structure or material.
- 8) Field dimensions, clearly identified.
- 9) Standards or Industry Specification references.
- 10) Identification of deviations from the Contract Documents.
- 11) Contractor's stamp, initialed or signed, dated and certifying to review of submittal, certification of field measurements and compliance with Contract.
- 12) Physical location and location relative to other connected or attached material at which the equipment or materials are to be installed.

(c) An 8-inch by 3-inch blank space shall be provided for CONTRACTOR and ENGINEER stamps.

(d) Three blue line or black line prints or two reverse sepia reproducible and 1 blue or black line print shall be submitted. One reproducible or one print will be returned.

(e) Materials, products or systems shall not be installed until copy of applicable product data showing only approved information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site. Five additional copies shall be marked with the date of approval and forwarded to the ENGINEER for use in field and for Department's records.

#### 1.8.10 Product Data

(a) Required product data shall be collected into a single submittal for each element of work or system. Where product data has been printed to include information on several similar products, some of which are not required for use on Project or are not included in submittal, copies shall be marked to clearly show such information is not applicable.

(b) Where product data must be specially prepared for required products, materials or systems, because standard printed data are not suitable for use, data shall be submitted as a Shop Drawing and not as product data.

(c) Submittal is for information and record, and to determine that products, materials, and systems comply with Contract Documents. Submittal shall be final when returned by ENGINEER marked "Approved".

(d) Four submittal copies, in addition to the number the Contractor requires returned, including those required for Operation and maintenance Manuals, shall be submitted to the Engineer. An additional two submittal copies shall be submitted to the Design Engineer:

AB&H, A DONOHUE GROUP  
125 S. Wacker Drive, Suite 1850  
Chicago, Illinois 60606  
Attn: Kou Chang

(e) Materials, products or systems shall not be installed until copy of applicable product data showing only approval information is in possession of installer. One set of product data (for each submittal) shall be maintained at Project site, available for reference by ENGINEER and others.

#### 1.8.11 Samples

(a) Where possible, samples shall be physically identical with proposed materials or products to be incorporated into the Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, multiple units (not less than 3 units) shall be submitted showing approximate limits of variations.

(b) A full set of optional samples shall be provided where ENGINEER's selection required. Samples shall be prepared to match ENGINEER's selection where so indicated.

(c) Each sample shall include generic description, source or product name and manufacturer, limitations, and compliance with standards.

(d) Samples for ENGINEER's visual review and final check of coordination of these characteristics with other related elements of work shall be of general generic kind, color, pattern, texture.

(e) At CONTRACTOR's option, and depending upon nature of anticipated response from ENGINEER, initial submittal of samples may be either preliminary or final submittal.

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

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

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

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

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

#### 1.8.13 Miscellaneous Submittals

##### (a) Inspection and Test Reports

1) Each inspection and test report shall be classified as either "Shop Drawings" or "product data", depending on whether report is specially prepared for Project or standard publication of workmanship control testing at point of production. Inspection and test reports shall be processed accordingly.

##### (b) Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds

1) Refer to Specification sections and section Guarantees and Warranties of this Division for specific requirements. Submittal is final when returned by ENGINEER marked "Approved" or "Approved as Noted".

2) In addition to copies desired for CONTRACTOR's use, 2 executed copies shall be furnished. Two additional copies shall be provided where required for maintenance data.

##### (c) Certifications

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

2) Where certifications are specified, the information submitted for approval shall incorporate certification information. When a certification can be made prior to manufacture, the certification shall be included with initial submittal information. When certification is possible only after manufacture, the initial submittal information shall include a statement of intent to furnish the certification after equipment approval and manufacture. Certifications involving inspections and/or tests shall be complete with all test data presented in a neat, descriptive format, with all test data, applicable dates, times, and persons responsible.

(d) Tools

1) Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units shall be submitted.

2) Special tools are considered to be those tools which, because of their limited use, are not normally available but which are necessary for maintenance of particular equipment.

3) For each type of equipment provided under this CONTRACT, a complete set of all special tools shall be furnished including grease guns and other lubricating devices, which may be needed for the adjustment, operation, maintenance, and disassembly of such equipment. Tools shall be of high grade, smooth forged alloy tool steel. Grease guns shall be of the lever type.

4) One or more neat and substantial steel wall cases or cabinets shall be furnished and erected with flat key locks and clips or hooks to hold each special tool in a convenient arrangement.

1.8.14 Operation and Maintenance Manuals

(a) Operation and Maintenance Manuals shall be submitted in accordance with Subsection 1.12, Operation and Maintenance Manuals, in this Section.

1.8.15 Contractor's Stamp

(a) Prior to submittal, the Contractor shall review the submittal material and shall affix his stamp of approval, with comments as applicable, signed by a responsible representative, to each appropriate submittal item. In the case of Subcontractor's submittals, both the Subcontractor and the General Contractor shall review and stamp the submittal. Submittals which are not approved or approved-as-noted by the Contractor shall not be submitted to the Engineer. The Contractor shall not give an approved-as-noted status to submittals having incompleteness or major corrective notations as this will only delay the ultimate approval process.

(b) The receipt of submittal information from the Contractor will be construed as the Contractor's assurance that he has reviewed the submittal information and attests to the submittal's accuracy and conformance to the requirements of the contract documents. Submitted information shall be complete and in sufficient detail to demonstrate compliance with all requirement of the contract documents, including fitting in the space provided and meeting all salient features of the specifications.

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

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

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

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

1.8.20 When submittals are marked "Approved as Noted" or "Approved Subject to Corrections Marked", Work covered by submittal may proceed provided it complies with both ENGINEER's notations or corrections on submittal and with Contract Documents. Acceptance of Work will depend on that compliance. Resubmittal is not required.

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

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

1.8.23 Coordination

(a) Preparation and processing of submittals shall be coordinated with performance of the work, other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities that require sequential activity.

(b) Submission of different units of interrelated work shall be coordinated so that one submittal will not be delayed by ENGINEER's need to review a related submittal. ENGINEER may withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

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

#### 1.9. Resubmittal Preparation

1.9.1 Resubmittal Preparation shall comply with the requirements described in subsection 1.8, Submittal, of this section. In addition, it shall be identified on the transmittal form that the submittal is a resubmission.

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

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

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

#### 1.10 Record Drawings

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

1.10.2 At completion of the CONTRACT and before final payment is made, one set of clearly readable, reproducible mylar Contract Drawings reflecting all changes made during construction shall be delivered to the ENGINEER. The drawings shall each be stamped "RECORD DRAWING", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's representative. Refer to individual sections for addition requirements.

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

#### 1.11 Guarantees and Warranties

1.11.1 All equipment shall be furnished complete with the manufacturer's standard trade guarantee or warranty, applicable to the Illinois Department of Transportation, from the date of final acceptance.



Such guarantee shall accompany submittal shop drawings and product data.

1.11.2 Prior to final payment, the original and one copy of all bonds, warranties, guarantees and similar documents, including those customarily provided by manufacturers and suppliers which cover a period greater than the one year correction period shall be delivered to the Department.

## 1.12 Operation and Maintenance Manuals

1.12.1 Four copies of an Operation and Maintenance Manual shall be furnished to the ENGINEER for all equipment and associated control systems furnished and installed.

1.12.2 Prior to the Work Reaching 50 Percent Completion, one copy of the manual shall be submitted to the ENGINEER for approval with all specified material. The approval copies shall be submitted with the partial payment request for the specified completion. Within 30 days after the ENGINEER's approval of the two-copy submittal, the remaining 3 copies of the manual shall be furnished to the ENGINEER. Space shall be provided in the manual for additional material. Any missing material for the manual shall be submitted prior to requesting certification of substantial completion.

1.12.3 Each copy of the manual shall consist of the following and shall be prepared and arranged as follows:

(a) A section of an equipment data summary (see sample form at end of section) for each item of equipment.

(b) A section of an equipment preventive maintenance data summary (see sample form at end of section) for each item of equipment.

(c) A section of the equipment manufacturer's operating and maintenance instructions. Operating instructions include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting. Maintenance instructions include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, troubleshooting, parts list and recommended spare parts.

(d) List of electrical relay settings and control and alarm contact settings.

(e) Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.

(f) One valve schedule giving valve number, location, fluid, and fluid destination for each valve installed. All valves in same piping systems shall be grouped together in the schedule. A sample of the valve numbering system shall be obtained from the ENGINEER.

(g) All O&M Manual material shall be on 8-1/2 inch by 11 inch commercially printed or typed forms or an acceptable alternative format.

1.12.4 Each manual shall be organized into sections paralleling the equipment specifications. Each section shall be identified using heavy section dividers with reinforced holes and numbered plastic index tabs.

The data shall be compiled in high-quality heavy-weight, hard cover binders with piano-style metal hinges or in an alternate approved format. Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders. The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled. All loose data shall be punched for binding. Composition and printing shall be arranged so that punching does not obliterate any data. The project title, and manual title, as furnished and approved by the ENGINEER shall be printed on the cover and binding edge of each manual.

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

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS

STORMWATER PUMP STATION NO. 27  
Operation and Maintenance Manual

Equipment Data Summary

Equipment Name:

Specification Reference:

Manufacturer

Name:

Address:

Telephone:

Number Supplied:                      Location/Service:

Model No:                      Serial No:

Type:

Size/Speed/Capacity/Range (as applicable):

Power Requirement (Phase/Volts/Hertz):

Local Representative

Name:

Address:

Telephone:

NOTES:

STATE OF ILLINOIS  
DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS

STORMWATER PUMP STATION NO. 27  
Operation and Maintenance Manual

Preventive Maintenance Summary

Equipment Name:  
Reference

Location:

O&M Manual

Manufacturer:

Address:

Telephone:

Model No:

Serial No:

Maintenance Task

Lubricant/Part

D W M Q SA A

NOTES:

\*D-Daily  
A-Annual

W-Weekly

M-Monthly

Q-Quarterly

SA-Semi-Annual

1.12.6 Binders shall be labeled Volume 1, 2, and so on, where more than one binder is required. The table of contents for the entire set, identified by volume number, shall be included in each binder.

### 1.13 Storage of Equipment and Materials

1.13.1 All materials and equipment shall be protected from wear and damage both before and after delivery to the job site.

1.13.2 Unless specifically permitted by the Engineer, all equipment such as pumps, fans, electrical apparatus, valve operators, SCADA equipment, and the like shall be stored indoors out of exposure to the weather. Items having electrical parts, such as motors, electronic panels, and the like, shall be kept in heated storage, at a temperature to prohibit the accumulation of condensation on the equipment. Where equipment is provided with integral space/strip heaters, (such as the motor control center), these heaters shall be energized as soon as the equipment is present at the job site and they shall remain energized from temporary circuits until final permanent energization is attained.

1.13.3 Unless otherwise specifically permitted by these specifications or as allowed by the Engineer, all materials for use on the project shall be stored indoors out of exposure to the weather. Such materials would include ductwork, doors and frames, louvers, grating, slate roofing, building hardware, windows and glass block, wire and cable, conduit, and piping. Certain materials such as building steel, exterior hatch covers, fencing, and the like which will be applied exposed to the weather, may be stored outdoors in a safe manner as approved. Note the specified requirements for the storage of building masonry in Section 4A.

### 1.14 Protection of the Work

1.14.1 All work shall be protected from damage by vandals, the weather, or other sources until final acceptance by the Department. Such protection shall include temporary fencing or other barriers, if necessary, to restrict access to the work. Open pits, doors, hatches, etc. shall be covered, closed and locked. No additional compensation will be granted and no additional time will be allowed due to delays caused by failure to adequately protect the work from damage. In addition, the Contractor shall make the worksite safe at the end of each work day, leaving no attractive nuisance hazards and no open electrical boxes and the like.

### 1.14.2 Clean-Up and Public Safety

The work site shall be maintained in a clean condition, free of hazards to the work force and the public, all in conformance with the requirements of Article 107 of the Standard Specifications. Special care shall be taken to see that electrical systems are not left in an exposed or otherwise hazardous condition. All electrical boxes, cabinets, pole handholes, etc., which contain wiring, either energized or non-energized, shall be closed or have their cover in place and shall be locked when possible, during off-work hours.

### 1.15 Standards of Workmanship

1.15.1 All work shall be performed to the highest standard of each respective trade. The work shall demonstrate all due care and attention so that all specified requirements are met and that the end product is a first-rate installation.

1.15.2 The Contractor shall comply with the requirements of Sections 105 and 108 of the Standard Specifications, and any Supplements thereto shall, in addition, comply with the requirements for control of work specified herein.

## 1.16 Quality Control

### 1.16.1 Submittals

All submittals, including the following, shall be provided as specified in this Section.

Authoritative evidence in the form of Certificates of Manufacture shall be furnished to the ENGINEER to show that the materials and equipment to be used in the Work have been manufactured and tested in conformity with the Contract Documents. Copies of the results of physical tests that have been made directly on the product or on similar products of the manufacturer shall be included where necessary.

1.16.2 At all times during the progress of the Work and until the date of final completion, afford the Department and Engineer every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any work will not relieve the CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Work rejected due to faulty design, inferior, or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, shall be replaced with satisfactory work at no additional cost to the DEPARTMENT. Finished or unfinished work found not to be in strict accordance with the Contract shall be replaced as directed even though such work may have been previously approved and payment made thereof.

1.16.3 The DEPARTMENT and the Department's Authorized Representatives have the right to reject materials and workmanship which are defective or require correction. Rejected work and materials shall be promptly removed from the site.

1.16.4 Failure or neglect on the part of the Department or the Department's Authorized Representatives to condemn or reject bad or inferior work or materials does not imply an acceptance of such work or materials. Neither is it to be construed as barring the DEPARTMENT or the Department's Authorized Representatives at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

1.16.5 Should it be considered necessary or advisable by the Department or the Department's Authorized Representatives, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, all necessary facilities, labor, and material to make such an examination shall be promptly furnished. If such Work is found to be defective in any respect, all expenses of such examination and of satisfactory reconstruction shall be paid for by the CONTRACTOR. If, however, such work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

1.16.6 Proper operation of equipment during tests and instruction periods shall be the full responsibility of the CONTRACTOR. The CONTRACTOR shall make no claim for damage which may occur to equipment prior to the time when the Department accepts the Work.

1.16.7 If at any time prior to the expiration of any applicable warranties or guarantees, equipment is rejected by the Department, all sums of money received for the rejected equipment on progress certificates or otherwise on account of the Contract lump sum prices shall be repaid to the Department. Upon the receipt of the sum of money, Department will execute and deliver a bill of sale of all its rights, title, and interest in and to the rejected equipment. The equipment shall not be removed from the premises of the DEPARTMENT until the Department obtains, from other sources, equipment to take the place of that rejected. The Department hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that the Department may use the equipment furnished by the CONTRACTOR without rental or other charge until the other new equipment is obtained.

1.16.8 Notice shall be given in writing to the ENGINEER sufficiently in advance of the commencement of manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. When required, notice shall include a request for inspection, the date of commencement, and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, ENGINEER will arrange to have a representative present at such times during the manufacture or testing as may be necessary to inspect the materials, or will notify CONTRACTOR that the inspection will be made at a point other than the point of manufacture or testing, or that the inspection will be waived. These provisions shall be complied with before shipping any materials. Such inspection will not constitute a release from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

1.16.9 Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or IEEE, except as may otherwise be stated herein.

1.16.10 Personnel shall be provided to assist the ENGINEER in performing the following periodic observation and associated services.

(a) Soils: Observe and test excavations, placement and compaction of soils. Determine suitability of excavated material. Observe subgrade soils and foundations.

(b) Concrete: Observe forms and reinforcement; observe concrete placement; witness air entrainment tests, facilitate concrete cylinder preparation and assist with other tests performed by ENGINEER.

(c) Masonry: Sample and test mortar, bricks, blocks and grout; inspect brick and block samples and sample panels; inspect placement of reinforcement and grouting.

1.16.11 When specified in Divisions 2 through 16 of the Contract Documents, an independent laboratory testing facility shall be provided to perform required testing. The laboratory shall be qualified as having performed previous satisfactory work. Prior to use, such qualifications shall be submitted to the ENGINEER for approval.

1.16.12 Cooperate with the ENGINEER and laboratory testing representatives. At least 24 hours notice shall be given prior to when specified testing is required. Labor and materials, and necessary facilities shall be provided by the CONTRACTOR at the site as required by the ENGINEER and the testing laboratory.

1.16.13 Equipment test procedures shall be coordinated and demonstrated as specified in the Contract Documents or as otherwise required during the formal tests.

1.16.14 Test procedures and requirements for pipelines and other testing shall conform to that specified in the appropriate Specification Sections.

1.16.15 Where transcripts or certified test reports are required by the Contract Documents, the following requirements shall be met:

For all required transcripts, certified test reports, certified copies of the reports of all tests required in referenced specifications or specified in the Contract Documents, submit and obtain approval of the ENGINEER before delivery of materials or equipment. All testing shall be performed in an approved independent laboratory or the manufacturer's laboratory. Reports of shop equipment tests shall be submitted for approval within thirty days of testing. Transcripts or test reports are to be accompanied by a notarized certificate in the form of a letter from the manufacturer or supplier certifying that tested material or equipment meets the specified requirements and the same type, quality, manufacture and make as specified. The certificate shall be signed by an officer of the manufacturer or the manufacturer's plant manager.

1.16.16 At the option of the ENGINEER, or where not otherwise specified, a notarized Certificate of Compliance shall be submitted for approval. The Certificates may be in the form of a letter stating the following:

- (a) Manufacturer has performed all required tests
- (b) Materials to be supplied meet all test requirements
- (c) Tests were performed not more than one year prior to submittal of the certificate
- (d) Materials and equipment subjected to the tests are of the same quality, manufacture and make as those specified
- (e) Identification of the materials

1.16.17 Initial inspection and testing of materials furnished under this Contract will be performed by the Department or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR, unless otherwise expressly specified. If subsequent testing is necessary due to failure of the initial tests or because of rejection for noncompliance, the Department shall be reimbursed by the CONTRACTOR for expenditures incurred in making such tests.

1.16.18 Except as expressly provided elsewhere herein, all the costs of shop and field tests of equipment and other tests specifically called for in the Contract Documents shall be included in the Contract Price.

1.16.19 Materials and equipment submitted by the CONTRACTOR as the equivalent to those specifically named in the Contract may be tested by the Department for compliance. The Department shall be reimbursed for expenditures incurred in making such tests on materials and equipment which are rejected for noncompliance.

1.16.20 The Department shall be reimbursed for the costs of any job site inspection between the hours of 7:00 p.m. and 6:00 a.m. and any work on Saturdays, Sundays or Holidays.

1.16.21 The Department shall be reimbursed for all costs associated with Witness Tests which exceed 5 Calendar Days per kind of equipment.

1.16.22 As soon as conditions permit, all labor and materials and services to perform preliminary field tests of all equipment shall be furnished as provided under this Contract. If the preliminary field tests disclose that any equipment furnished and installed under this Contract does not meet the requirements of the Contract Documents, all changes, adjustments and replacements required shall be made prior to the acceptance tests.

1.16.23 Upon completion of the Work and prior to final payment, all equipment, piping and appliances installed under this Contract shall be subjected to specified acceptance tests to demonstrate compliance with the Contract Documents.

1.16.24 All labor, fuel, energy, water and other materials, equipment, instruments and services necessary for all acceptance tests shall be furnished by the CONTRACTOR.

1.16.25 Field tests shall be conducted in the presence of the ENGINEER. The field tests shall demonstrate that under all conditions of operation each equipment item:

- (a) Has not been damaged by transportation or installation
- (b) Has been properly installed
- (c) Has no mechanical defects
- (d) Is in proper alignment
- (e) Has been properly connected
- (f) Is free of overheating of any parts
- (g) Is free of all objectionable vibration
- (h) Is free of overloading of any parts
- (i) Operates as intended

1.16.26 Work or portions of work shall be operated for a minimum of 100 hours or 14 days continuous service, whichever comes first. Test on those systems which require load produced by weather (heating or cooling) exercise shall be conducted only when weather will produce proper load.

1.16.27 If the acceptance tests reveal defects in material or equipment, or if the material or equipment in any way fails to comply with the requirements of the Contract Documents, such deficiencies shall be promptly corrected. Failure or refusal to correct the deficiencies, or if the improved materials or equipment, when tested again, fail to meet the guarantees or specified requirements, the DEPARTMENT, notwithstanding its partial payment for work and materials or equipment, may reject said materials or equipment and may order the CONTRACTOR to remove the defective work from the site at no addition to the Contract Price, and replace it with material or equipment which meets the Contract Documents.



1.16.28 If it is ascertained by testing or inspection that the material or equipment does not comply with the Contract, said material or equipment shall not be delivered, or if delivered it shall be promptly removed from the site or from the Work and replaced with acceptable material without additional cost to the DEPARTMENT. All obligations under the terms and conditions of the Contract shall be fulfilled even though the DEPARTMENT or the DEPARTMENT's Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

## 1.17 Cutting and Patching

1.17.1 No structural members shall be removed, cut or otherwise modified without approval and any such work shall be done in a manner as directed by the ENGINEER.

1.17.2 Cutting of concrete slabs, walls and members shall be performed without over-cutting at corners or elsewhere.

1.17.3 Cutting and patching shall be performed in a neat and workmanlike manner, consistent with the best practices of the appropriate trade. All patching shall be done in a manner consistent with the building material being patched.

1.17.4 All cutting, fitting or patching of the Work that may be required to make the several parts thereof join shall be provided in accordance with the Contract Documents. Restoration shall be performed by competent workmen skilled in the trade.

1.17.5 All cutting and patching required to install improperly timed work or to remove samples of installed materials for testing shall be provided.

1.17.6 Except when the cutting or removal of existing construction is specified or indicated, any cutting or demolition which may affect the structural stability of the Work or existing facilities shall not be undertaken without the ENGINEER's concurrence.

1.17.7 Shoring, bracing, supports, and protective devices necessary to safeguard all work during cutting and patching operations shall be provided.

1.17.8 All materials shall be cut and removed to the extent shown or as required to complete the Work. Materials shall be removed in a careful manner with no damage to adjacent facilities. Materials which are not salvageable from the site shall be removed.

1.17.9 All work affected by demolition, cutting operations, and equipment removal shall be patched, repaired or restored with new materials or with salvaged materials acceptable to the ENGINEER to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished. Affected surfaces shall match adjacent surfaces and provide uniform appearance. Unnecessary gaps, holes, openings and depressions shall be filled with suitable patching material.

## 1.18 Definition of Terms

### 1.18.1 Abbreviations

Wherever the following abbreviations are used in these Special Provisions or on the Plans, they are to be construed the same as the respective expressions represented:

AASHTO	<i>American Association of State Highways and Transportation Officials</i>
ANSI	<i>American National Standards Institute</i>
ASME	<i>American Society of Mechanical Engineers</i>
ASTM	<i>American Society for Testing and Materials</i>
AWG	<i>American Wire Gauge</i>
ICEA	<i>Insulated Power Cable Engineers Association</i>
IEEE	<i>Institute of Electrical and Electronic Engineers</i>
IES	<i>Illuminating Engineering Society of North America</i>
NEC	<i>National Electrical Code</i>
NEMA	<i>National Electrical Manufacturer's Association</i>
NESC	<i>National Electrical Safety Code</i>
UL	<i>Underwriters' Laboratories</i>
ACI	<i>American Concrete Institute</i>
FM	<i>Factory Mutual</i>
SSPC	<i>Steel Structures Painting Council</i>

#### 1.18.2 Standard Specifications

Where used in these Special Provisions, this term shall mean the "Standard Specifications for Road and Bridge Construction", published by the Illinois Department of Transportation dated January 1, 2002.

#### 1.18.3 Specifications

Where used in these Special Provisions, this term shall mean the complete body of specifications, including the Standard Specifications, these Special Provisions, and referenced specifications and standards. See article 101.42 of the Standard Specifications.

#### 1.18.4 Supplements

Where used in these Special Provisions, this term shall mean the "Supplemental Specifications and Recurring Special Provisions" published by the Illinois Department of Transportation dated March 1, 2005.

1.18.5 Contract Documents

The complete body of agreements, specifications and drawings which define the contract work.

1.18.6 Provide

Where used in these Special Provisions, this term shall mean "furnish and install, complete, including any required connection and testing".

1.18.7 Department

See Article 101.14 of the Standard Specifications.

1.18.8 Engineer

See Article 101.15 of the Standard Specifications.

1.19 Referenced Specifications and Standards

1.19.1 The referenced specifications and standards are incorporated, by reference, in these Special Provisions and shall apply to the work as though fully written herein:

(a) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, a publication of the Illinois Department of Transportation.

(b) SUPPLEMENTAL SPECIFICATIONS AND RECURRING SPECIAL PROVISIONS, a publication of the Illinois Department of Transportation.

(c) NATIONAL ELECTRICAL SAFETY CODE, a publication of American National Standards Institute.

(d) SAFETY CODE, a publication of the Illinois Department of Transportation.

(e) AMERICAN NATIONAL STANDARD PRACTICE FOR ROADWAY LIGHTING, ANSI/IES RP-8, published by Illuminating Engineering Society, approved by National Standards Institute.

(f) ELECTRICAL MAINTENANCE CONTRACT, State of Illinois. Department of Transportation, Division of Highways, District 1.

1.20 Schedule of Values

1.20.1 A Schedule of Values shall be submitted as payment basis for Pump Station General Work, Pump Station Electrical Work, and Pump Station Mechanical Work.

1.20.2 The Contractor shall submit a Schedule of Values, as specified herein, at least fifteen (15) days prior to submitting the first payment estimate and shall provide information as requested to substantiate the prices included in the Schedule of Values.

1.20.3 The Schedule of Values shall be approved by the Engineer and IDOT District One, Bureau Electrical Operations, prior to any project payments.

1.20.4 Complete Schedule of Values

(a) The Schedule of Values shall be typewritten on 8-1/2 inch by 11 inch paper in a format approved by the Engineer.

(b) The Schedule of Values shall be used to determine the value of work completed for payment purposes. After review by the Engineer, the Contractor shall revise and resubmit the Schedule of Values as required.

(c) The Schedule of Values shall have each item further itemized by Specification Division as listed in the Specification index.

(d) For the item Pump Station General Work, Pump Station Electrical Work and Pump Station Mechanical Work, each item which has an installed value of over \$10,000, a list of the costs for the major products or operations shall be indicated under each item. Round off figures to the nearest ten (10) dollars. The "value" for each item listed shall be the supplied, installed and operational start-up cost incurred to the Contractor for that item (overhead and profit included). No items shall be listed as calendar units (i.e. per month). The sum total of all items in the Schedule shall be equal to the payment item total.

1.21 Start-Up

1.21.1 Item to be checked on start-up include, but not limited to, the following:

- (a) Demonstration of back-up float controls
- (b) Gas detection calibration kit shall be always stored on site
- (c) Demonstration of transfer switch operation and maintenance
- (d) Demonstration of pump control system
- (e) Check alarm operation SCADA and Aegis system

1.21.2 The Contractor shall be prepared to demonstrate operation and maintenance procedures for all equipment installed.

1.22 Temporary Pumping Sequences

1.22.1	Existing two (2) low flow pumps .....	5,000 gpm
1.22.2	Existing eight (8) main pumps .....	<u>240,000 gpm</u>
	Station pumping capacity.....	245,000 gpm
1.22.3	Remove #1 existing main pump.....	<u>30,000 gpm</u>
	Remaining pumping capacity.....	215,000 gpm
1.22.4	Install #1 new main pump.....	<u>30,000 gpm</u>
	Station pumping capacity .....	245,000 gpm
1.22.5	Remove #2 existing main pump .....	<u>30,000 gpm</u>
	Remaining pumping capacity.....	215,000 gpm
1.22.6	Install #2 new main pump.....	<u>30,000 gpm</u>
	Station pumping capacity.....	245,000 gpm
1.22.7	Remove #3 existing main pump .....	<u>30,000 gpm</u>

Remaining pumping capacity.....	215,000 gpm	
1.22.8	Install #3 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	
1.22.9	Remove #4 existing main pump.....	<u>30,000 gpm</u>
Remaining pumping capacity.....	215,000 gpm	
1.22.10	Install #4 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	
1.22.11	Remove #5 existing main pump.....	<u>30,000 gpm</u>
Remaining pumping capacity.....	215,000 gpm	
1.22.12	Install #5 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	
1.22.13	Remove #6 existing main pump.....	<u>30,000 gpm</u>
Remaining pumping capacity.....	215,000 gpm	
1.22.14	Install #6 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	
1.22.15	Remove #7 existing main pump.....	<u>30,000 gpm</u>
Remaining pumping capacity.....	215,000 gpm	
1.22.16	Install #7 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	
1.22.17	Remove #8 existing main pump.....	<u>30,000 gpm</u>
Remaining pumping capacity.....	215,000 gpm	
1.22.18	Install #8 new main pump.....	<u>30,000 gpm</u>
Station pumping capacity.....	245,000 gpm	

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 1 - GENERAL REQUIREMENTS

**SECTION 1B - TRAFFIC CONTROL AND PROTECTION**

1. GENERAL:

1.1 Description

1.1.1 Traffic Control shall be in accordance with the applicable sections of the Standard Specifications, the Supplemental Specifications, the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways", any special details and Highway Standards contained in the Drawings, the Traffic Specifications and the Special Provisions contained herein.

1.1.2 Special attention is called to Articles 107.09 and 107.14 of the Standard Specifications and the following Highway Standards, Details, Recurring Special Provisions and Special Provisions contained herein, relating to traffic control.

1.1.3 The Contractor shall contact the District One Bureau of Traffic at least 72 hours in advance of beginning work.

1.1.4 Standards

(a) 702001 Typical Application of Traffic Control Devices.

1.1.5 At the preconstruction meeting, the Contractor shall furnish the name of the individual in his direct employ who is to be responsible for the installation and maintenance of the traffic control for this project. If the actual installation and maintenance are to be accomplished by a subcontractor, consent shall be requested of the Engineer at the time of the preconstruction meeting in accordance with Article 108.01 of the Standard Specifications. This shall not relieve the Contractor of the requirement to have a responsible individual in his direct employ supervise the work. The Department will provide the Contractor the name of its representative who will be responsible for the administration of the Traffic Control Plan.

## 1.2 Traffic Control and Protection

1.2.1 This Section of work shall include furnishing, installing, maintaining, replacing, relocating and removing all traffic control devices used for the purpose of regulating, warning or directing traffic during the construction or maintenance of this improvement.

1.2.2 Traffic Control and Protection shall be provided as called for in the Drawings, these Special Provisions, applicable Highway Standards, applicable sections of the Standard Specifications, or as directed by the Engineer.

1.2.3 The governing factor in the execution and staging of work for this project is to provide the motoring public with the safest possible travel conditions along the roadway through the construction zone. The Contractor shall arrange his operations to keep the closing of any lane of the roadway to a minimum.

1.2.4 All traffic control devices used on this project shall conform to the Drawings, Special Provisions, Traffic Control Standards, Traffic Specifications and the "Illinois Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD). No modification of these requirements will be allowed without prior written approval of the Engineer.

1.2.5 Traffic Control Devices include signs and their supports, signals, pavement markings, barricades with sand bags, channelizing devices, warning lights, arrow boards, flaggers, or any other device used for the purpose of regulating, detouring, warning or guiding traffic through or around the construction zone.

1.2.6 Only signs, barricades, vertical panels, drums and cones that meet the requirements of the Department's "Quality Standard for Work Zone Traffic Control Devices - 1990" shall be used on this project. Copies of this publication are available from the Engineer of Traffic for the Contractor's use prior to the initial set-up.

At the time of the initial set-up or at the time of major stage changes, 100 percent of each type of device (cones, drums, barricades, vertical panels or signs) shall be acceptable as defined by the referenced publication. Throughout the duration of the project, the percentage of acceptable devices may decrease to 75 percent only as a result of damage/or deterioration during the course of the work. The Contractor is required to conduct routine inspections of the work site at a frequency that will allow for the prompt replacement of any traffic control device that has become displaced, worn or damaged to the extent that it no longer conforms to the Traffic Control Standards or will no longer present a neat appearance to motorists. A sufficient quantity of replacement devices, based on vulnerability to damage, shall be readily available to meet this requirement.

1.2.7 The Contractor shall be responsible for the proper location, installation and arrangement of all traffic control devices. Special attention shall be given to advance warning signs during construction operations in order to keep lane assignment consistent with barricade placement at all times. The contractor shall immediately remove, cover or turn from the view of the motorists all traffic control devices which are inconsistent with detour lane assignment patterns and conflicting conditions during the transition from one construction stage to another. When the contractor elects to cover conflicting or inappropriate signing materials used he shall totally block out reflectivity of the sign and shall cover the entire sign. The method used for covering the signing shall meet with the approval of the Engineer.

1.2.8 The Contractor shall coordinate all traffic control work on this project with adjoining or overlapping projects, including barricade placement necessary to provide a uniform traffic detour pattern. When directed by the Engineer, the Contractor shall remove all traffic control devices which were furnished, installed and maintained by him under this Contract, and such devices shall remain the property of the Contractor. All traffic control devices shall remain in place until specific authorization for relocation or removal is received from the Engineer.

1.2.9 The Contractor shall ensure that all traffic control devices installed by him are operational, functional and effective 24 hours a day, including Sundays and holidays.

### 1.3 Signs

1.3.1 All signs, except those referring to daily lane closures, shall be post mounted in accordance with Standard 702001 for all projects that exceed four days.

1.3.2 Construction signs referring to daytime lane closures during working hours shall be removed, covered or turned away from the view of the motorists during non-working hours.

1.3.3 Flashing lights shall be used on each approach in advance of the work area and installed above the first two signs in each series during the hours of darkness.

1.3.4 Prior to the beginning of construction operations, the Contractor will be provided a sign log of all existing signs within the limits of the construction zone. The Contractor is responsible for verifying the accuracy of the sign log. Throughout the duration of this project, all existing traffic signs shall be maintained by the Contractor. All provisions of Article 107.22 of the Standard Specifications shall apply except the third paragraph shall be revised to read: "The Contractor shall maintain, furnish and replace at his own expense, any traffic sign or post which has been damaged or lost by the Contractor or a third party. The Contractor will not be held liable for third party damage to large freeway guide signs.

1.3.5 Whenever any vehicle, equipment, workers or their activities infringe on the shoulder or within 15 feet of the traveled way and the traveled way remains unobstructed, then the applicable Traffic Control Standard shall be 701101, or U-4. "Shoulder Work Ahead" sign (W21-5(0)-48) shall be used in lieu of the "Men Working" sign (W21-1 or W-21-1a).

#### 1.4 Barricades

1.4.1 All type I and type II barricades and vertical panels be equipped with a steady burn light when used during hours of darkness unless otherwise stated herein.

1.4.2 Check barricades shall be placed in work areas perpendicular to traffic every 1,000 feet, one per lane and per shoulder, to prevent motorists from using work areas as a traveled way. Two additional check barricades shall be placed in advance of each patch excavation or any other hazard in the work area, the first at the edge of the open traffic lane and the second centered in the closed lane. Check barricades shall be Type I or II and equipped with a flashing light. Vertical panels, drums or other delineating devices may be substituted for type I or II barricades with the approval of the Engineer.

1.4.3 Vertical panels shall have a minimum reflective area of 192 square inches when used along a road with a posted speed limit of 40 mph or less. When the posted speed limit is greater than 40 mph, the vertical panels shall have a minimum reflective area of 270 square inches.

#### 1.5 Placement and Removal of Signs and Barricades

1.5.1 Placement of all signs and barricades shall proceed in the direction of flow of traffic. Removal of all signs and barricades shall start at the end of the construction areas and proceed toward oncoming traffic unless otherwise directed by the Engineer.

#### 1.6 Arrow Boards

1.6.1 A flashing arrow board meeting the requirements of Article 718.22 of the Standard Specifications shall be operating at all times when a lane is closed to traffic on a multi-lane highway. Arrow boards shall be provided and located in a head-on position within each lane closure taper.

#### 1.7 Reflective Sheeting for Drums

1.7.1 The reflective sheeting used on all drums shall meet the following minimum requirements:



Color	Divergence Angle 0.2 Incidence Angle			Divergence Angle 0.5 Incidence Angle		
	-4	+30	+50	-4	+30	+50
Silver/White 0	250.	100.0	5.0	95.0	50.0	5.0
Orange 0	100.	30.0	5.0	40.0	15.0	3.0

1.8 Temporary Concrete Barrier Vertical Panels and Lights

1.8.1 Whenever temporary concrete barrier wall is specified in the Drawings, vertical panels and steady burning lights meeting the requirements of Articles 718.14, 718.17 and 718.18 of the Standard Specifications and Standard 2299 shall be installed on the barrier wall at 50 foot centers minimum or at the spacing shown on the Drawings. The method of mounting shall be approved by the Engineer.

1.9 Public Safety and Convenience

1.9.1 The Contractor shall provide a telephone number where a responsible individual can be contacted on a 24 hour-a-day basis to receive notification of any deficiencies regarding traffic control and protection. the Contractor shall dispatch men, materials and equipment to correct any such deficiencies. The Contractor shall respond to any call from the Department concerning any request for improving or correcting traffic control devices and begin making the requested repairs within two hours from the time of notification.

1.9.2 When traveling in lanes open to public traffic, the Contractor's vehicles shall always move with and not against or across the flow of traffic. These vehicles shall enter or leave work areas in a manner which will not be hazardous to, or interfere with, traffic and shall not park or stop except within designated work areas. Personal vehicles shall not park within the right-of-way except in specific areas designated by the Engineer.

1.9.3 The Contractor's equipment shall not be allowed on the pavement open to traffic. The Contractor shall not park any equipment or vehicles unnecessarily on the shoulder. Whenever work is in progress adjacent to the traveled way, the Contractor shall provide necessary traffic signs to warn the public and protect the work as required herein or as provided in the Standards. The Contractor shall remove all equipment from the shoulder and medians after work hours during the week and on weekends.

1.9.4 No road closure or restriction shall be permitted, except those covered by Standard Designs, without written approval by the Engineer.

1.10 Measurement and Payment

1.10.1 Measurement: Work specified herein or as required shall not be measured for payment.

1.10.2 Payment: Payment for the work specified under this Section and as required shall be at the Contract lump sum for TRAFFIC CONTROL AND PROTECTION, which price shall be considered as payment in full for this Item.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 1 - GENERAL REQUIREMENTS

**SECTION 1C - MEASUREMENT AND PAYMENT:**

1. GENERAL:

1.1 Description

1.1.1 The work under this Contract for the rehabilitation of Pump Station 27 shall include all labor, materials, tools, equipment and incidentals and for performing all work required for the complete rehabilitation for a complete operational facility, as included in all Contract Documents and shall be as measured and paid for as described herein.

1.1.2 EARTH EXCAVATION will be paid for at the Contract unit price per cubic yard as specified in Section 2A, Site Work.

1.1.3 AGGREGATE BASE COURSE, TYPE B, 6" will be paid for at the Contract unit price per square yard as specified in Section 2A, Site Work.

1.1.4 AGGREGATE BASE COURSE, TYPE B, 12" will be paid for at the Contract unit price per square yard as specified in Section 2A, Site Work.

1.1.5 AGGREGATE SURFACE COURSE, TYPE B, 6" will be paid for at the Contract unit price per square yard as specified in Section 2A, Site Work.

1.1.6 BITUMINOUS MATERIALS (PRIME COAT) will be paid for at the Contract Unit price per gallon as specified in Section 2A, Site Work.

1.1.7 BITUMINOUS CONCRETE SURFACE COURSE, SUPERPAVE, MIX "C", N50 will be paid for at the contract unit price per ton as specified in Section 2A, Site Work.

1.1.8 BITUMINOUS CONCRETE BINDER COURSE, SUPERPAVE, IL-19.0, N50, will be paid for at the contract unit price per ton as specified in Section 2A, Site Work.

1.1.9 CHAIN LINK FENCE, 8', (SPECIAL) will be paid for at the Contract unit price per lineal foot as specified in Section 2A, Site Work.

1.1.10 CHAIN LINK GATES, 8'X20' DOUBLE will be paid for at the Contract unit price each as specified in Section 2A, Site Work.

1.1.11 CONCRETE REMOVAL will be paid for at the Contract price per cubic yard as specified in Section 2B, Demolition.

1.1.12 CLASS SI CONCRETE will be paid for at the Contract unit price per cubic yard as specified in Section 3A, Cast-In-Place Concrete.

1.1.13 REINFORCEMENT BARS, EPOXY COATED will be paid for at the Contract unit price per pound as specified in Section 3A, Cast-In-Place Concrete.

1.1.14 FURNISHING AND ERECTING STRUCTURAL STEEL will be paid for at the Contract unit price per pound as specified in Section 5A, Structural Steel.

1.1.15 ENGINEER'S FIELD OFFICE, TYPE A will be paid for at the Contract unit price per calendar month and shall be in accordance with the requirements of Section 670 of the Standard Specifications.

1.1.16 TRAFFIC CONTROL AND PROTECTION will be paid for at the Contract lump sum price and shall be in accordance with the requirements of Section 1B, Traffic Control and Protection.

1.1.17 ELECTRIC SERVICE CONNECTION shall consist of charges by the electric utility for both the temporary and permanent electrical service, if any, to be paid to the utility by the Contractor. For bidding purposes, this item shall be estimated at \$175,000.00. The Contractor will be reimbursed the exact amount of the charges by the utility.

1.1.18 PUMPING STATION SCADA EQUIPMENT shall consist of charges by the SCADA equipment suppliers for providing equipment and services to be paid to the suppliers by the Contractor as specified under the applicable requirements of Division 1, General Requirements, and Division 16, Electrical. For bidding purposes, this item shall be estimated at \$75,000.00. The Contractor will be reimbursed the exact amount of the charges by the suppliers.

1.1.19 PUMP STATION, GENERAL WORK shall include all work which is not listed as a specific pay item but which is required for compliance with the specifications and for a complete operational facility and will be paid for at the Contract lump sum price as specified in the Special Provisions; Division 1, General Requirements; and the applicable requirements under the following: Division 2, Site Work; Section 3B, Grout; Division 4, Masonry; Division 5, Metals (except Section 5A); Division 6, Carpentry; Division 7, Thermal and Moisture Protection; Division 8, Doors and Windows; Division 9A, Painting; and Division 10, Specialties.

1.1.20 PUMP STATION, ELECTRICAL WORK will be paid for at the Contract lump sum as specified in the applicable requirements of the Special Provisions and Division 1, General Requirements and all requirements Under Division 16, Electrical.

1.1.21 PUMP STATION, MECHANICAL WORK will be paid for at the Contract lump sum as specified in the applicable requirements of the Special Provisions and Division 1, General Requirements and all requirements under Division 14, Conveying Systems and Division 15, Mechanical.

1.1.22 COMPLETE SPARE MAIN PUMP ASSEMBLY shall be paid for at the contract unit price each as specified in the applicable requirements of Division 1, General Requirements, and Division 15, Mechanical.

1.1.23 COMPLETE SPARE LOW FLOW PUMP ASSEMBLY shall be paid for at the contract unit price each as specified in the applicable requirements of Division 1, General Requirements, and Division 15, Mechanical.

1.1.24 TRAINEES will be paid for at the Contract unit price per hour.

1.1.25 REMOVAL AND DISPOSAL OF LEAD BASED PAINT will be paid for at the Contract unit price per square foot as specified in Section 9B, Removal and Disposal of Lead Paint.

1.1.26 MOBILIZATION will be paid for at the Contract lump sum price and shall be in accordance with the requirements of Standard Specifications for Road and Bridge.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

**DIVISION 2 - SITE WORK**

**SECTION 2A - SITE WORK**

1. GENERAL:

1.1 Description

1.1.1 This Section shall include all work required for the furnishing and completing all site work as indicated on the Contract Drawings and as specified herein.

1.1.2 The work included under this Section shall include, but not be limited to, the following:

- (a) Site clearing
- Earth Excavation
- (c) Excavation and backfill
- (d) Removal and disposal of the existing fence and gate
- Gravel fill
- (f) Bituminous Paving
- (g) Gravel Paving
- (h) Installing new fence and gates

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Section

1.2.1 Section 3A - Cast-In-Place Concrete.

1.3 Guarantee

1.3.1 Provide guarantee under provisions of Section 1A.

1.4 Submittals

1.4.1 Submit product data under provisions of Section 1A.

1.5 Basis of Payment

1.5.1 Earth Excavation shall be paid for at the contract unit price per cubic yard for EARTH EXCAVATION.

1.5.2 Aggregate base course shall be paid for at the contract unit price per square yard for AGGREGATE BASE COURSE, TYPE B, 6" which price shall be considered as payment in full for this item.

1.5.3 Aggregate base course shall be paid for at the contract unit price per square yard for AGGREGATE BASE COURSE, TYPE B, 12" which price shall be considered as payment in full for this item.

1.5.4 Chain link fence will be measured for payment in lineal foot of the respective height of fence. The length paid for will be the overall length along the top of the fence from center to center of end posts, excluding the length occupied by gates.

1.5.5 This work shall be paid for at the Contract unit price per lineal foot for CHAIN LINK FENCE of the height specified on the Contract Drawings, and measured as specified herein, which price shall include payment for all excavation and backfilling.

1.5.5 The Contract unit price for CHAIN LINK FENCE, 8' (SPECIAL) shall also include the cost of furnishing all materials and installing the complete fence.

No additional compensation will be allowed the Contractor for clearing, encasing the posts with concrete, for furnishing and installing protective electrical grounds.

1.5.6 The Contract unit prices for CHAIN LINK GATES shall also include the cost of furnishing all materials and installing the complete gate including the gate posts and fittings and accessories for the gate and gate posts as specified. No additional compensation will be allowed the Contractor for clearing or for encasing the posts with concrete.

1.5.7 Site clearing, excavation and backfill and the existing fence removal and disposal shall be included for payment under the Item, PUMP STATION, GENERAL WORK.

1.5.8 The work specified under this Section and as required for bituminous material shall be paid for at the contract unit price per gallon for BITUMINOUS MATERIAL (PRIME COAT), which price shall be considered as payment in full for this item.

1.5.9 The work specified under this Section and as required for bituminous binder course shall be paid for at the contract unit price per ton for BITUMINOUS BINDER COURSE, SUPERPAVE, IL-19.0, N50, which price shall be considered as payment in full for this item.

1.5.10 The work specified under this Section and as required for bituminous surface course shall be paid for at the contract unit price per ton for BITUMINOUS CONCRETE SURFACE COURSE, SUPERPAVE, MIX "C", N50, which price shall be considered as payment in full for this item.

1.5.11 The work specified under this Section and as required for gravel paving surface course shall be paid for at the contract unit price per square yard for AGGREGATE SURFACE COURSE, TYPE A 6" which price shall be considered as payment in full for this item.

1.5.12 All remaining site work as specified herein or as required shall be included in the Contract lump sum price for the Item, PUMP STATION, GENERAL WORK.

## 2. PRODUCTS:

### 2.1 Chain Link Fence Materials

2.1.1 Posts and fence with barbed wire are specified according to Section 664 of the Standard Specifications. Horizontal braces shall be all pipe type A per IDOT Standard 664001-01. Line post shall be 2 3/8" with 3.65 lb/ft and terminal (end, corner or pull) posts shall be 2 7/8" with 5.79 lb/ft steel pipe. All steel pipe shall be galvanized per ASTM F 669.

2.1.2 Concrete is Class SI conforming to the applicable portions of Sections 503 and 664 of the Standard Specifications.

2.1.3 Top and bottom rail shall be 1 5/8" with 2.27 lb/ft galvanized steel pipe per ASTM F 669.

2.1.4 Fabric shall be woven in 2" mesh 9 gauge with 0.148" diameter wire with Type II, aluminum-coated steel per Section 1006.27 of the Standard Specifications. The fabric shall be knuckled selvage on top and twisted and barbed selvage on bottom.

2.1.5 8' high fence shall consist of a 7' high chain link fence plus 1' of six strands of barb wires.

## 2.2 Swing Gates

### 2.2.1 Gate posts:

Steel pipe posts meeting requirements of ASTM F1184, Type II, and requirements for steel pipe framework specified in the Standard Specifications, 4.0 inches outside diameter, 9.11 pounds per linear foot for Group 1A pipe, or 6.56 pounds per linear foot for Group 1C pipe minimum.

### 2.2.2 Framing

Steel pipe frame shall meet requirements of ASTM F1184 and requirements for steel pipe framework specified in this Section. Minimum weight of pipe specified in ASTM F1184 shall be for Group 1A pipe.

### 2.2.3 Fabrication

Fabricate perimeter frames of gate from metal and finish to match fence frame work. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8 feet apart, except as otherwise required.

### 2.2.4 Fabric

Provide same fabric as required for adjacent fence, except as otherwise required. Install fabric with tension bars at vertical edges and at top and bottom edges. Attach tension bands to gate frame at 15 inch centers maximum.

### 2.2.5 Bracing

Install diagonal cross bracing consisting of 3/8 inch diameter adjustable length truss rods on gate to ensure frame rigidity without sag or twist.

### 2.2.6 Locking Device

Locking device shall be as shown on the drawing.

## Barbed Wire

2.3.1 Barbed wire supporting arms shall meet the requirements of ASTM F626. Metal and finish shall match the framework, with provision for anchorage to posts and attaching the rows of barbed wire and coil of barbed tape to each arm. Support arms shall be either attached to posts and be capable of withstanding 250 pound downward pull at outmost end, except as otherwise required. Provide a single 45-degree arm for three stands of barbed wire, one for each post.

2.3.2 Steel barbed wire shall be ASTM A121, Chain Link Fence Grade, Class 3 coating, three stands 0.099 inch minimum diameter (12-1/2 gage) steel wire with 0.080 minimum diameter (14 gage), four-point barbs spaced at 5 inches maximum centers. Ends of barbs shall be cut on bias.

## 2.4 Excavation and Backfill

2.4.1 Structure excavation shall be in accordance with Section 502 of the Standard Specifications.

2.4.2 The Contractor shall use such methods and procedures as will protect surrounding property from damage and any damage to existing utilities or private property caused by the Contractor's operations shall be repaired by the Contractor in a manner satisfactory to the Engineer and at no additional cost to the State.

2.4.3 Where it is necessary to tight sheet or brace the excavation, or to dewater the excavation, this work shall be as approved by the Engineer. Temporary sheet piling shall be as specified in Section 502 of the Standard Specifications. All sheeting or bracing shall be removed in a manner approved by the Engineer prior to backfilling.

2.4.4 Fill or backfill for structure shall be porous granular backfill as specified herein.

## 2.5 Gravel Fill

2.5.1 Gravel fill for transformer foundation shall be coarse aggregate conforming to CA 3 of Section 1004 of the Standard Specifications.

## 2.6 Bituminous Paving

2.6.1 Paving shall be of the thicknesses shown on the Drawing.

2.6.2 Bituminous concrete surface course shall be SUPERPAVE, MIX "C", N50.

2.6.3 Bituminous concrete binder source shall be SUPERPAVE, IL-19.0, N50.

## 2.7 Gravel Paving

2.7.1 Aggregate surface course and base course shall be Type B, 6" thickness as shown on the Drawing. Grade for aggregate surface course shall be CA 10. Grade for aggregate base course shall be CA 6.

## 3. EXECUTION:

### 3.1 Site Clearing

3.1.1 Unless otherwise specifically indicated, this work shall consist of clearing and grubbing within the existing site.

### 3.2 Existing Fence Removal and Installing New Fence



3.2.1 Existing fence including concrete post footings to be removed shall be disposed of off the project site.

3.2.2 Chain Link fence shall be installed in accordance with Standard 664001 except that the top rail and barbed wire shall be as specified herein.

3.2.3 Fence shall be provided with three strands of barbed wire and attached tilt as shown.

3.2.4 Barbed wire: Pull wire taut and install securely to extension arms, secure to end post or terminal arms as instructed by manufacturer to prevent movement or displacement.

### 3.3 Bituminous Paving

3.3.1 Work shall be in accordance with Sections 311 and 406 of the Standard Specifications.

### Gravel Paving

3.4.1 Work shall be in accordance with Section 402 of the Standard Specifications.

END OF THIS SECTION

## DIVISION 2 - SITE WORK

### **SECTION 2B - DEMOLITION**

#### 1. GENERAL:

##### 1.1 Description

1.1.1 The extent and location of the Demolition works shall be as indicated on the Drawings and as specified herein. The work includes the requirements for the removal, wholly or in part, and satisfactory disposal of all materials except materials approved by the Engineer may be reused in the work.

1.1.2 The Demolition work is included in the Drawings for guidance only to indicate typical general construction features of the various types of construction and shall not be constructed as definitive or adequate to supplement the actual on-site inspection by the Contractor.

##### 1.2 Job Conditions

1.2.1 The Contractor represents that it has visited the site to become familiar with the quantity and character of all materials to be demolished. The Contractor agrees that the premises were made available prior to deadline for submission of Bids for whatever inspection and tests the Contractor deemed appropriate. The Contractor assumes full responsibility for the proper disposal of all demolition materials.

1.3 Related Sections

1.3.1 Section 3A - Cast-In-Place Concrete.

1.3.2 Section 5A - Structural steel.

1.4 Submittal

1.4.1 Submit under provisions of Section 1A.

1.4.2 Shop drawings: Indicate demolition and removal sequence and location of salvageable items.

1.5 Basis of Payment

1.5.1 Measurement

(a) The demolition work for concrete removal shall be measured for payment by the cubic yard of concrete removed.

(b) The demolition work for general work, structural steel work, mechanical work and electrical work shall not be measured for payment.

1.5.2 Payment

(a) The work specified under this Section and as required for the removal of concrete will be paid for at the Contract unit price per cubic yard for CONCRETE REMOVAL, which price shall be considered as payment in full to complete all work under this item.

(b) The work specified under this Section and as required for the removal of structural steel shall be included in the contract lump sum price for the Item, PUMP STATION, GENERAL WORK.

(c) The work specified under this Section and as required for all general demolition work shall be included in the Contract lump sum price for the Item, PUMP STATION, GENERAL WORK.

(d) The work specified under this section and as required for all mechanical demolition work shall be included in the contract lump sum for the Item, PUMP STATION, MECHANICAL WORK.

(e) The work specified under this Section and as required for all electrical demolition work shall be included in the Contract lump sum for the Item, PUMP STATION, ELECTRICAL WORK.

2. PRODUCTS:

2.1 Materials, General

Products that are required to accomplish, or to be incorporated into, the work of this section shall be as selected by the Contractor, subject to the approval of the Engineer.

### 2.1.1 Salvage Items

- (a) The existing brick and glazed brick shall be salvaged for use in patching of masonry as specified under Division 4, Masonry.
- (b) Refer to Division 15, Mechanical, and Division 16, Electrical, for information on the salvage of items under those respective Divisions.

## 3. EXECUTION:

### 3.1 Demolition

3.1.1 Demolition work to be included under the Item, PUMP STATION, GENERAL WORK shall include the removal and disposal of designated materials in areas as indicated on the Drawings and shall include, but not be limited to, the following:

- (a) Glass block windows and framing
  - (b) Doors and frames
  - (c) Masonry at existing exterior and interior walls and at new door opening
  - (d) Built-up roofing
  - (e) Gravel stop and nailer
  - (f) Miscellaneous metals and structural steel
- Louvers and dampers  
Miscellaneous mechanical and piping

3.1.2 Demolition work to be included under the Item CONCRETE REMOVAL shall be in accordance with the applicable requirements of Section 501 of the Standard Specifications and as specified herein.

- (a) Concrete areas to be removed shall be saw cut to depth of two inches, at perimeter, unless otherwise indicated on the Drawings.

Corners of saw-cut openings shall not be overcut.

- (c) Concrete removal shall include reinforcing steel and other materials encountered.
- (d) All materials removed under the Article shall become the property of the Contractor and shall be disposed of in a lawful manner.
- (e) Clean all concrete from reinforcing steel that is to remain and protect same from damage.

3.1.3 All demolition work to be included under the Item PUMP STATION, MECHANICAL WORK shall be as indicated on the Drawings.

3.1.4 All demolition work to be included under the Item PUMP STATION, ELECTRICAL WORK shall be as indicated on the Drawings and shall include, but not be limited to, the following:

Com Ed disconnects (Removal by Com Ed)  
Com Ed transformers (Removal by Com Ed)  
Metering equipment  
Motor Control Center  
Light fixtures  
Receptacles  
Raceway and conduit systems  
Grounding system

3.1.5 The contractor shall maintain the operations of the Pump Station as specified under Division 1, General Requirements, during all demolition operations. All demolition shall be subject to approval of the Engineer.

3.1.6 The Contractor shall protect adjacent materials, equipment, areas and related construction during all demolition operations from all dirt, dust, debris or damage of any kind.

3.1.7 The demolition operations shall be coordinated with the Contractor's proposed sequence of construction and maintenance of pumping of storm water at the Pump Station.

3.1.8 At the completion of construction, all surfaces, including interior and exterior concrete and masonry, shall be cleaned of all dirt, dust, graffiti and other marks. Surfaces designated to be painted shall be as specified under Section 9A, Painting.

3.1.9 Adjacent materials designated to remain that are damaged by the Contractor due to his operations shall be replaced at no additional cost to the State.

(a) Special operations necessary for the removal of an existing structure or obstruction shall be subject to the approval of the State.

(b) The Contractor shall provide adequate temporary support for all structures to remain that are normally supported by structures to be demolished.

3.1.10 The state will provide a list of items to be salvaged at the time of transfer of maintenance. The salvaged items shall be removed carefully and not damaged and protected until they are picked up by the state.

## 3.2 Disposal

3.2.1 General: All materials, except those indicated to be salvaged upon their demolition, shall become the property of the Contractor and shall be removed and promptly disposed of in a lawful manner away from the site.

3.2.2 Cleanup: After removal of designated areas of structure, clean and grade the area. There shall be no debris, rubble, or litter left at the site from any of the demolition operations, and the site shall be clean.

END OF THIS SECTION

DIVISION 2 - SITE WORK

## **SECTION 2C – LIFT PIER SYSTEMS**

### **1. GENERAL:**

#### **1.1 Section Includes**

1.1.1 This work consists of furnishing all labor, tools, equipment and materials associated with designing and installation of Resistance Piers system to lift the existing Transformer Room to the original design elevation according to the specifications contained herein.

#### **1.2 Related Sections**

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 5A - Structural Steel.

1.2.3 Section 5E - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts.

#### **1.3 References**

All reference standards shall be the latest edition.

1.3.1 International Building Code.

1.3.2 ASTM A500B - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.3.3 ASTM A513 – Electric Resistance Welded Carbon and Alloy Steel Mechanical Tubing.

1.3.4 ASTM A572 – High Strength Structural Steel.

1.3.5 ASTM A53 - Welded and Seamless Steel Pipe.

1.3.6 ASTM A29 – Steel Bars, Carbon and Alloy, Hot Wrought and Cold Finished.

1.3.7 ASTM A615 – All Thread Rebar, Grade 60.

#### **1.4 Submittals**

##### **1.4.1 Shop drawings:**

(a) Profiles and product components, including anchorage and accessories.

(b) Pier shop drawings sealed by a Registered Structural Engineer licensed in the State of Illinois.

##### **1.4.2 Product data:**

(a) Manufacturer's product data for specified products.

(b) Manufacturer's installation instructions.

1.4.3 Test results:

(a) Certified test reports showing compliance with specified characteristics and physical properties.

(b) Pier logs documenting drive pressures.

1.4.4 Documentation submittals:

(a) Project record documents for installed materials.

Name of Contractor.

Project name.

Date.

Pier location/number.

Equipment description.

Number and size of piers.

Pier dimensions, length, and dia.

Ground elevation.

Pier deviation from plan location.

Driving force records.

Drive equipment monitoring calibration data.

Notes on unusual phenomena.

1.4.5 Submit in accordance with Section 01330.

1.5 Quality Assurance

1.5.1 Qualifications

(a) Piers shall be installed by Contractor or Subcontractor specializing in particular type of pier to be provided, and at least 3 years experience placing piers in type of soil conditions that may be encountered and shall have participated in construction of 5 or more jobs of similar scope and magnitude using same method of construction as specified herein.

(b) Installer shall be certified by pier manufacturer.

(c) Owner reserves the right to require written documentation of above.

1.5.2 Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 System Description

1.6.1 Design Criteria

Design Uplift Load: 25 tons/pier, minimum factor of safety of 2.

Uplift: 6 inches.

Installation: 1.5 times working load.

1.7 Basis of Payment

1.7.1 The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

2. PRODUCTS:

2.1 Manufacturer

2.1.1 AB Chance Company.

2.2.1 Atlas Systems, Inc.

2.2 Materials

2.2.1 Pier bracket: ASTM A36, minimum 1/2" thick.

2.2.2 Pier section: ASTM A500 Grade B, pipe section.

2.2.3 Coupling: ASTM A513 or ASTM A500 Grade B. The coupling shall be attached by an embossed mechanical connection or plug welding the coupling to the pier pipe.

2.2.4 Top pier sleeve: ASTM A53 or ASTM A500 Grade B.

2.2.5 Lift head assembly: ASTM A36, minimum 5/8" thick.

2.2.6 Cap plate: ASTM A36, minimum 5/8" thick.

2.2.7 Grout:

Pressure bearing grout: Quick setting premixed mortar with a 4,500 psi (minimum), three day strength. Master Builder's 713 Non-Shrink Grout or equivalent.

Flowable pipe grout: Quick setting, neat cement flowable grout with a 4,000 psi (minimum), three day strength.

(c) Flowable grout fill: The grout slurry shall consist of sand, soil or other suitable void fill material mixed with any recognized lubricant such as 12 percent cement (2-1/2 sack mix), bentonite or other lubricant to promote proper flow characteristics.

2.3 Fabrication

2.3.1 Conform to approved shop drawings.

2.3.2 Welds shall conform to requirements of AWS D1.1.

2.3.3 Hot-dip galvanize after fabrication. Conforming to ASTM A123.

2.4 Equipment

2.4.1 Equipment used to install piers shall be specifically designed for installation of piers of this type, and shall be approved by pier manufacturer.

3. EXECUTION:

3.1 Preliminary Work

3.1.1 Do not install piers until earthwork in area in which piers are to be installed has been completed, as follows:

Perform earth excavation to expose top of existing drilled shaft and as required for installation of resistance piers.

Cut top of drilled shaft.

3.2 Installation

3.2.1 Comply with manufacturer's product data, including product technical bulletins.

3.2.2 Locate piers where shown on shop drawings.

3.2.3 Provide installation hydraulic powered units. Minimum drive equipment rating to equal or exceed the maximum force of the specified pier. Provide force monitoring device as part of the installing unit or as a separate in-line device.

3.2.4 Position pier as indicated.

3.2.5 Connect the pier bracket to the footing with manufacturer's approved anchors. Provide safe and secure connection. Apply sufficient downward pressure to advance pier. Install in a smooth and continuous manner.

3.2.6 Monitor force applied by the installing unit during the entire installation, and record values achieved on each pier. Remove encountered obstructions, or relocate pier as required.

3.2.7 Provide extensions to obtain required depth.

3.2.8 Once the pier is installed to load bearing stratum and cut to the proper elevation, a neat cement flowable pipe grout shall be installed into the pier pipe. The grout shall be introduced to the bottom of the pier by means of a tube inserted into the pier pipe.



As the grout is pumped into the pier pipe, the tube shall be removed as the elevation of the grout increases. The process shall be executed in a manner to not entrain air into the grout.

3.2.9 After raising operations are complete, voids created between the slab/grade beams and underlying soil shall be filled using a low pressure injection of flowable grout. Injection shall be through holes through the slab. The contractor shall inject the grout in such a manner as to completely fill the void without trapping pockets of air. When the operation is complete, the contractor shall repair the injection holes by filling the holes with high strength non-shrinking grout and finishing to reasonably matching the existing surface textures and elevations.

3.2.10 Grout the gaps between grade beams and drilled shaft with pressure bearing grout.

### 3.3 Depth and Tolerances

3.3.1 All pier sections shall be continuously driven by use of the drive stand and hydraulic cylinder assembly. The initial pier sections shall have the friction reduction collar on the bottom end. Additional pier sections shall be added as the pier driving operation continues. Driving of the pier sections will continue until suitable bearing stratum is reached 1.5 times working load and lifting of the structure is achieved.

Terminate at depth obtained with written approval of Engineer.

### 3.4 Field Quality Control

3.5.1 Monitor force applied by the installing units during the entire installation.

#### 3.5.2 Installation Load Tests:

Materials and equipment for testing, testing procedures, and recordkeeping shall be provided in accordance with ASTM D1143, as outlined and modified herein.

Install pier by loading in accordance with ASTM D1143 to 150% of design load. Or until lifting of the structure is archived.

#### 3.5.3 Check Pier Logs:

Throughout course of Work, Engineer may select piers to be reviewed.

#### 3.5.4 Install pier within following maximum tolerances:

Location: 3 in. from location indicated.

Plumbness: Maintain 1 in. in 10 ft. from vertical or maximum of 4 in., measured when pier is above ground.

Final pier top elevation shall be within 1 in. of Drawing top elevation.

3.5.5 Damaged piers and piers installed outside required tolerances will not be accepted. Piers rejected after installation may be abandoned and cut-off and additional piers installed to replace rejected units.

3.6 Protection

3.6.1 Protection: Protect installed product from damage during construction.

END OF THIS SECTION

**DIVISION 3 - CONCRETE**

**SECTION 3A - CAST-IN-PLACE CONCRETE**

1. GENERAL:

1.1 Description:

1.1.1 The work shall include requirements for all Cast-In-Place Concrete, as shown and specified herein. The work shall also include requirements for Concrete Form work for structural concrete, Concrete Reinforcement and Concrete Accessories.

1.1.2 Unless otherwise indicated, concrete material and work shall be in conformance with the requirements of the Standard Specifications for Road and Bridge Construction, adopted January 1, 2007, a publication of the Illinois Department of Transportation. Refer to Division 1 for additional requirements.

1.2 Submittals

1.2.1 Submit under provisions of Section 1A and Standard Specifications.

1.3 Quality Assurance

1.3.1 Under provisions of Standard Specifications.

1.4 Basis of Payment

1.4.1 Measurement

(a) The work specified for concrete shall be measured as specified in Article 503.21 of the Standard Specifications.

1.4.2 Payment

(a) The work specified under this Section shall be paid for at the contract unit price per cubic yard for CLASS SI CONCRETE, which price shall be considered as payment in full for this Item.

2. PRODUCTS:

2.1 Concrete Form Work

2.1.1 Forms shall be of wood or metal, as required, and supplied in sufficient quantities so that work can be properly accomplished.

2.1.2 Forms shall be constructed to slopes, lines and dimensions shown, plumb, straight and sufficiently tight to prevent leakage and so braced that no distortion or settling can take place during or after placing of concrete.

2.1.3 Forms shall conform to the requirements of Section 503 "Concrete Structures" of the Standard Specifications.

## 2.2 Concrete Reinforcing

### 2.2.1 General

(a) All steel reinforcement bars shall be epoxy coated deformed bars.

(b) All steel reinforcement bars shall be deformed bars conforming to the requirements of AASHTO M-31, M-42 or M-53 Grade 60 ksi, and the applicable portions of the Standard Specifications. Epoxy coated bars shall conform to the requirement of AASHTO M284. Submit one sample of 12 inch long steel reinforcement bars and one sample each reinforcement accessories. Materials shall meet the requirements of Section 508 and Section 1006 of the Standard Specifications.

(c) Reinforcing bars shown to be welded on Drawings shall be Designation ASTM A706, Grade 60.

(d) Welded wire fabric shall conform to the requirements of AASHTO M55.

(e) Minimum clearances for reinforcement bars shall be as shown on the Plans. Where clearances are not shown on the Plans, the minimum clearances shall be as specified in ACI-318 (Building Code Requirements for Structural Concrete).

## 2.3 Cast-In-Place Concrete

### 2.3.1 General

(a) Unless otherwise indicated, all regular concrete shall be Class SI with 14 days Compressive Strength of 3,500 psi Section 1020 of the Standard Specifications.

Fly ash shall be stored at the concrete mixing plant separately from the cement. Fly ash and cement shall not be intermixed prior to being added to the concrete mix.

(b) Unless otherwise indicated, all cement shall be Portland Cement type I or II.

(c) The coarse aggregate gradations for all regular concrete (Class SI) shall be CA7 or CA 11.

(d) Concrete Proportions: Concrete proportions shall be selected to provide the required strength and durability and to provide work ability and consistency so that the concrete can be worked into forms and around reinforcement without segregation or excessive bleeding.

Establish concrete proportions including the water-cementitious material ratio on the basis of field experience or trial mixtures with the materials to be used in accordance with Section 5.3 of ACI 318.

- (e) The concrete mix design slumps shall be within the following limits:

Concrete Placement (Class Sl)

Normal 2 in. to 4 in.

Pumped 4 in. to 6 in.

3. EXECUTION:

3.1 Form

3.1.1 Form Installation

(a) Form surfaces shall be smooth and free from any imperfections which would cause objectionable roughness on the finished surface of the concrete.

(b) All forms for concrete shall be tied with rods or patented ties where the concrete is to be exposed. Ties within the forms shall be constructed so as to permit their removal in accordance with the requirements of Section 503.06 of the Standard Specifications. Ties which are left in place within water containing structures shall be provided with swaged washers or other suitable devices to prevent seepage or moisture along the ties. Use lugs, cones, washers or other devices which do not leave holes or depressions greater than 7/8-inch in diameter.

(c) All necessary inserts in form work such as rods, bolts, anchorages, fillets, and other devices shall be installed as required.

(d) Forms shall not be treated with material that will adhere to or discolor the concrete.

(e) All sheeting, bracing and timbering shall be placed entirely outside of the neat lines of the structure, except that flanges or projections of steel shapes may extend into the concrete a distance not exceeding 2 inches. All sheeting shall be closely fitted to the excavation and no timber shall be left within the finished lines of the structure. The bracing shall be so arranged that no stress will be placed on any part of the sub-structure concrete until the concrete has developed sufficient strength to support safely the load thereon.

(f) For all exposed concrete edges a 3/4 inch chamfer strip shall be provided.

3.1.2 Form Removal

(a) Forms shall be removed in such manner and at such a time as to insure the complete safety of the structure. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support safely their weight and load thereon. The results of suitable control tests shall be used as evidence that the concrete has attained the required strength.

(b) Removal of forms shall conform to Section 503.06 of the Standard Specifications.

### 3.2 Concrete Reinforcing

#### 3.2.1 Reinforcing Installation

(a) Placing and fastening of reinforcement shall be as per Article 508 of Standard Specifications.

(b) The Contractor shall furnish to the Engineer complete bar bending details, bar lists, weights and detail drawings for the fabricating and placing of all reinforcement to be furnished under this contract. Such lists and drawings shall be prepared in accordance with the methods and standards of "Manual of Standard Practice for Detailing Reinforced Concrete Structures", issued by the American Concrete Institute (ACI 315, SP66), except as otherwise shown on the plans or ordered by the Engineer.

(c) Bar bending details, bar lists, weights and detail drawings furnished by the Contractor will be examined by the Engineer and it shall be understood by the Contractor that a responsible amount of time will be necessary for their examination before they can be approved or returned for correction. No reinforcement shall be fabricated until the bar bending details and detail drawings have been approved by the Engineer. The Contractor shall furnish to the Engineer, without extra charge therefore, copies of the approved bar bending details, bar lists and detail drawings in such number as the Engineer may require.

(d) Mechanical connections, where shown, shall be provided to develop at least 125 percent of the Specified Yield Strength of the bar in tension.

### 3.3 Cast-In-Place Concrete

#### 3.3.1 Placing Concrete

(a) Concrete placement and consolidation shall comply with provisions of Section 503 of the Standard Specifications.

(b) Once concreting is started it shall be carried on as a continuous operation until the placing of the section between construction joints is completed. Sections containing "cold joints" will not be accepted and shall be removed and replaced at the Contractor's expense.

(c) Concreting in freezing weather shall comply with the provisions of Section 1020 of the Standard Specifications.

(d) Old concrete surfaces that will be in contact with the new concrete shall be coated with an epoxy bonding agent, Sika Chemical Co. Sikadur Ili-Mod (Sikastix 370), or approved equal. Application shall be in strict conformity with the manufacturer's recommendations, with particular attention given to temperature requirements. Applicable provisions of Article 503.09 (a) (2) of the Standard Specifications shall be followed. This work will not be paid for separately, but shall be incidental to the contract unit price for Class SI Concrete, and no additional compensation will be allowed.

- (e) The concrete surface for wet well and channel bottom shall be screeded and wood floated.
- (f) All interior surfaces that will be exposed to view after completion of the work shall be given a normal finish in accordance with Section 503.16(a) of the Standard Specifications.
- (g) All top slab surfaces exposed to the weather shall be finished to a true and even surface with floats and trowels. The final troweling shall be done with a steel trowel, leaving a smooth even surface. After the water sheen has disappeared, the surface shall be given a final finish by brushing with a whitewash brush. The brush shall be drawn across the slab with adjacent strokes slightly overlapping, producing a uniform, slightly roughened surface with parallel brush marks. All edges shall be rounded with an edging tool.
- (h) Concrete floor slab of building shall have a smooth steel troweled finish and all edges of finished surfaces shall be rounded or leveled with edging tools. The pumping station floor slab shall be treated with an approved floor hardener and sealer.
- (i) All concrete shall be cured for a minimum of 7 days in accordance with Section 1020.13, "Curing and Protection" of Portland Cement Concrete.

END OF THIS SECTION

## DIVISION 3 - CONCRETE

### **SECTION 3B - GROUT**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Grout for pipe and conduit penetrations.

1.1.2 Grout for anchor bolts.

1.1.3 Grout for slide gate frame.

##### 1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 4A - Unit Masonry.

1.2.3 Section 5A - Structural Steel.

##### 1.3 References

1.3.1 ASTM C109 - Compressive Strength of Hydraulic Cement Mortars (using 2" or 50 mm. Cube Specimens).

1.3.2 ASTM C144 - Aggregate for Masonry Mortar.

1.3.3 ASTM C150 - Portland Cement.

1.3.4 ASTM C191 - Time of Setting of Hydraulic Cement by Vicat Needle.

1.3.5 ASTM C827 - Early Volume Change of Cementitious Mixtures.

1.3.6 CRD-C-588 - Specifications for Non-Shrink Grout.

1.3.7 CRD-C-619 - Specification for Grout Fluidifier.

1.3.8 CRD-C-621 - Specification for Non-Shrink Grout.

#### 1.4 Submittals

1.4.1 Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476 and test and evaluation reports to ASTM C1019.

1.4.2 Submit manufacturer's installation instructions under provisions of Division 1.

#### 1.5 Tests

1.5.1 Testing of grout will be performed under provisions of Division 1.

#### 1.6 Delivery, Storage and Handling

1.6.1 Grout materials from manufacturers shall be delivered in unopened containers.

1.6.2 Maintain packaged materials clean, dry and protected against dampness, freezing and foreign matter.

#### 1.7 Environmental Requirements

1.7.1 Maintain materials and surrounding air temperatures to a minimum of 50°F prior to, during and 48 hours after completion of the Work.

1.7.2 If manufacturer's requirements are more stringent, such requirements shall govern.

#### 1.8 Basis of Payment

1.8.1 The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

### 2. PRODUCTS:

#### 2.1 Materials

2.1.1 Each required material shall have one manufacturer throughout the use of that material on the Work.

2.2 Manufacturers - Non-Shrink, Non-Metallic, 100% Solid, High Strength Epoxy Grout

2.2.1 Sikadur 42, Grout-Pak by Sika Chemical Company.

Five Star Epoxy Grout by U.S. Grout Corporation.

Substitutions: Under provisions of Division 1.

2.3 Materials- Non-Shrink, Non-Metallic, Cementitious Grout

2.3.1 Pre-mixed, non-staining, cementitious grout requiring only the addition of water at the job site; conforming to the following:

(a) Non-shrink: No shrinkage (0.0%) and a maximum of 0.2% expansion in the hardened state when tested in accordance with CRD-C-621.

(b) Compressive Strength: A minimum 28-day compressive strength of 7,000 psi when tested in accordance with ASTM C109.

(c) Setting Time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C191.

(d) Composition: Shall not contain metallic, particles, chlorides or expansive cement.

2.4 Manufacturers - Non-Shrink, Non-Metallic, Cementitious Grout

2.4.1 Sika Grout 212 by Sika Chemical Company.

2.4.2 Masterflow 928 by Master Builders Company.

2.4.3 Sealtight 588 grout by W. R. Meadows, Inc.

2.4.4 Substitutions: Under provisions of Division 1.

2.5 Materials - Cement-Sand Grout

2.5.1 Use 1 part cement to 3 parts sand. Keep the water cement ratio below 0.45 and achieve a minimum 28-day compressive strength of 4,000 psi.

2.5.2 Cement: ASTM C150, Type 2.

2.5.3 Sand: ASTM C33.

2.5.4 Water: Clean, fresh, potable water free from injurious amounts of vegetable matter and mineral salts.

3. EXECUTION:



### 3.1 Inspection

3.1.1 Examine conditions under which grout is to be installed and notify Engineer in writing of unsatisfactory conditions or deficiencies that have been corrected.

### 3.2 Installation

3.2.1 Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until Engineer provides clarification.

3.2.2 Drypacking for vertical grouting behind vertical base plates.

3.2.3 Manufacturers of proprietary products shall make available upon 72 hours' notification the services of a qualified, full-time employee to aid in assuring proper use of the product under job conditions.

3.2.4 Placing grout shall conform to temperature and weather limitations in Section 3A.

### 3.3 Schedule

3.3.1 Non-Shrink, Non-Metallic Cementitious Grout: anchor bolts, pipe supports, pipe and conduit penetration, slide gate frame, pipe thrust support structures.

3.3.2 Cement-Sand Grout: Pipe and conduit penetrations for non-water containing structure, masonry Work and repair of exposed concrete.

END OF THIS SECTION

## **DIVISION 4 - MASONRY SYSTEM**

### **SECTION 4A - UNIT MASONRY**

#### 1. GENERAL:

##### 1.1 Description

1.1.1 The scope of work under this Division shall include the furnishing and installing of all masonry units, grout and mortar, reinforcing steel, wall ties, flashing, and appurtenant work required to complete the masonry walls as shown on the Drawings and as specified herein. Refer to Division 1 for additional requirements.

1.1.2 The Contractor shall be responsible for ascertaining the extent of work by other trades which require coordination with this work and shall be responsible for the coordination thereof.

1.1.3 This work shall include the building in of all door and window frames, vents, louvers, conduits, pipes, etc. as shown on the Drawings and as furnished by and set by others.

##### 1.2 Related Sections

- 1.2.1 Section 3A - Cast-In-Place Concrete.
- 1.2.2 Section 5A - Structural Steel.
- 1.2.3 Section 5B - Metal Fabrications.
- 1.2.4 Section 6A – Rough Carpentry.
- 1.2.5 Section 7B - Sheet Metal Flashing and Trim.
- 1.2.6 Section 7C - Joint Sealers.
- 1.2.7 Section 7D - Board Insulation.
- 1.2.8 Section 8A - Aluminum Doors and Frames.
- 1.2.9 Section 8B - Door Hardware.
- 1.2.10 Section 10A – Specialties.
- 1.2.11 Divisions 15.

1.3. Reference Standards

1.3.1 This work is subject to the requirements of the applicable portions of the following standards:

General:

- (a) ACI-530: Building Code Requirements for Concrete Masonry Structures.
- (b) ACI-530.1: Specifications for Masonry Structures.
- (c) IBC 2006: International Building Code.

Mortar:

ASTM C5: Quicklime for Structural Purposes.

ASTM C144: Aggregate for Masonry Mortar.

ASTM C150: Portland Cement.

ASTM C207: Hydrated Lime for Masonry Purposes.

ASTM C270: Mortar for Unit Masonry.

ASTM 404: Aggregates for Masonry Grout.

ASTM C476: Grout for Masonry.

ASTM C780: Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

ASTM C1019: Method of Sampling and Testing Grout.

Unit Masonry:

ASTM A123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

ASTM A525: Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

ASTM B370: Copper Sheet and Strip for Building Construction.

ASTM C90: Hollow Load Bearing Concrete Masonry Units.

ASTM C216: Facing Brick (Solid Masonry Units Made From Clay or Shale).

1.4 Submittals

1.4.1 Samples of glass block shall be submitted. As a minimum, samples shall include 3 blocks.

1.4.2 Samples of brick (to match existing brick used) shall be submitted. As a minimum, samples shall include 3 blocks.

1.4.3 Samples of glazed masonry units (to match existing interior glazed brick or block used) shall be submitted. As a minimum, samples shall include 3 blocks.

1.4.3 Material submittals shall include manufacturer's certification of compliance for the type and grade of masonry units supplied.

1.4.4 Include design mix, indicate proportion or property method used, required environmental conditions, and admixture limitations.

1.4.5 Submit test reports on mortar indicating conformance with ASTM C270.

1.4.6 Submit test reports on grout indicating conformance with ASTM C476 and C1019.

1.4.7 Submit manufacturer's certificate indicating that products meet or exceed specified requirements.

1.5 Delivery and Storage

1.5.1 Deliver cements and lime to the site in unopened containers. Use one manufacturer's product for each type of material throughout the work. Do not use material that has, in the opinion of the Engineer, become unstable for good construction.

1.5.2 Store cementitious materials off the ground and completely cover with a wind safe waterproof covering.

1.5.3 Take special precautions during transit and storage of masonry units to protect them from staining or discoloration from any cause whatsoever and replace permanently discolored units, whether set in place or not. Stains which cannot be removed with clean water and fiber brushes shall be considered defects and pieces so stained shall not be used.

1.5.4 Stack masonry units on platforms and cover, or store in other approved manner that will protect them from contact with soil and from weather exposure.

## 1.6 Environmental Requirements

1.6.1 Maintain materials and surrounding air temperatures to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

## 1.7 Mix Tests

1.7.1 Testing of Mortar Mix: In accordance with ASTM C780.

1.7.2 Test mortar mix for compressive strength, slump, consistency, mortar aggregate ratio, water content, air content and splitting tensile strength.

1.7.3 Testing of Grout Mix: In accordance with ASTM C1019.

## 1.8 Field Measurements

1.8.1 Verify that field measurements are as indicated on the Drawings.

## 1.9 Basis of Payment

1.9.1 The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

## 2. PRODUCTS:

### 2.1 Brick units

#### 2.1.1 Manufacturers:

Belden

Darlington

Hanley

Substitutions: Approved equal

2.1.2 Brick masonry units shall be face brick in accordance with ASTM C216, Type FBS, Grade SW (severe weathering/exposure), zero efflorescence.

2.1.3 Brick masonry units shall be nominal modular size of 4 x 8 x 2-3/8 inches. Provide special solid brick units for corners, lintels, headers, bases and other special conditions as required.

2.1.4 Color and texture of brick to be desert color and textures matching to the existing pump station exterior brick..

## 2.2 Concrete Block (Glazed and Standard Type CMU)

### 2.2.1 Manufacturers:

Each type of masonry unit shall have a single source of supply through completion of the Work. Substitutions will not be allowed without written approval of the Engineer.

2.2.2 Glazed concrete masonry units shall be subjects to requirements, provide factory glazed concrete masonry units from one of the following or approved equal.

1. The Spectra Group, Spectra glazed II CMU.
2. Trenwyth, Astra-glazed CMU.

2.2.3 Hollow load bearing concrete block units shall conform to ASTM C 90, Grade N, Type 1, normal weight.

2.2.4 Masonry units: Provide nominal modular size of 8 x 16 x 4, 6, or 8 inches. Provide special units for 90 degree corners, bond beams, lintels, jambs, and other special conditions as required.

2.2.5 Contractor shall provide samples that are the closest color and texture matching to the existing interior glazed block. Color and texture of glazed block will be chosen by the Department. If samples are unsatisfactory to the Department, Contractor shall provide additional samples for review. The Department may also suggest a glazed block type for Contractor to use as the match. The Department's glazed block chosen shall be provided by the Contractor at no additional cost to the Department.

2.2.6 Concrete Masonry Unit Compressive Strength: Provide units with a minimum net area compressive strength of  $f'm = 3,000$  pounds per square inch.

## 2.3 Glass Block

2.3.1 Manufacturer - Subject to compliance with requirements, provide glass block of one of the following, or an approved equal:

Pittsburgh Corning Corp., Vistabrick Type  
Saint-Gobain

2.3.2 The glass block shall be solid, transparent blocks with smooth outer faces made by fusing together two solid slabs of clear, colorless glass with manufacturer's standard coating factory-applied on edge surfaces. Sizes shall be either 3 inch thick by 7-3/4 inch square actual size.

2.3.3 Accessories: Panel reinforcing shall be formed of two parallel wires with cross wires at regular intervals. Expansion strips shall be dense glass fiber matting 3/8" thick x 3" wide. Asphalt emulsion shall be water based.

2.3.4 Aluminum angles, plates and tube sections are to be provided with an anodic R1-A1 finish. Interior and exterior color to be selected by Engineer.

## 2.4 Mortar

### 2.4.1 Materials:

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Masonry Cement: Not permitted for use.
- C. Mortar Aggregate: ASTM C144, standard masonry type. Grading and color suitable for type of masonry, one source for entire project.
- D. Hydrated Lime: ASTM C207. Type S
- E. Quicklime: ASTM C5, non-hydraulic type.
- F. Grout Aggregate: ASTM C404
- G. Grout Fine Aggregate: Sand, 50 percent by volume.
- H. Water: Clean and potable.

### 2.4.2 Pre-Mix Mortar:

Ready mix mortar may be used on this project per the following mortar type listed below:

Ready Mixed Mortar for all load bearing and non loading bearing walls and partitions: ASTM C1142, Type RS with an average compressive strength of 1800 psi at 28 day strength.

### 2.4.3 Mortar Mixes:

Mortar for Load, Non-Load Bearing Walls and Partitions, and Reinforced Masonry: Mortar shall be Type S and shall conform to ASTM C 270, with a minimum compressive strength of 1800 psi utilizing the Proportion Method.

Pointing Mortar: Mortar shall be Type N and shall conform to ASTM C270, using the Property Method.

The mortar shall have proportions of 1 part Portland cement, 1/2 part hydrated lime and 4 parts sand by volume. A measuring box shall be used to attain the specified mix. Sand shall be measured in a loose, damp condition.

Mortar shall be freshly prepared and uniformly mixed and shall be of spreadable, workable consistency.

The mortar shall be re-tempered with water as required to maintain high plasticity. Re-tempering on mortar boards shall be done only by adding water within a basin formed with the mortar and the mortar worked into the water. Any mortar which has stiffened or which is unused after one and one-half hours from the initial mixing shall not be used.

The mortar ingredients shall be mixed in a batch mixer for not less than three minutes.

The use of fire clay, rock dust, dirt and other deleterious materials is prohibited.

## 2.5 Grout

2.5.1 Grout shall conform to ASTM C 476 and shall have a minimum strength of 3,000 psi at 28 days.

2.5.2 Grout shall have proportions of 1 part Portland cement 0.10 parts hydrated lime and 3 parts sand by volume.

2.5.3 Bond Beams: Lintels: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.5.4 Engineered Masonry: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

## 2.6 Cement

Cement shall be Type 1 Portland cement conforming to ASTM C 150. Plastic cement shall not be used.

## 2.7 Lime

Hydrated lime shall conform to ASTM C 207.

## 2.8 Aggregates

2.8.1 All aggregate for mortar and grout shall be sharp, clean, and well graded and free of injurious amounts of dust, lumps, shale, alkali, surface coatings and organic matter.

2.8.2 Aggregate for mortar shall conform to ASTM C 144.

2.8.3 Aggregate for grout shall conform to ASTM C 404 Size No. 2.

## 2.8 Water

2.8.1 Water shall be free of deleterious quantities of acids, alkalis and organic materials and shall come from a domestic supply.

## 2.9 Reinforcing Steel

2.9.1 Steel reinforcement bars shall conform to the requirements of AASHTO M-53 Grade 60 ksi, or ASTM A615 Grade 60 ksi, epoxy coated, deformed billet bars and the applicable portions of the Standard Specifications.

2.9.2 Reinforcement shall be clean and free from loose rust, scale, dirt, and any coatings that reduce bond.

2.9.3 Mechanical splice anchors for reinforcing bars: submit product data and information for review.

## 2.10 Horizontal Joint Reinforcement and Metal Accessories:

2.10.1 Wire for joint reinforcement shall be truss type, with moisture drip, hot dip galvanized after fabrication, cold-drawn steel and shall conform to ASTM A 82 and ASTM A 153, Class B2. As a minimum, longitudinal wires shall be 3/16" side rods with gage cross ties.

2.10.2 Manufacturer - Subject to compliance with requirements, provide horizontal joint reinforcement of one of the following, or an approved equal:

A. A. Wire Products Co.  
Dur-O-Wall, Inc.

2.10.3 Horizontal Joint Reinforcement and Metal Accessories shall be as follows:

(a) The width of the horizontal reinforcing shall be 2 inches less than the actual thickness of the wall or partition in which it is to be placed. Splicing of horizontal reinforcing, including corner and partition reinforcing, shall be done by providing a 8-inch overlapping of side rods.

(b) Corners shall be reinforced with Blok-Trus Corner-Lok, standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R. Intersection between walls and partitions shall be reinforced horizontally with Blok-Trus Partition-Lok, standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R, or equal, spaced at 16-inch centers vertically, in the same course as the wall reinforcing.

(c) Solid and hollow interior or exterior masonry walls shall be reinforced horizontally with Blok-Trus AA600, (AA610) Standard 9-gauge (0.148") S/R by 9-gauge (0.148") C/R or equal, spaced at 16-inch centers vertically.

## 2.11 Flashings

2.11.1 Refer to Section 7B Sheet Metal Flashings and Trim.

## 2.12 Accessories

2.12.1 Preformed Control Joints: Neoprene or Polyvinylchloride; polyethylene, or polyurethane, oversized 50 percent joint width; self-expanding; maximum lengths.

2.12.2 Weep Holes: Cotton wicks to be installed in drilled out holes that will be used as weep holes.

2.12.3 Bellows Type Wall Expansion Joint: Wall expansion joint-consists of a polyurethane in open-cell type expanding foam laminations; laminations are enclosed with a closed cell external silicone skin surface; composite joint is precompressed with bellows type surface on the front exposed face that allows for 50%± movement in each direction.

Bellows Type Wall Expansion Joint: ASeismic Colorseal® by Emseal or approved equal.

2.12.4 Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials per the following:



Cleaners for red and light colored brick not subject to metallic staining with mortar not subject to bleaching.

- (a) Sure Klean No. 600 Detergent; PrSoCo. Inc.
- (b) Approved equal.

Cleaners for brick subject to metallic staining:

- (a) Sure Klean Vana Trol; ProSoCo. Inc.
- (b) 202V VanaStrop; Deitrich Technologies, Inc.
- (c) Approved equal.

2.12.5 Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 inch steel wire, hot-dip galvanized after fabrication.

## 2.13 Limestone Sill

2.13.1 Furnish Indiana (oolitic) limestone complying with ASTM C568, Category II (medium density), and as follows.

2.13.2 Minimum Compressive Strength: 4,000 psi (ASTM C170) and maximum absorption of 7.5% (ASTM C97).

## 3. EXECUTION:

### 3.1 General

3.1.1 The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed before starting the masonry.

3.1.2 All masonry shall be laid true, level and plumb in accordance with the Drawings.

3.1.3 Proper masonry units shall be used to provide for all windows, doors, vents, bond beams, lintels, etc. as shown on the Drawings or otherwise required to provide a minimum of unit cutting.

3.1.4 Where masonry unit cutting is necessary, all cuts shall be neat and true and made by a masonry saw. Openings for other trades shall be neatly patched.

3.1.5 Unless otherwise indicated, the masonry units shall be laid in a running bond pattern. All bond patterns and special details shown on the drawings shall be accurately and uniformly executed.

3.1.6 All masonry units shall be sound, free of cracks or other defects that would interfere with the proper placing of the unit or impair the strength of construction.

3.1.7 The starting joint on foundations shall be laid with full mortar coverage on the bed joints, except that area where the grout occurs shall be free from mortar, so that the grout will be in contact with the foundation.

The starter course shall be laid out dry to determine the extent to which they must be cut, or joint sizes varied, to accomplish accurate horizontal coursing.

3.1.8 Mortar joints shall be straight, clean, and uniform in thickness and shall be tooled joints. Unless otherwise indicated, both horizontal and vertical masonry joints shall be 3/8-inch nominal thickness.

3.1.9 Unless otherwise indicated, all face joints shall be tooled to provide a concave joint. Tooling shall be done when the mortar is partially set and still sufficiently plastic to bond. The tooling shall be done in a manner to provide strength and weather resistance. Unless otherwise indicated all concrete block joints shall be tooled. Where tooled joints are not possible, the joints shall be troweled flush.

3.1.10 Care shall be taken to prevent visible mortar and grout stains on all sides that will be exposed to view. In general, the walls shall be kept continually clean. Grout run over shall be cleaned immediately.

3.1.11 All surfaces, including sills, ledges, finished concrete, etc., shall be protected from mortar droppings or other damage during construction.

3.1.12 Horizontal reinforcing shall be laid on the webs of bond beam units.

3.1.13 Wire reinforcement shall be completely embedded in mortar or grout. Mortar joints with wire reinforcement shall be at least twice the thickness of the wire.

3.1.14 Install horizontal joint reinforcement 16 inches o.c. Place joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening. Place joint reinforcement continuous in first joint below top of walls.

3.1.15 As a minimum, wire reinforcement shall be lapped 8 inches at splices and shall contain at least one cross wire of each piece of reinforcement in the lap distance.

3.1.16 Reinforcement shall be in place before grouting starts. The grouting space shall be free from mortar droppings. All grout shall be puddled or vibrated in place.

3.1.17 All cells containing reinforcement, anchor bolts, inserts, etc. shall be grouted solidly. Spaces around metal door frames and other built-in items shall be filled solidly with grout.

3.1.18 Beams and other structural members shall be anchored to the wall with anchor bolts or their equivalent. Anchors shall be fully, solidly embedded in place. Embedment shall not be less than 2/3 of wall thickness unless otherwise noted. Bearing pads shall be furnished below beams to prevent spalling of the masonry, if required.

3.1.19 Masonry shall not be erected when the ambient temperature is below 0 degrees C (32 degrees F) with a rising temperature, or below 4 degrees C (40 degrees F) with a falling temperature, or when there is a probability of such a condition existing within 48 hours, unless special provisions are made for heating the materials and protecting the work from freezing. Protection shall consist of heating and maintaining the temperature of the masonry materials at not less than 4 degrees C (40 degrees F) but not more than 71 degrees C (160 degrees F), and maintaining an air temperature above 4 degrees C (40 degrees F) on both sides of the masonry for not less than 72 hours.

Work will not be permitted with or on frozen materials. Masonry work which has frozen before the mortar has set shall be removed and replaced. No brick or other units having a film of frost on their surfaces shall be laid in the walls.

3.1.20 One section of the walls shall not be carried up in advance of the others, unless specifically approved. Heights of masonry shall be checked with an instrument at sills and heads of openings, to maintain the level of the walls.

3.1.21 Unfinished work shall be stepped back for jointing with new work; toothing will not be permitted, except where specified. All loose mortar shall be removed and the exposed jointing thoroughly wetted for not less than 12 hours before laying new work.

3.1.22 Surfaces of masonry not being worked on shall be properly protected at all times during the construction operation. When rain or snow is imminent and the work is discontinued, the tops of exposed masonry walls and similar surfaces shall be covered with a strong waterproof membrane, well secured in place.

### 3.2 Cavity Wall Construction

3.2.1 Do not permit mortar to drop or accumulate into cavity air space or to plug weep.

3.2.2 Build inner wythe ahead of outer wythe to receive cavity insulation and vapor barrier sheet/adhesive.

3.2.3 Provide weephole at base of flashings space not over 32 in. on center with a minimum of one weephole between openings. Keep weepholes and area above flashings free of mortar.

### 3.3 Concrete Masonry Units

3.3.1 All concrete masonry units shall be true, plumb and built to the thickness and bond pattern indicated. Special units shall be furnished and used where indicated and as specified. Cutting of units shall be avoided insofar as possible. Cutting at the site shall be done with a power-driven carborundum saw. Units shall not be wetted prior to use.

3.3.2 The first course of concrete masonry units shall be laid in a full bed of mortar for the full width of the unit. Bed joints of a concrete masonry unit shall be formed by applying the mortar to the entire top surfaces of the inner and outer face shells, and the head joints shall be formed by applying the mortar for a width of about 1 inch to the ends of the adjoining units laid previously. Mortar for joints shall be smooth, not furrowed, and of such thickness that it will be forced out of the joints as the units are being placed in position. Where anchors, bolts, reinforcing and ties occur within the cells of the units, such cells shall be filled with mortar or grout as the work progresses. Concrete brick shall be used for topping out walls under sloping slabs, distributing concentrated loads, backing brick headers, and elsewhere as indicated.

3.3.3 Concrete masonry lintels shall be installed over openings where steel lintels are not scheduled. Place reinforcing bars 1 inch from bottom web. Use single piece reinforcing bars only; do not splice reinforcing bars. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position. Place and consolidate grout fill without displacing reinforcing. Grout minimum 2 courses solid (16 inches high) or higher as shown on Contract Drawings.

Allow masonry lintels to attain specified strength before removing temporary supports. Refer to the following bond beam lintel schedule below:

Openings up to 42 inches wide: Place two (2) No. 4 bars 1 inch from bottom web.

Openings from 42 inches up to 78 inches wide: Place two (2) No. 5 bars 1 inch from bottom web.

#### 3.3.4 Grouted Components

Reinforce bond beam (where required and as indicated on drawings) with two (2) No. 5 bars, placed continuous bottom reinforcement.

Reinforce other grouted components as shown on Contract Drawings.

Lap splices minimum 40 bar diameters.

Support and secure reinforcing bars from displacement. Maintain position within 2 inch of dimensioned position.

Place and consolidate grout fill without displacing reinforcing.

At bearing locations, fill masonry cores with grout for a minimum 16 inches either side of opening.

#### 3.3.5 Control Joints:

Do not continue horizontal joint reinforcement through control joints.

Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

#### 3.3.6 Built-In Work

As work progresses, build in steel frames at door openings, anchor bolts, embed bearing plates, lintels and other items furnished by other Sections.

Build in items plumb and level.

Bed anchors of steel frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

Do not build in organic materials subject to deterioration.

#### 3.3.7 Tolerances

Maximum variation from unit to adjacent unit: 1/32 inch.

Maximum variation from plane of wall: 1/4 inch in 10 feet, and 2 inch in 20 feet or more.

Maximum variation from plumb: 1/4 inch per story non-cumulative; 2 inch in two stories or more.

Maximum variation from level coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 2 inch in 30 feet.

Maximum variation of joint thickness: 1/8 inch in 3 feet.

Maximum variation from cross sectional thickness of walls: 1/4 inch.

### 3.3.8 Cutting and Fitting

Cut and fit for chases, pipes, conduit, sleeves and other components. Coordinate with other Sections of work to provide correct size, shape, and location.

Obtain Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.4 Glass Block

3.4.1 Glass block including reinforcing, expansion strips, coatings, anchors and sealants shall be installed in accordance with the manufacturer's recommendations.

3.4.2 Clean glass units of substances that may impair bond with mortar or sealant. Coat sill under units with asphalt emulsion as a bond breaker, and allow to dry. Set panel anchors in mortar bed directly over coating. Provide full mortar joints. Furrowing not permitted. Remove excess mortar. Maintain uniform joint width of 3/8 inch.

3.4.3 Place panel reinforcement at every second horizontal joint in full mortar bed and at first course above and below openings within the glass unit panel. Discontinue reinforcement at expansion strips.

### 3.5 Clean-Up

3.5.1 All surplus material and debris shall be removed from the job site when the masonry work is completed. Any items defaced from the masonry work shall be cleaned.

3.5.2 Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units where intended. Provide new units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

3.5.3 After mortar is thoroughly set and cured, remove large mortar particles by hand with wooden paddles and non-metallic scrape holes or chisels.

3.5.4 Use bucket and brush hand cleaning method as described in BIA "Technical Note No. 20 Revised" to clean brick masonry made from clay or shale, except use detergent type masonry cleaner.

END OF THIS SECTION

## **DIVISION 5 - METALS**

### **SECTION 5A - STRUCTURAL STEEL**

1. GENERAL:
  - 1.1 Section Includes
    - 1.1.1 Structural steel framing members and support members.
    - 1.1.2 Base plates.
    - 1.1.3 Grouting under base plates.
  - 1.2 Related Sections
    - 1.2.1 Section 3A - Cast-In-Place Concrete.
    - 1.2.2 Section 3B - Grout.
    - 1.2.3 Section 4A - Unit Masonry.
    - 1.2.4 Section 5B - Metal Fabrications.
    - 1.2.5 Section 9A - Painting.
  - 1.3 References

All reference standards shall be from the latest edition.

- 1.3.1 AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
- 1.3.2 ASTM A36 - Structural Steel.
- 1.3.3 ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- 1.3.4 ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
- 1.3.5 ASTM A123 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
- 1.3.6 ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- 1.3.7 ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
- 1.3.8 ASTM A325 - High Strength Bolts for Structural Steel Joints.
- 1.3.9 ASTM A500 - Cold-Formed Welded & Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.3.10 ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

1.3.11 ASTM A 992 – Structural Steel Shapes

1.3.12 ASTM B6 - Zinc (slab zinc).

1.3.13 AWS A2.0 - Standard Welding Symbols.

1.3.14 AWS D1.1 - Structural Welding Code.

1.3.15 SSPC - Steel Structures Painting Council.

#### 1.4 Design Requirements

1.4.1 Where final design of members and connections for any portion of the structure is not indicated, perform final design of such members and connections in accordance with AISC Specification and as Specified herein, at no additional cost.

1.4.2 Members and connections shall be designed by a structural engineer registered in the place of the project.

1.4.3 Unless otherwise indicated, design connections in accordance with American Institute of Steel Construction "Manual of Steel Construction, Latest Edition" to support half the total uniform load calculated from the table of "Allowable Uniform Loads for Beams Laterally Supported" for given shape, span and steel strength specified. If load in kips has been noted in parentheses near end of beam designation on Drawings, design connection at each end of that member for that load.

1.4.4 One-sided, or other types of eccentric connections not indicated, will not be permitted without prior approval.

#### 1.5 Submittals

##### 1.5.1 Shop Drawings

(a) Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments and fasteners.

(b) Connections. Show connection details and submit all connection design calculations, sealed by a Professional Structural Engineer licensed in the place of the project.

(c) Indicate welded connections with AWS A2.0 welding symbols. Indicate net weld lengths and size. Distinguish between work to be performed in the shop and in the field.

(d) Review of shop drawings in no way affects the Contractor's responsibility for carrying out the Work to Contract Drawings and specifications.

(e) Shop drawings shall be approved prior to fabrication.

(f) Copies of the contract drawings shall not be marked and submitted as shop drawings.

1.5.2 Manufacturer's Mill Certificate: Submit under provisions of Division 1 certifying that products meet or exceed specified requirements.

1.5.3 Welders' Certificates: Submit under provisions of Division 1 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualifications within the previous 12 months in the position in which they will be carrying out the welding.

1.5.4 Substitutions of sections or modifications of details and the reasons for these changes shall be submitted by letter with shop drawings for review by the Engineer. Changes in related portions of the Work shall be coordinated by the Contractor.

## 1.6 Quality Assurance

1.6.1 Fabricate structural steel members in accordance with AISC-Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

## 1.7 Qualifications

1.7.1 Fabricator: Company specializing in performing the work of this Section with minimum 5 years documented experience.

1.7.2 Erector: Company specializing in performing the work of this Section with minimum 5 years documented experience.

## 1.8 Field Measurements

1.8.1 Verify that field measurements are as shown on Drawings, shop drawings and as instructed by the manufacturer.

## 1.9 Basis of Payment

1.9.1 The work specified under this Section and as required shall be paid for at the Contract unit price per kilogram (pound) for FURNISHING AND ERECTING STRUCTURAL STEEL, which price shall be payment in full for all labor, materials, tools, equipment and incidentals required to complete this Item.

## 2. PRODUCTS:

### 2.1 Materials

2.1.1 Structural Steel Members: ASTM A36 or A 992.

2.1.2 Structural Tubing: ASTM A500, Grade B.

2.1.3 Pipe: ASTM A53, Grade B.

2.1.4 Bolts, Nuts, and Washers: ASTM A325, friction type.



2.1.5 Anchor Bolts: ASTM A307, Grade A for headed anchor bolts. ASTM A36 for non-headed anchor bolts.

2.1.6 Welding Materials: AWS D1.1; type required for materials being welded.

Welding Electrodes:

- (a) Shielded Metal-Arc: AWS A5.1 or AWS 5.5, E70XX.
- (b) Submerged-Arc: AWS A5.17, F7X-EXXX.
- (c) Gas Metal-Arc: AWS A5.18, E70S-X or E70U-1.
- (d) Flux Cored-Arc: AWS A5.20, E70-T-X (except 2, 3, 10,-GS).

2.1.7 Sliding Bearing Plates: ASTM A36.

2.1.8 Shop and Touch-Up Primer: Per Section 9A - PAINTING.

2.1.9 Headed studs to conform to ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi. Studs to conform to requirements of AWS Code.

2.1.10 Materials shall meet the requirements of the Standard Specifications, Section 1,000.

2.2 Fabrication

2.2.1 Fabricate all members as indicated on Drawings and as outlined in AISC.

2.2.2 Make connections as indicated. Weld shop connections. Bolt field connections. Use nuts and bolts conforming to requirements of ASTM A325 in friction-type connections for all bolted connections except column base anchor bolts to be ASTM A307 bolts. Unless noted otherwise, all bolts to be 3/4 inch diameter.

2.2.3 Perform welding in accordance with AWS D1.1.

2.2.4 Bevels for field welds may be flame cut, provided such cutting is done automatically. Leave free of burrs and slag.

2.2.5 Grind flush web fillets at webs notched to receive backup plates for flange groove welds.

2.2.6 Flame cut edges of stiffener plates at field or shop for butt welds. Do not shear.

2.2.7 Accurately mill bearing ends of compression members.

2.2.8 Provide camber in accordance with section 1.19 of AISC Specification unless otherwise indicated.

2.2.9 Fabricating tolerances for finished parts shall comply with AISC Code of Standard Practice.

2.2.10 Cut, drill, or punch holes at right angles to surface of metal. Do not make or enlarge holes by burning. Make holes clean cut, without torn or ragged edges. Remove outside burrs resulting from drilling or reaming operations with a tool making a 1/16-inch bevel. Provide holes in members to permit connection of Work of other trades.

2.2.11 Make splices only where indicated.

2.2.12 All surfaces exposed in final position to have sharp edges and corners removed and all surfaces made smooth.

## 2.3 Finish

2.3.1 Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.

2.3.2 Shop prime structural steel members except members to be galvanized. Do not prime surfaces that will be field welded, contact surface for friction bolts, top surfaces of crane rails, top surface of bottom flange of monorails, welded studs, deformed bar anchors and steel encased in concrete.

2.3.3 Zinc used for hot-dip galvanizing coating shall conform to the Standard Specifications for Slab Zinc (Spelter) ASTM Designation B6 and shall be at least equal to the grade designated as "Prime Western". Thickness of coatings shall conform to ASTM Specifications A123, A153, and A385, as applicable for items coated.

2.3.4 Quality of galvanizing shall be rigidly controlled and it shall be understood that any defects as mentioned below shall be just grounds for rejection.

2.3.5 Galvanized steel shall have no bare spots unless small and suitable for patching, pimples showing excessive contamination, flux, ash inclusions, or blisters.

2.3.6 Where cutting existing galvanized metal Work or attaching to existing galvanized metal Work, such as by welding, the connection or bore edges shall be cold galvanized.

2.3.7 Structural and miscellaneous metal Work shall be galvanized when located on the exterior and on the interior where so indicated and/or specified.

2.3.8 Prime paint items in accordance with finish coat requirements.

2.3.9 Repair all damage to field-primed surfaces.

## 2.4 Source Quality Control and Tests

2.4.1 Testing and analysis of components will be performed under provisions of Division 1.

## 3. EXECUTION:

### 3.1 Examination

3.1.1 Verify that field conditions are acceptable and are ready to receive work.

### 3.2 Erection

3.2.1 Erect structural steel in compliance with AISC Code of Standard Practice and Specification.

3.2.2 Allow for erection loads, dead loads, wind loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

3.2.3 Field weld components indicated on Drawings and shop drawings.

3.2.4 Do not field cut or alter structural members without approval of Engineer.

3.2.5 After erection, prime welds, abrasions, and surfaces not shop primed.

3.2.6 Grout under base plates.

3.2.7 High strength bolts shall be installed as specified in "Specifications for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts", as approved by the Research Council, unless otherwise specified or shown on the Drawings.

3.2.8 If calibrated wrench tightening is used, the field inspector shall verify the calibration of the wrenches at the start of each working day and at mid-day.

### 3.3 Erection Tolerances

3.3.1 Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

3.3.2 Maximum Offset From True Alignment: 1/4 inch.

### 3.4 Field Quality Control

3.4.1 Field inspection will be performed under provisions of Division 1.

END OF THIS SECTION

## DIVISION 5 - METALS

### **SECTION 5B - METAL FABRICATIONS**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Shop fabricated and standard manufactured aluminum items and ferrous metal items, galvanized or prime painted as scheduled.

1.1.2 Items include, but are not limited to brackets, supports, frames, ledge and shelf angles, chains, access hatches and roof scuttles.

1.1.3 Metal Fabrications shall conform to applicable provisions of Section 505 of the Standard Specifications.

## 1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 4A - Unit Masonry System.

1.2.3 Section 5A - Structural Steel.

1.2.4 Section 5C - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts.

1.2.5 Section 9A - Painting.

## 1.3 References

All reference standards shall be the latest edition.

1.3.1 ASTM A36 - Structural Steel.

1.3.2 ASTM A53 - Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

1.3.3 ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.

1.3.4 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

1.3.5 ASTM A276, Type 316 - Stainless Steel.

1.3.6 ASTM A283 - Carbon Steel Plates, Shapes, and Bars.

1.3.7 ASTM A325 - High Strength Bolts for Structural Steel Joints.

1.3.8 ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

1.3.9 ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.3.10 ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

1.3.11 ASTM A 992 – Structural Steel Shapes

1.3.12 AWS A2.0 - Standard Welding Symbols.

1.3.13 AWS D1.1 - Structural Welding Code.

1.3.14 AISI - Standard for Stainless Steel.

1.3.15 SSPC - Steel Structures Painting Council.

1.3.16 ANSI A14.3: Safety requirements for fixed ladders.

1.3.17 Specifications for Aluminum Structures, The Aluminum Association.

#### 1.4 Submittals

1.4.1 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.4.2 Submit Product Data.

1.4.3 Shop drawings shall be approved prior to fabrication.

1.4.4 Indicate all revisions on resubmissions.

#### 1.5 Qualifications

1.5.1 Welders' Certificates

Submit under provisions of Division 1, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

#### 1.6 Field Measurements

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

#### 1.7 Design

1.7.1 Where size and spacing of expansion anchors, inserts, and anchor bolts are not shown or specified, provide such items of sufficient size, length, load carrying capacity and spacing to carry the design load times a safety factor of four.

1.7.2 Provide anchorage in accordance with Section 5E "Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts".

1.7.3 Provide calculations where specified.

#### 1.8 Basis of Payment

1.8.1 The work shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for the work described herein.

### 2. PRODUCTS:

#### 2.1 Materials

2.1.1 Steel Sections: ASTM A36 or ASTM A992.

- 2.1.2 Steel Tubing: ASTM A500, Grade B.
- 2.1.3 Plates: ASTM A283.
- 2.1.4 Pipe: ASTM A53, Grade B, Schedule 40.
- 2.1.5 Stainless Steel Sheet and Plate: ASTM A276, Type 316.
- 2.1.6 Extruded Shapes and Tubes: ASTM B221.
- 2.1.7 Aluminum Plate and Sheet: ASTM B209.
- 2.1.8 Aluminum Bars, Rods and Wire: ASTM B211.
- 2.1.9 Aluminum Seamless Tubes: ASTM B210.
- 2.1.10 Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
- 2.1.11 Stainless Steel Fasteners and Fittings: ASTM A276, Type 316.
- 2.1.12 Welding Materials: AWS D1.1; type required for materials being welded.
- 2.1.13 Welding Electrodes: AWS D1.1; type required for materials being welded.
- 2.1.14 Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.
- 2.2 Fabrication
  - 2.2.1 Fit and shop assemble in largest practical sections, for delivery to site.
  - 2.2.2 Fabricate items with joints tightly fitted and secured.
  - 2.2.3 Continuously seal joined members by continuous welds.
  - 2.2.4 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
  - 2.2.5 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
  - 2.2.6 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- 2.3 Finishes
  - 2.3.1 Prepare structural component surfaces in accordance with SSPC-SP6 - Commercial Blast Cleaning.

2.3.2 Shop prime structural steel members except members to be galvanized. Do not prime surfaces that will be field welded, contact surface for friction bolts, top surfaces of crane rails, top surface of bottom flange of monorails, welded studs, deformed bar anchors and steel encased in concrete.

2.3.3 Zinc used for hot-dip galvanizing coating shall conform to the Standard Specifications for Slab Zinc (Spelter) ASTM Designation B6 and shall be at least equal to the grade designated as "Prime Western". Thickness of coatings shall conform to ASTM Specifications A123, A153, and A385, as applicable for items coated.

2.3.4 Quality of galvanizing shall be rigidly controlled and it shall be understood that any defects as mentioned below shall be just grounds for rejection.

2.3.5 Galvanized steel shall have no bare spots unless small and suitable for patching, pimples showing excessive contamination, flux, ash inclusions, or blisters.

2.3.6 Where cutting existing galvanized metal Work or attaching to existing galvanized metal Work, such as by welding, the connection or bore edges shall be cold galvanized.

2.3.7 Structural and miscellaneous metal Work shall be galvanized when located on the exterior and on the interior where so indicated and/or specified.

2.3.8 Prime paint items in accordance with finish coat requirements.

2.3.9 Repair all damage to field-primed surfaces.

## 2.4 Access Hatches

2.4.1 Fabricate access hatches for the locations shown, with type, dimensions, details and anchorages as shown and specified.

2.4.2 Where specified, provide manufacturer's standard units, modified, if necessary, to comply with the requirements.

2.4.3 If standard units are not available for the sizes and types required, custom fabricate units to match manufacturer's similar units or as detailed on the Drawings.

2.4.4 Loading: Unless otherwise indicated, hatch covers shall be designed and reinforced to support pedestrian loading and shall be 1/4" diamond checkered aluminum plate designed and reinforced for 300 lb./sq. ft.

2.4.5 The entire frame shall be extruded aluminum with an integral anchor flange and door seat. All parts of the frame and cover shall be aluminum or stainless steel. Removable covers shall be equipped with flush drop handles that do not protrude above the cover. Removable covers shall be bolted down to the frame in at least two places with a stainless steel flush mounted bolt.

2.4.6 Hinged hatch covers shall be fitted with the required number and size of spring operators to afford ease of operation through the entire arc of opening and to act as a check in retarding downward motion when being closed.

Covers shall be equipped with a hold-down arm which automatically locks the cover in the open position. A conveniently located handle shall release the covers for closing.

2.4.7 A stainless steel snap lock with fixed turn handle shall be mounted on the underside of the cover. Covers in walkways shall have a lift handle that is designed to be flush with the walking surface when not in use. Hardware shall be 316 or 304 stainless steel including springs, lifting mechanism supports and hold-open arms, hold-open arm guides, hinges, hinge pins, snap lock and lock strike, and all fasteners.

2.4.8 All parts, except as specified or noted on the Drawings, shall be aluminum. All fasteners shall be of stainless steel.

2.4.9 Hatch shall be coordinated before fabrication with equipment and pump manufacturers approved shop drawings and field measurements of existing pump requirements to assure adequate clearances for equipment handling.

2.4.10 Acceptable Manufacturers

2.4.10.1 U.S. Foundry and Manufacturing Corp.

2.4.10.2 Halliday Products, Inc.

2.4.10.3 Flygt.

2.4.10.4 Substitutions under provision of Division 1.

2.5 Roof Scuttles

2.5.1 Fabricate access hatches for the locations shown, with type, dimensions, details and anchorages as shown and specified.

2.5.2 Where specified, provide manufacturer's standard units, modified, if necessary, to comply with the requirements.

2.5.3 If standard units are not available for the sizes and types required, custom fabricate units to match manufacturer's similar units or as detailed on the Drawings.

2.5.4 Roof scuttle shall be double door leaf with frame opening sizes as shown on the drawings. Covers shall be 14 gauge stainless steel with 3" beaded flange, neatly welded. Cover insulation shall be 1" thick glass fiber, fully covered and protected by a metal liner of 22 gauge stainless steel. Curb shall be 12" height and of 14 gauge stainless steel. Curb shall be formed with a 3.5" flange with holes provided for securing to the roof. Curb shall be equipped with an integral cap flashing of the same gauge and material as the curb, fully welded at corners for weathertightness. Insulation of the exterior of the curb shall be rigid fiberboard, 1" thickness. Roof scuttle shall have a live load capacity of 40 lb./sq.ft.

2.5.5 Scuttle shall be fully assembled with heavy pintle hinges and spring operators for ease in opening and closing covers. Cover shall automatically lock in open position with a rigid hold open arm equipped with a 1" diameter vinyl grip handle to permit easy release for closing.



Cover shall have a rubber gasket fitted into a retainer that is mechanically fastened to the interior of the cover to assure a continuous seal when compressed to the top surface of the curb.

2.5.6 Hardware shall be Type 316 stainless steel for latch assembly, inside and outside padlock hasps, arm guide bracket, lifting mechanism bracket, hinges, hinge pins, hold open arm, lock strike casting, springs, spring tubes, shoe castings and all fasteners.

2.5.7 Special requirements: Roof scuttles covers must allow clear access for removing and installing the 48" diameter tube pumps by a mobile crane. Roof scuttles shall have padlock hasps for padlocking from outside.

2.5.8 Acceptable Manufacturers

2.5.8.1 Bilco Company.

2.5.8.2 Substitutions under provision of Division 1.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that field conditions are acceptable and are ready to receive Work.

3.1.2 Preparation

(a) Clean and strip primed steel items to bare metal where site welding is required.

(b) Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate Sections.

3.2 Installation

3.2.1 Install items plumb and level, accurately fitted, free from distortion or defects.

3.2.2 Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

3.2.3 Field weld components indicated on the Drawing.

3.2.4 Perform field welding in accordance with AWS D1.1.

3.2.5 Obtain Engineer approval prior to site cutting or making adjustments not scheduled.

3.2.6 Perform cutting, drilling, and fitting required for installation of metal fabrications. Set the work accurately. Provide temporary bracing and anchors in formwork for items to be built into masonry or concrete. Field weld joints not shop welded because of size limitations. Grind welds smooth and touch-up shop paint coat. Do not weld, cut or abrade surfaces that have been galvanized.

3.2.7 Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2.8 Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

3.2.9 Protect aluminum in contact with dissimilar material with asphalt paint to provide 2 mil dry thickness. Paint miscellaneous metal work which is to be in contact with but not fully embedded in concrete or masonry with a heavy coat of asphalt paint. Coating shall not extend onto surfaces which will be exposed.

3.2.10 Install hatches and manufactured items in accordance with manufacturer's instruction.

3.2.11 Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.2.12 Touch up damaged galvanizing with cold galvanizing compound as produced by Rust-Oleum Corp. or ZRC Chemical Company, Quincy, Mass. (Aerosol acceptable).

### 3.3 Erection Tolerances

3.3.1 Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

3.3.2 Maximum Offset From True Alignment: 1/4 inch.

### 3.4 Schedule

3.4.1 The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.

3.4.2 Fall Prevention System: All ladders shall be provided with a fall prevention system as required to meet OSHA standards and as noted the Drawings.

(a) Fixed ladders below manhole covers and as shown on Drawings shall have a telescoping safety post section for safe access and exit of manhole. Device shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Steel shall be hot dipped galvanized. Unit shall be installed in accordance with manufacturer's instructions. Device shall be ladder-up safety post as manufactured by Bilco Company, New Haven, Connecticut, or approved equal.

(b) Two safety chains with snap-hook closures and eye bolts shall be provided as fall protection for ladder extensions and handrail access openings at ladders as shown on the Drawings and as required.

(c) Fall Prevention System with Harness Belt.

3.4.3 Where specifically shown on the Plans, (long ladders), each ladder shall be provided with a complete fall prevention system with harness belt as described below. The system shall comply with all OSHA standards.

(a) The system shall consist of a rail permanently attached to the ladder to which a harness belt is attached. A removable extension section shall be provided at the top of the ladder.

(b) Provide a complete Saf-T-Climb fall prevention system as manufactured by North Specialty Products, Brea, CA 92621, or approved equal.

(c) Saf-T-Climb Systems shall consist of three (3) primary components: Saf-T-Lok Sleeve, Saf-T-Belt, and Saf-T-Notch Rail.

(d) Material: stainless steel.

(e) Fall prevention systems must meet or exceed Federal Spec # RR-S-001301 and OSHA regulation #1910.27. Equipment must be tested according to ANSI 14.3. Belts and harnesses must be tested according to ANSI 10.14.

3.4.4 Chains shall be 1/4" open link security chain hot galvanized wrought iron with snap hook and eye bolt on one end and as shown on the Drawings.

3.4.5 Ledge and Shelf Angles, Channels and Plates, Not Attached to Structural Framing, for support of masonry: hot-dip galvanized.

3.4.6 Lintels: Hot-Dip galvanized, as detailed.

3.4.7 Miscellaneous brackets, supports and frames: hot-dip galvanized.

3.4.8 Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates, or other Work to be retained by the framing.

3.4.9 Except as otherwise shown, fabricate from structural shapes, plates and bars of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection.

3.4.10 Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.

3.4.11 Access hatches as specified.

END OF THIS SECTION

## DIVISION 5 - METALS

### **SECTION 5C - BOLTS, ANCHOR BOLTS, EXPANSION ANCHORS, AND CONCRETE INSERTS**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Furnishing and installing all bolts, anchors and inserts, anchor bolts, expansion anchors and concrete inserts for:

- (a) Piping.
- (b) Hangers and brackets.
- (c) Equipment.
- (d) Electrical, plumbing and HVAC work.
- (e) Concrete patching.
- (f) Pump base.
- (g) Miscellaneous fasteners.

##### 1.2 Related Sections

- 1.2.1 Section 4A - Unit Masonry.
- 1.2.2 Section 5A - Structural Steel.
- 1.2.3 Section 5B - Metal Fabrications.
- 1.2.4 Section 15C - Piping and Appurtenances.

##### 1.3 References

- 1.3.1 Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
- 1.3.2 ACI 349 - Appendix B - Code Requirements for Nuclear Safety Related Concrete Structures.
- 1.3.3 AISC - American Institute of Steel Construction, Structural Steel Detailing.
- 1.3.4 ANSI B1.1 - Screw Threads, Coarse Thread Series.
- 1.3.5 ANSI B18.2 - Square and Hex Bolts and Nuts.
- 1.3.6 ASTM A36 - Structural Steel.
- 1.3.7 ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

- 1.3.8 ASTM A193 - Alloy-Steel & Stainless Steel Bolting Materials for High-Temperature Service.
- 1.3.9 ASTM A194 - Carbon & Alloy Steel Nuts for Bolts for High Pressure & High Temp. Service.
- 1.3.10 ASTM A242 - High Strength Low-Alloy Structural Steel.
- 1.3.11 ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- 1.3.12 ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum tensile Strength.
- 1.3.13 ASTM A354 - Quenched & Tempered Alloy Steel Bolts, Studs & Other Externally Threaded Fasteners.
- 1.3.14 ASTM A563 - Carbon and Alloy Steel Nuts.
- 1.3.15 ASTM A588 - High Strength Low-Alloy Structural Steel With 50 KSI Minimum Yield Point.
- 1.3.16 ASTM B98 - Copper Silicon Alloy Rods, Bars, and Shapes.
- 1.3.17 AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- 1.4 Submittals
  - 1.4.1 Samples: Submit for approval the following:
    - (a) Representative samples of bolts, anchors and inserts as may be requested by the Engineer. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of Contractor.
  - 1.4.2 Shop Drawings: Submit for approval the following:
    - (a) Setting drawings and templates for location and installation of anchorage devices.
    - (b) Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.
  - 1.4.3 Contractor shall submit calculations stamped by a professional engineer.
- 1.5 Quality Assurance: Bolts, anchor bolts, expansion anchors and concrete inserts shall conform to applicable Section 1006, METALS, of the Standard Specifications.
- 1.6 Basis of Payment

1.6.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

## 2. PRODUCTS:

### 2.1 Design Criteria

2.1.1 All bolts, studs and nuts shall have American National form right-hand machine cut threads which shall be in conformity with the current ANSI B1.1, "Screw Threads", Coarse Thread Series, Class 2 Fit, unless otherwise specified.

2.1.2 Bolt heads and nuts shall be semi-finished and shall be in conformity with ANSI B18.2, "Wrench-head Bolts and Nuts and Wrench Openings", Heavy Series, unless otherwise specified. Nut dimensions shall conform to ANSI Standard B18.2.2 for heavy hex nuts.

2.1.3 Allowable tensile design stress for threaded fasteners shall not be greater than 0.33 times minimum tensile strength of threaded fastener on tensile stress area.

2.1.4 Concrete Fasteners: When the size, length and load carrying capacity of concrete fasteners is not specified or shown on the Drawings, provide the size, length and capacity required to satisfy all of the following. Concrete fasteners include anchor bolts, expansion anchors, or concrete inserts:

- (a) Working load shall be a minimum of the design load times a safety factor of four, and shall be based on a concrete compressive strength not exceeding 3000 psi.
- (b) Shall satisfy all requirements and recommendations of ACI 349, Appendix B.
- (c) Shall satisfy all minimum recommendations and requirements of Manufacturer.
- (d) Allowances for vibration are not included in the safety factor specified above.

2.1.5 Determine design loads as follows

- (a) For equipment anchors, use the design load recommended by the manufacturer and approved by the Engineer.
- (b) For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides. Load shall be increased where required to allow for thrust and temperature induced forces.

2.1.6 Anchors and inserts shall be located and sized so as not to impair the integrity of the supporting structure.

### 2.2 Materials

2.2.1 Bolts and Anchor Bolts (Excluding Pipe Joints):

- (a) Galvanized Steel Bolts and Nuts

1) Steel anchor bolts, studs, nuts and washers for interior installation shall be in conformity with the current ASTM Designation: A307 "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength", Grade B, A36 or approved equal. All steel bolts, studs, nuts and washers shall be hot-dip galvanized in conformance with Class C of ASTM A153. Nuts shall conform to requirements of ASTM A563, heavy hex style.

(b) Stainless Steel Bolts and Nuts

1) In buried, outdoor, high humidity or submerged locations, provide stainless steel bolts, nuts and washers. Stainless steel bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) 75 KSI Min. Tensile Strength), Class 1 and ASTM A194, Grade 8 (AISI 304), AISI 316 or approved equal.

2) For high strength applications, stainless steel bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) (Tensile Strength 100/125 KSI, Class 2 and ASTM A194, Grade 8 Strained Hardened (AISI 304) or approved equal.

(c) Bronze Bolts and Nuts

1) Where shown on Drawings or specified under other Sections, bronze anchor bolts, flange bolts, studs, and nuts shall be in conformity with the current ASTM Designation B98, "Copper-Silicon Alloy Rods, Bars, and Shapes." made of Alloy B12, Hard. Bolts, studs, and nuts machined from bar stock shall be made of Alloy A7, Hard.

(d) Other types, if shown on drawings or specified under other Sections.

2.3 Pipe Joints for Ductile Iron Pipe

2.3.1 Galvanized Bolts and Nuts (For EXPOSED Piping Installations)

(a) Steel anchor bolts, flange bolts, studs and nuts shall be in conformity with the current ASTM A307 "Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength", Grade B or approved equal.

(b) All steel bolts, studs and nuts, shall be hot-dip galvanized in accordance with ASTM A153.

(c) At joint harnesses and restrained harnesses connected to flange, the tie bolts and studs, flange bolts and nuts shall conform to ASTM A354 Grade BC or ASTM A193 Grade B7 115/125 KSI Min. Tensile Strength for 4" diameter and under. Lug and ring shall be ASTM A36 steel.

2.3.2 Stainless Steel Bolts and Nuts (Where Specified)

(a) Stainless steel flange bolts and nuts shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) 75 KSI Min. Tensile Strength), Class 1 & ASTM A194, Grade 8 (AISI 304) or approved equal.

(b) Stainless steel bolts and nuts for harness flanges and connecting restrained harnesses to flange shall be in conformity with the current ASTM A193, Grade B8 (AISI 304) (Tensile Strength 100/125 KSI, Class 2 and ASTM A194, Grade 8 Strained Hardened (AISI 304) or approved equal.

### 2.3.3 Corrosion resistant steel (CRS) (For BURIED Piping Installations)

- (a) CRS anchor bolts, flange bolts, studs and nuts shall be "Cor-Ten" type steel in conformity with the material characteristics listed in Sec.11-8 of AWWA C111 "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings", and also in conformity with the ASTM: A242 "High Strength Low-Alloy Structural Steel" Type 1, A588 "High Strength Low-Alloy Structural Steel With 50 KSI Minimum Yield Point" Grade A, or approved equal.
- (b) At buried mechanical joints, bolts and nuts shall be in conformity with all of AWWA C111 dimensions and requirements.
- (c) Above specified bolts and nuts shall be tension tested for a minimum ultimate tensile stress of 65 ksi using testing procedures corresponding to ASTM A307 requirements, and shall be proof load tested based on 45 ksi stress to AWWA C111 standards.
- (d) Bolt heads shall be marked with manufacturer, ASTM material designation/grade, and country where manufactured. Markings shall be raised or depressed.
- (e) At buried joint harnesses and restrained harnesses connected to flange, the tie bolts and studs, flange bolts and nuts shall be "Cor-Ten" type steel in conformity with the current ASTM: A325, "Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength", Type 3.
- (f) Bolt strength shall be adequate to provide compression needed for water tightness of the gasket material used.

### 2.3.4 Expansion Anchors

- (a) Expansion Anchors shall be single cone wedge type or multiple cone wedge type. Where self drilling anchors are shown on drawings, self drilling expansion anchor with plug expansion insert shall be used.
- (b) Expansion anchors for dry locations shall be zinc plated with chromate coating unless otherwise noted.
- (c) Expansion anchors in buried, exterior, submerged, high humidity or below grade locations shall be stainless steel, as specified above in paragraph 2.2.1(b)1).
- (d) Product and Manufacturer: Provide anchors by one of the following:
  - 1) Liebig International, Inc.
  - 2) Hilti, Incorporated.
  - 3) Illinois Tool Works Ramset/Red Head.
  - 4) Substitutions: Under provisions of Division 1.
- e) Provide stud type (male thread) or flush type (female thread), as required. Anchors shall be sized as required for the concrete strength specified.

### 2.3.5 Undercut Expansion Anchors



- (a) Undercut anchors shall be heavy duty mechanical anchor which expands into a tapered undercut to develop a high load capacity.
- (b) Anchor shall be hot dip galvanized carbon steel with a minimum ultimate tensile strength of 150 ksi.
- (c) Anchor shall be HUC Undercut Anchor as manufactured by KILTI, or Liebig Ultraplus as manufactured by Liebig International.

2.3.6 Other types: If shown on the drawings or specified under other Sections.

2.3.7 Standard holes, 1/16" larger than bolt, shall be drilled for bearing type connections in the connected steel part except where otherwise recommended by anchor manufacturer and reviewed by Engineer.

2.3.8 Expansion anchors shall be Underwriters Laboratories or Factory Mutual approved.

### 3. EXECUTION:

#### 3.1 Inspection

3.1.1 Examine conditions under which bolts, anchors, or inserts are to be installed, and notify Engineer in writing of unsatisfactory conditions existing.

3.1.2 Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to Engineer.

#### 3.2 Installation of Expansion Anchors and Undercut Anchors

3.2.1 Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.

3.2.2 Torque anchor as specified by manufacturer recommendation. Do not cut reinforcing bars.

3.2.3 Provide embedded items for placement in concrete form work and assure that embedded items are protected from damage and are not filled in with concrete.

3.2.4 Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller.

3.2.5 Expansion anchors shall not be used for larger pipe or supporting vibrating equipment unless otherwise shown or approved by the Engineer.

3.2.6 Unless otherwise shown, anchor design shall be in accordance with ACI 349, Appendix B and approved by Engineer, and in no case shall be less than:

- (a) Embedment depth in concrete: 7 diameters.

- (b) Anchor spacing on centers: 10 diameters.
- (c) Distance to edge of concrete: 1.5 embedment.
- (d) Distance to edge of concrete  
where anchor is loaded  
in direction of edge: 2.5 embedment.

3.2.7 Undercut Anchors shall be installed in accordance with manufacturer's instructions.

### 3.3 Cleaning

3.3.1 After embedding concrete is placed, remove protection and clean bolts and inserts.

END OF THIS SECTION

## **DIVISION 6 - CARPENTRY**

### **SECTION 6A - ROUGH CARPENTRY**

#### 1. GENERAL:

##### 1.1 Section Includes

- 1.1.1 Blocking and cant strip at roof system.
- 1.1.2 Other miscellaneous wood blocking as required or as noted.
- 1.1.3 Temporary protection.

##### 1.2 Related Sections

- 1.2.1 Section 7A - Elastomeric Membrane Roofing.

##### 1.3 References

1.3.1 ASTM A525 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-dip Process.

1.3.2 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

##### 1.3.3 Federal Specifications (FS):

- (a) FF-B-575C - Bolts, Hexagon and Square.
- (b) FF-N-105B - Nails, Brads, Staples, and Spikes.
- (c) FF-N-836D - Nut, Square, Hexagon, Cap, Slotted, Castle. Knurled, Welding, and Single Ball Seat.
- (d) FF-S-111D - Screw, Wood.

#### 1.4 Quality Assurance

##### 1.4.1 Grading Rules:

(a) Lumber Grading Rules and wood species shall conform with Voluntary Product Standard PS20. Grading rules of the following associations shall also apply to materials produced under their supervision.

- A. Northeastern Lumber Manufacturers Association, Inc. (NELMA).
- B. Southern Pine Inspection Bureau (SPIB).
- C. West Coast Lumber Inspection Bureau (WCLIB).
- D. Western Wood Products Association ((WWPA).
- E. Redwood Inspection Service (RIS).

##### 1.4.2 Grade Marks: Identify all lumber by official grade mark.

(a) Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacture.

- A. S-Dry: Maximum 19 percent moisture content.
- B. MC-5 or KD: Maximum 15 percent moisture content.
- C. Dense.

#### 1.5 Submittals

##### 1.5.1 Submit under provisions of Division 1.

1.5.2 Rough Carpentry: Submit certification that lumber and connection material conforms to specified minimum grade.

#### 1.6 Delivery, Storage, and Handling

1.6.1 Deliver, store, protect and handle products to site under provisions of Division 1 and in accordance with the manufacturer's instructions.

#### 1.7 Basis of Payment

1.7.1 Payment for work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

## 2. MATERIALS:

2.1 Blocking, nailing, etc. shall be construction grade douglas fir, hem-fir, or No. 1 common southern pine.

2.2 Fasteners for wood nailers for roofing, shall be not less than 3/16-inch diameter zinc coated steel or equivalent zinc-coated wire anchors, spaced 24 inches on center.

2.3 Pressure treatment of wood shall comply with applicable requirements of AWWA C1 and C9. Preservative shall be CCA type C. After treatment, kiln-dry lumber to maximum moisture content of 19%.

2.4 Blocking, nailers and other items, whether or not covered by other materials, shall be pressure treated.

2.5 Wood members in connection with roofing and flashing shall be pressure treated.

2.6 Lumber for temporary protection shall be southern yellow pine and an exterior type, Grade C, plugged fir plywood.

2.7 Anchors, connectors, and fastenings, not indicated or specified otherwise, shall be of the type, size, and spacing necessary to suit the conditions encountered and as recommended by the National Lumber Manufacturer's Association. Sizes, types, and spacing of nails, screws, or bolts for installation of manufactured building materials, shall be as recommended by the product manufacturer unless indicated or specified otherwise; bolts, nuts, washers, and all other rough hardware embedded in, or in contact with, exterior walls of masonry shall be zinc-coated, except as specified otherwise. Rough hardware shall be formed and punched before coating.

### 3. EXECUTION:

3.1 Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Provide blocking where indicated and as necessary to secure the work.

3.2 All field-cut edges and surfaces of treated lumber shall be liberally coated with a concentrated solution of preservative.

#### 3.3 Delivery and Storage

3.3.1 Protect lumber against dampness before and after delivery. Store under cover in a well ventilated area and where not exposed to extreme changes in temperature or humidity until used.

END OF THIS SECTION

## **DIVISION 7 - THERMAL MOISTURE PROTECTION**

### **SECTION 7A - ELASTOMERIC MEMBRANE ROOFING**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Fully adhered elastomeric 60 mil sheet membrane roofing over insulation.

1.1.2 Roof insulation.

1.1.3 Flexible flashings and base flashings around all openings and roof edge terminations as required by all trades.

1.1.4 Membrane terminations.

## 1.2 Related Sections

- 1.2.1 Section 3A - Cast-in-Place Concrete.
- 1.2.2 Section 6A - Rough Carpentry.
- 1.2.3 Section 7B - Sheet Metal Flashing and Trim.

## 1.3 References

### Insulation Board

- 1.3.1 ASTM C1289 – Faced Rigid Cellular Polyisocyanurate Insulating Board.
- 1.3.2 ASTM C1621 - Compressive Properties of Rigid Cellular Plastics.
- 1.3.3 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

### Roofing Membrane

- 1.3.1 ASTM D412 - Rubber Properties in Tension.
- 1.3.2 ASTM D746 - Brittleness Temperatures of plastics and Elastomers by Impact.
- 1.3.3 ASTM D624 - Rubber Property-Tear Resistance.
- 1.3.4 ASTM D822 - Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products.
- 1.3.5 ASTM D1004 - Initial Tear Resistance of Plastic Film and Sheeting.
- 1.3.6 ASTM D2240 - Rubber Property - Durometer Hardness.
- 1.3.7 ASTM E96 - Water Vapor Transmission of Materials.
- 1.3.8 NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.
- 1.3.9 ULI - Fire Hazard Classifications.

## 1.4 System Description

- 1.4.1 Elastomeric sheet membrane roof assembly to conform to UL requirements for a Class A rated assembly, and I-90 requirements for wind uplift resistance.

## 1.5 Submittals

- 1.5.1 Submittals: Procedures for submittals as specified in Division 1.
- 1.5.2 Shop Drawings:

Roof Plan (use 1/4" = 1'-0"): Submit general roof plan showing tapered insulation plan, which includes all valleys, ridges, slopes, saddles and crickets, and general drainage pattern based on tapered insulation.

Detail Drawings (use 1-1/2" = 1'-0"): Submit shop drawings detailing base flashings, roof edge termination flashings, reglets, membrane terminations, roof drains, roof projection flashings, roof hatch flashings.

1.5.3 Samples: Submit samples for the following items:

EPDM Membrane: 8"X10", 3 pieces.  
Termination bars: 2 pieces.  
Rigid insulation board: 8"X10", 3 pieces.

1.5.4 Product Data:

- (a) Provide product data for sheet membrane, elastic flashing, joint cover sheet, and joint and crack sealants, with temperature range for application of membrane.
- (b) Rigid insulation board(s).

1.5.5 Manufacturer's Installation Instructions: Provide manufacturer's instructions for a fully adhered membrane roof system, and indicate special precautions required for seaming the membrane; include installation instructions for roofing rigid insulation board.

1.5.6 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5.7 Manufacturer's Field Reports: Submit under provisions of Division 1.

1.5.8 Reports: Indicate procedures followed, ambient temperatures, and wind velocity during application.

1.6 Quality Assurance

1.6.1 Perform Work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

1.7 Qualifications

1.7.1 Manufacturer: Company specializing in manufacturing the products specified in this section with ten years documented experience.

1.7.2 Applicator: Company specializing in performing the work of this section with ten years documented experience and approved by system manufacturer.

1.8 Regulatory Requirements

1.8.1 Conform to applicable code for roof assembly fire hazard requirements.

1.8.2 ULI: Class A Fire Hazard Classification.

## 1.9 Delivery, Storage, and Handling

1.9.1 Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

1.9.2 Store products in weather protected environment, clear of ground and moisture.

1.9.3 Stand roll materials on end.

## 1.10 Environmental Requirements

1.10.1 Do not apply roofing membrane during inclement weather or when air temperature is below 40 degrees F and in accordance with manufacturer's instructions.

1.10.2 Do not apply roofing membrane to damp or frozen deck surface.

1.10.3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

## 1.11 Coordination

1.11.1 Coordinate the work with installing associated flashing as the work of this section proceeds.

## 1.12 Warranty

1.12.1 Provide 20 year warranty under provisions of Division 1.

1.12.2 Warranty: Cover damage to building resulting from failure to prevent penetration of water.

## 1.13 Basis of Payment

1.13.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

## 2. PRODUCTS:

### 2.1 Manufacturers - Membrane Brand - Membrane System (fully adhered type)

2.1.1 Carlisle SynTec Systems: - Sure-Seal.

2.1.2 Firestone Building Products Co.: - Rubbergard EPDM.

2.1.2 Substitutions: Under provisions of Division 1.

### 2.2 Membrane System

2.2.1 Fully adhered 0.060 inch (60 mil) thick EPDM system.

2.3 Sheet Materials

2.3.1 Sheet: 60 mil thick EPDM membrane:

Properties	Test	Results
Tensile Test	ASTM D412	1300 psi
Elongation	ASTM D421	350%
Tear Strength	ASTM D624	175 psi
Water Absorption	ASTM D471	4%
Moisture Vapor-perms	ASTM E96	20
Low Temperature Brittleness	ASTM D746	-75 F
Resistance to Ozone	ASTM D1149	No cracks

Manufacturer's 5" wide, pressure sensitive, self-adhering EPDM seam cover and as recommended by Manufacturer.

2.3.3 Manufacturer shall guaranty membrane over insulation.

2.4 Base and Flexible Flashing

2.4.1 Sheet: 60 mil thick EPDM; perm rating of 0.5 maximum; tensile strength of 1200 psi elasticity of 50 percent with full recovery without set; black color; manufactured by membrane manufacturer.

2.5 Vapor Retarder Materials

2.5.1 Fire Retardant Sheet Vapor Retarder: UL requirements; plastic sheet; manufactured by membrane manufacturer, including compatible fire retardant adhesive.

2.6 Accessories

2.6.1 Sealants: As recommended by membrane manufacturer.

2.6.2 Reglet Strip Devices: 16 oz. Copper or as recommended by Manufacturer.

2.7 Manufacturers - Roofing Insulation Materials

2.7.1 Firestone Building Products Co.



2.7.2 Atlas Roofing Corporation.

2.7.3 Apache ISO Products, LLC.

2.8.4           2.7.4 Substitutions: Under provisions of Division 1.

2.8    Insulation Materials

2.8.1           Polyisocyanurate rigid insulation and polyisocyanurate insulation board with cellulosic fiber insulation board overlay (sandwich/composite construction); Flat and tapered board insulation, 1/4-inch/ft. taper, with the following characteristics:

Polyisocyanurate board:

- (a)    Board Density:                   (2.0 lb/cu ft).
- (b)    Thermal Resistance: R-value of 6 per inch.
- (c)    Compressive Strength:        20 psi minimum per ASTM D1621.
- (d)    Water Absorption:    In accordance with ASTM C2842, less than 1.5 percent by volume maximum.
- (e)    Board Edges:            Ship lapped.
- (f)    Board Thickness:        As required to achieve an average R-value of 19.0.

Overlay boards(s):

- (a)    2" high density fiberboard:    R-value of 1.39 per 2" per ASTM C208.
- (b)    gypsum decking overlay (if req'd):    R-value of 1.12 per 1" per ASTM C1177.

2.9.2 Protection Boards: All polyisocyanurate in contact with concrete roof deck and membrane roofing shall be overlaid (or composite sandwich construction) with 2" High Density fiberboard. Note: several manufacturers may require gypsum overlay when used with fully adhered.

2.10   Adhesive Materials

2.10.1 Adhesive: Type recommended by insulation manufacturer for application that provides a fully adhered system.

2.11   Components and Accessories

2.11.1 Crickets & Saddles: Slope 1/4"/ft.

2.11.2 Protective Boards: see item 2.9.2 above.

2.11.3 Underlayment: see item 2.9.2 & 2.10.1 above.

2.11.4 Wood Nailers: Coordinate and specify thickness of wood blocking to be equal to the thickness of all layers of insulation and protection board at all locations. Coordinate with Division 6A Rough Carpentry.

2.11.5 Termination Bar:

1/8" x 1 1/2" aluminum or stainless steel bar with 45 degree sealant pocket where space permits.

(b) 1/8" x 1" aluminum or stainless steel bar under counter flashing or other restricted areas.

2.11.6 Metal Flashings: Coordinate with Division 7B Sheet Metal Flashing and Trim.

2.11.7 Top Surface Reflective Coating

(a) Coating: An acrylic based coating consisting of primer and finish coats as recommended by manufacturer for a reflective roof coating. Acrylic coating shall be in a white or light color as selected by Owner or Engineer from manufacturer's standard available colors.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that surfaces and site conditions are ready to receive work.

3.1.2 Verify deck is supported and secured.

3.1.3 Verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains.

3.1.4 Verify deck surfaces are dry and free of snow or ice.

3.1.5 Beginning of installation means acceptance of the surface of the substrate.

3.1.6 Comply with manufacturer's climatic restrictions.

3.2 Preparation

3.2.1 Fill concrete surface honeycomb and variations with latex filler.

3.2.2 Verify that all work of other trades which penetrates and modifies the roof deck or requires workmen and equipment to traverse the roof deck has been completed.

3.3 Roof Insulation Installation

3.3.1 Lay underlayment and bottom layer of insulation in accordance with manufacturer's instructions.

3.3.2 Adhere insulation with a bonding mastic or adhesive between concrete roof surface and insulation system, and between successive insulation boards in accordance with manufacturer's recommendations and instructions. Ensure compatibility of adhered insulation method(s) and bonding adhesive to the EPDM membrane system.

3.3.3 Lay insulation in parallel course with all joints staggered between courses and each course firmly adhered to deck.

3.3.4 Where more than one layer of insulation is required, stagger joints where possible in relation with the layer beneath and firmly adhere each layer to the previous layer.

3.3.5 Lay insulation boards to moderate contact without forcing joints. Cut insulation to fit neatly to perimeter blocking and protrusions through roof.

3.3.6 Miter cut all valleys.

3.3.7 Place fiberboard or other protective covering as the top surface that meets the EPDM membrane roofing system or as required by roofing manufacturer.

#### 3.4 Membrane Application

3.4.1 Install membrane roofing in accordance with membrane manufacturer's instructions for a fully adhered membrane system using manufacturer's recommended bonding adhesive.

3.4.2 Overlap edges and ends minimum 4 inches and adhesive seal. Apply uniform bead sealant to joint edge.

3.4.3 Centered over all field seams, apply a minimum 5" wide strip of pressure sensitive, self adhering EPDM.

3.4.4 Shingle joints on sloped substrate in direction of drainage.

3.4.5 Minimize wrinkles and bubbles.

3.4.6 Seal adjoining surfaces.

3.4.7 Continue membrane up vertical surfaces minimum 8 inches unless otherwise noted.

3.4.8 Install membrane flashings. Seal watertight to membrane.

3.4.9 Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or moving.

3.4.10 Apply roof control and expansion joint materials to isolate roof into areas per manufacturer's recommendations. Seal roofing membrane sheet to joint flange; apply sealant to edge or seam.

3.4.11 Place traffic surfacing at locations noted.

3.4.12 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

### 3.5 Flashing and Accessories

3.5.1 Apply membrane base flashing to seal membrane to vertical elements.

3.5.2 Coordinate installation of roof drains, roof hatches and related flashing.

3.5.3 Seal flashing and flanges of items penetrating membrane.

3.5.4 Protective - Reflective Coating.

1. Apply coating to exposed membrane surfaces and base flashing in accordance with manufacturer's instructions.

### 3.6 Field Quality Control

3.6.1 Field inspection will be performed under provisions of Division 1.

3.6.2 Correct identified defects or irregularities.

3.6.3 Request site attendance of roofing and insulation materials manufacturers during installation of the Work.

3.6.4 Inspection shall be performed by manufacturer of roofing system for compliance to the Work of this Section. The manufacturer shall certify the installation is complete and in accordance with the manufacturer's requirements for optimal roof life.

### 3.7 Cleaning

3.7.1 Remove and legally dispose of all debris from the job site.

3.7.2 In areas where finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

3.7.3 Repair or replace defaced or disfigured finishes caused by work of this Section.

### 3.8 Protection

3.8.1 Protect building surfaces against damage from roofing work.

3.8.2 Where traffic must continue over finished roof membrane, protect surfaces.

END OF THIS SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

**SECTION 7B - SHEET METAL FLASHING AND TRIM**

1. GENERAL:

1.1 Section Includes

1.1.1 Coping, sill, lintel, base, through wall and cap flashings.

1.1.2 Counterflashing.

1.1.3 Fascias.

1.1.4 Scuppers, downspouts, and accessories.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 5B - Metal Fabrications.

1.2.3 Section 7A - Elastomeric Membrane Roofing.

1.2.4 Section 7C - Joint Sealers.

1.2.5 Section 15A - General Mechanical Provisions.

1.3 References

1.3.1 AISI (American Iron and Steel Institute) - Stainless Steel Uses in Architecture.

1.3.2 ASTM A167 - Stainless and Heat-Resisting Chromium- Nickel Steel Plate.

1.3.3 ASTM B32 - Solder Metal.

1.3.4 FS O-F-506 - Flux, Soldering, Paste and Liquid.

1.3.5 FS QQ-S-571 - Solder, Tin Alloy.

1.3.6 NAAMM - Metal Finishes Handbook.

1.3.7 NRCA (National Roofing Contractors Association) - Roofing Manual.

1.3.8 SMACNA - Architectural Sheet Metal Manual.

1.3.9 ASTM A240 - Heat-resisting, Chromium & Chromium-Nickel Stainless Steel Plate, Sheet, and Strip.

1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.

1.4.3 Samples: Submit two samples 300 mm (12") long of each type of metal flashing illustrating typical material, and finish.

## 1.5 Qualifications

1.5.1 Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years minimum experience.

## 1.6 Delivery, Storage and Handling

1.6.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.6.2 Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.6.3 Prevent contact with materials during storage which may cause discoloration, staining, or damage.

## 1.7 Basis of Payment

1.7.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

## 2. PRODUCTS:

### 2.1 Manufacturers

2.1.1 Stainless Steel Flashing Trim and Coping: Through wall, base, lintel, sill, cap and coping; Brake formed to required profiles.

2.1.2 Scuppers and downspouts; Brake formed to required profiles.

2.1.3 Substitutions: Under provisions of Division 1.

### 2.2 Sheet Materials

2.2.1 Stainless Steel: ASTM A240, type 304, 20 gauge, architectural grade alloy, finish to be 2B.

### 2.3 Accessories and Components

2.3.1 Fastener: Same material and finish as flashing metal with soft neoprene washers at exposed fasteners.

2.3.2 Underlayment: 6 mil polyethylene.

2.3.3 Slip Sheet: Rosin sized building paper.

- 2.3.4 Sealant: Type specified in Section 7D.
- 2.3.5 Solder: ASTM B32; 50/50 type.
- 2.3.6 Flux: FS O-F-506.
- 2.3.7 Scupper: Same material and finish as flashing metal. Fabricate to dimensions as shown on drawings.
- 2.3.8 Downspout: Same material and finish as flashing metal. Fabricate to 3" x 4" rectangular profile.
- 2.3.9 Splash Pads: Precast concrete type: minimum 3000psi at 28 days, with minimum 5 percent air entrainment.

## 2.4 Fabrication

- 2.4.1 Form sections true to shape, accurate in size, square, and free from distortion or defects. Form scupper and downspout sections to sizes as shown on drawings.
- 2.4.2 Fabricate cleats, hold-down clips, and starter strips of same material as sheet, minimum 2 inches wide, interlockable with sheet.
- 2.4.3 Form pieces in longest practical lengths.
- 2.4.4 Hem exposed edges on underside 1/2 inch; miter and seam corners.
- 2.4.5 Form material with flat lock seam.
- 2.4.6 Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
- 2.4.7 Fabricate corners from one piece with minimum 16 inch long legs; solder for rigidity, seal with sealant.
- 2.4.8 Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed 45° to form drip.
- 2.4.9 Fabricate flashing to allow toe to extend 2 inches over roofing. Return and brake edges.

## 3. EXECUTION:

### 3.1 Examination

- 3.1.1 Verify roof openings, pipes, or vents through roof are solidly set and nailing strips located.
- 3.1.2 Verify roofing termination and base flashing are in place, sealed, and secure.

### 3.2 Preparation

3.2.1 Install starter and edge strips, and cleats before starting installation.

3.2.2 Field measure site conditions prior to fabricating work.

### 3.3 Installation

3.3.1 Secure flashing in place using concealed fasteners. Use exposed fasteners only in locations approved by Engineer.

3.3.2 Lap, Cleat and seal all joints.

3.3.3 Fit flashing tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

3.3.4 Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.3.5 Seal metal joints watertight.

3.3.6 Secure scuppers and downspouts in place using concealed fasteners where applicable.

3.3.7 Set concrete splash pads under downspouts.

### 3.4 Field Quality Control

3.4.1 Field inspection will be performed under provisions of Division 1.

3.4.2 Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF THIS SECTION

## DIVISION 7 - THERMAL AND MOISTURE PROTECTION

### **SECTION 7C - JOINT SEALERS**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Preparing sealant substrate surfaces.

1.1.2 Sealant and backing.

##### 1.2 Related Sections



- 1.2.1 Section 3A - Cast-In-Place Concrete.
- 1.2.2 Section 4A - Unit Masonry System.
- 1.2.3 Section 7B - Sheet Metal Flashing and Trim.
- 1.2.4 Section 8A - Aluminum Doors and Frames.
- 1.2.5 Section 10A - Specialties.
- 1.3 References
  - 1.3.1 ASTM C920 - Elastomeric Joint Sealants.
  - 1.3.2 ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
  - 1.3.3 FS TT-S-00227 - Sealing Compound: Elastomeric Type, Multi-Component.
  - 1.3.4 FS TT-S-001543 - Sealing Compound, Silicone Rubber Base.
  - 1.3.5 SWRI (Sealing, Waterproofing, and Restoration Institute) - Sealant and Caulking Guide Specification.
- 1.4 Submittals
  - 1.4.1 Submit under provisions of Division 1.
  - 1.4.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
  - 1.4.3 Samples: Submit two samples 4 x 1/2 inches in size illustrating color for selection.
  - 1.4.4 Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.
  - 1.4.5 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- 1.5 Quality Assurance
  - 1.5.1 Perform work in accordance with SWRI requirements for materials and installation.
- 1.6 Qualifications
  - 1.6.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

1.6.2           Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.

## 1.7    Environmental Requirements

1.7.1           Do not install solvent curing sealants in enclosed building spaces without providing adequate ventilation.

1.7.2           Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

## 1.8    Coordination

1.8.1           Coordinate work under provisions of Division 1.

1.8.2           Coordinate the work with all sections referencing this section.

## 1.9    Basis of Payment

1.9.1           Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

## 2.    PRODUCTS:

### 2.1    Sealants

2.1.1           Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A, O; single component, moisture curing, low modulus type; color as selected; Spectrem 1 manufactured by Tremco.

### 2.2    Accessories

2.2.1           Primer: Non-staining type, recommended by sealant manufacturer to suit application.

2.2.2           Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

2.2.3           Joint Backing: ASTM D1056; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

2.2.4           Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.2.5           Bituminous and Fiber Joint Filler: ASTM D1751 or FS HH-F-341.

## 3.    EXECUTION:

### 3.1    Examination

3.1.1 Verify that substrate surfaces and joint openings are ready to receive work and field measurements are as shown on Drawings and recommended by the manufacturer.

3.1.2 Verify that joint backing and release tapes are compatible with sealant.

### 3.2 Preparation

3.2.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

3.2.2 Clean and prime joints in accordance with manufacturer's instructions.

3.2.3 Perform preparation in accordance with ASTM C804 for solvent release sealants.

3.2.4 Protect elements surrounding the work of this section from damage or disfiguration.

### 3.3 Installation

3.3.1 Install sealant in accordance with manufacturer's instructions.

3.3.2 Measure joint dimensions and size materials to achieve required width/depth ratios.

3.3.3 Install joint backing to achieve a neck dimension no greater than 1/3 the joint width.

3.3.4 Install bond breaker where joint backing is not used.

3.3.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

3.3.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.3.7 Tool joints concave.

### 3.4 Cleaning and Repairing

3.4.1 Clean work under provisions of Division 1.

3.4.2 Clean adjacent soiled surfaces.

3.4.3 Repair or replace defaced or disfigured finishes caused by work of this Section.

### 3.5 Protection of Finished Work

3.5.1 Protect finished installation under provisions of Division 1.

3.5.2 Protect sealants until cured.

END OF THIS SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

**SECTION 7D - BOARD INSULATION**

1. GENERAL:

1.1 Section Includes

Cavity Wall: 2" thick board insulation for cavity wall.

1.2 Related Section

Section 4A - Unit Masonry System.

1.3 References

1.3.1 ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions.

1.3.2 ASTM C578 - Rigid Cellular Polystyrene Thermal Insulation.

1.3.3 ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

1.3.4 ASTM C1621 - Compressive Properties of Rigid Cellular Plastics.

1.3.5 ASTM D1622 - Apparent Density of Rigid Cellular Plastics.

1.3.6 ASTM D2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.

1.3.7 ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

1.3.8 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

1.3.9 ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

1.4 System Description

1.4.1 Materials of this Section shall provide a continuous thermal barrier at building enclosure elements.

1.5 Submittals

1.5.1 Submit under provisions of Division 1.

1.5.2 Product Data: Provide data on product characteristics, performance criteria, and limitations.

1.5.3 Manufacturer's Installation Instructions: Indicate special environmental conditions required for installation and installation techniques.

1.5.4 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.6 Delivery, Storage, and Protection

1.6.1 Deliver, store, protect and handle products to site under provisions of Division 1 and in accordance with the manufacturer's instructions.

## 1.7 Environmental Requirements

1.7.1 Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

## 1.8 Basis of Payment

1.8.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for PUMP STATION GENERAL WORK.

## 2. PRODUCTS:

### 2.1 Manufacturers - Insulation Materials

2.1.1 The Dow Chemical Company: Styrofoam.

2.1.2 Substitutions: Under provisions of Division 1.

### 2.2 Insulation Materials

2.2.1 Extruded Polystyrene Insulation: ASTM C578 Type IV; cellular type, conforming to the following:

(a) Thermal Resistance: R-value of 5 per inch.

(b) Compressive Strength: 25 psi minimum per ASTM D1621.

(c) Water Absorption: In accordance with ASTM C2842, less than 0.1 percent by volume maximum.

(d) Board Edges: Square.

(e) Board Thickness: 2" min. thickness for walls and foundations. Foundation walls to 4'-6" below grade minimum for frost protection.

### 2.3 Adhesive Materials

2.3.1 Adhesive: Type recommended by insulation manufacturer for application.

### 2.4 Accessories

2.4.1 A 1/2" or 5/8" fiber board for protection of rigid insulation surfaces.

2.4.2 Nails or Staples: Steel wire; galvanized; type and size to suit application.

2.4.3 Insulation Fasteners: Impale clip type of galvanized steel; of type to be mechanically fastened to surface to receive rigid insulation; length to suit insulation thickness; capable of securely and rigidly fastening insulation in place.

### 3. EXECUTION:

#### 3.1 Examination

3.1.1 Verify substrate and adjacent materials and insulation boards are dry and ready to receive insulation and adhesive.

3.1.2 Verify substrate surface is flat, free of honeycomb, fins, irregularities and materials that may impede adhesive bond.

3.1.3 Verify insulation boards are unbroken, free of damage.

#### 3.2 Installation – Masonry Cavity Walls

3.2.1 Secure impale fasteners to substrate at a frequency of 6 per insulation board.

3.2.2 Adhere a 6 inch wide strip of polyethylene sheet over control and expansion joint with double beads of adhesive each side of joints. Tape seal joints between sheets. Extend sheet full height of joint.

3.2.3 Apply adhesive in three continuous beads per board length to full bed 1/8 inch thick on substrate. Daub adhesive tight to protrusions to ensure continuity of vapor and air barrier.

3.2.4 Place boards in a method to maximize contact bedding. Stagger end joints. Butt edges and ends tight to adjacent boards and no protrusions. Place impale fastener locking discs.

        Cut and fit insulation tight to protrusions or interruptions to the insulation plane.

3.2.6 In masonry cavity walls, coordinate placement of rigid insulation boards with installation of masonry wire reinforcing, brick ties, flashing and other masonry and insulation accessories, and in accordance with manufacturer's instructions.

3.2.7 Cut and fit insulation tight to cavity wall protrusions and interruptions to the insulation plane.

#### 3.3 Protection of Finished Work

3.3.1 Protect finished work under provisions of Division 1.

3.3.2 Do not permit work to be damaged prior to covering insulation.

END OF THIS SECTION

## **DIVISION 8 - DOORS AND WINDOWS**

### **SECTION 8A - ALUMINUM DOORS AND FRAMES**

#### 1. GENERAL:

##### 1.1 Section Includes

1.1.1 Aluminum flush doors and frames.

##### 1.2 Related Section

1.2.1 Section 3A – Cast-In-Place Concrete.

1.2.2 Section 5B - Metal Fabrications.

1.2.3 Section 8B - Door Hardware.

1.2.4 Section 15A - General Mechanical Provisions: Louver and Damper coordination.

##### 1.3 References

1.3.1 ANSI/ASTM B209 - Aluminum and Aluminum - Alloy Sheet and Plate.

1.3.2 ANSI/ASTM B221 - Aluminum - Alloy Extruded Bar, Rod, Wire, Shape and Tube.

##### 1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 Shop Drawings: In addition to requirements below, provide a schedule of doors and frames using same reference numbers for details and openings as those on Drawings:

- (a) Elevations of each door design.
- (b) Details of doors, including vertical and horizontal edge details.
- (c) Frame details for each frame type, including dimensioned profiles.
- (d) Details and locations of reinforcement and preparations for hardware.
- (e) Details of each different wall opening condition.
- (f) Details of anchorages, accessories, joints, and connections.
- (g) Details of glazing frames and stops showing glazing.

1.4.3 Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4.4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

##### 1.5 Qualifications

1.5.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

1.6 Delivery, Storage and Protection

1.6.1 Deliver, store, protect and handle products to site under provisions of Division 1.

1.6.2 Provide strippable coating to protect pre-finished aluminum surfaces.

1.7 Basis of Payment

1.7.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Manufacturers

2.1.1 Cross Aluminum Products, Inc.

2.1.2 United States Metals & Manufacturing Corp.

2.1.3 Substitutions: Under provisions of Division 1.

2.2 Materials

2.2.1 Extruded Aluminum: ANSI/ASTM B221; 6063-T5 alloy.

2.2.2 Sheet Aluminum: ASTM B209; 5005 - H134 alloy.

2.2.3 Fasteners: Stainless steel.

2.3 Doors and Frames

2.3.1 Doors: 1-3/4 inches thick, full flush, tubular aluminum jamb rails, tubular grid sections with 0.090 inch thickness face sheet with vertical rib.

2.3.2 Frames: 0.125 inch minimum wall thickness, extruded aluminum. Frame tubular cross-section dimensions: head and jambs shall be nominal 2 inches deep; width shall be as indicated on drawings.

2.3.3 Insulated Panel: Construction of insulated panel (adjacent to louver and damper in door transom area) to match door construction.

2.4 Door and Insulated Panel Core

2.4.1 Core: Polyurethane foam.

2.4.2 Insulated door insulation R-value of 11.0 minimum.

2.5 Accessories

2.5.1 Rubber Silencers: Resilient rubber.



## 2.6 Fabrication

2.6.1 Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.

2.6.2 Coordinate fabrication of doors and frames with louver and damper size and mounting requirements as specified in Division 15 and as indicated on drawings. Fabrication to include trim to hide exterior mounting fasteners for the louvers and dampers, as required.

2.6.3 Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline and weatherproof.

2.6.4 Fabricate frames and doors with hardware reinforcement. Reinforcements to be aluminum alloy 6061-T6, minimum 0.25 inch thickness.

2.6.5 Prepare components to receive anchor devices. Fabricate anchorage items.

2.6.6 Arrange fasteners, attachments, and jointing to ensure concealment from view.

2.6.7 Prepare frame for silencers. Provide three single rubber silencers for single doors and two single silencers on frame head at double doors.

2.6.8 Fabricate frames with 2 inch head member.

## 2.7 Finish

2.7.1 Extruded Aluminum Surfaces: Anodize to clear color.

2.7.2 Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 2.0 oz/sq ft primed with iron oxide paint.

2.7.3 Apply one coat of bituminous paint to concealed aluminum and steel surfaces in contact with cementitious or dissimilar materials.

## 3. EXECUTION:

### 3.1 Examination

3.1.1 Verify that opening dimensions and tolerances are acceptable.

### 3.2 Installation

3.2.1 Install doors, frames, glazing and hardware in accordance with manufacturer's instructions.

3.2.2 Coordinate installation of doors with masonry and concrete construction for anchor placement.

3.2.3 Coordinate installation of frames with louvers and dampers.

- 3.2.4 Use anchorage devices to securely attach frame assembly to structure.
- 3.2.5 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- 3.2.6 Install hardware using templates provided. Refer to Section 8B for installation requirements.
- 3.3 Tolerances
  - 3.3.1 Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.
- 3.4 Adjusting and Cleaning
  - 3.4.1 Adjust work under provisions of Division 1.
  - 3.4.2 Adjust door for smooth and balanced door movement.
  - 3.4.3 Remove protective material from pre-finished aluminum surfaces.

Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

END OF THIS SECTION

DIVISION 8 - DOORS AND WINDOWS

**SECTION 8B - DOOR HARDWARE**

- 1. GENERAL:
  - 1.1 Section Includes
    - 1.1.1 Hardware for aluminum doors.
    - 1.1.2 Thresholds.
    - 1.1.3 Weatherstripping.
  - 1.2 Products Furnished but not Installed Under This Section
    - 1.2.1 Section 8A - Aluminum Doors and Frames.
  - 1.3 Related Sections
    - 1.3.1 Section 4A - Unit Masonry System.
    - 1.3.2 Section 5B - Metal Fabrications.

1.3.3 Section 8A - Aluminum Doors and Frames.

1.4 References

1.4.1 ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.4.2 BHMA - Builders' Hardware Manufacturers Association.

1.4.3 DHI - Door and Hardware Institute.

1.4.4 NAAMM - National Association of Architectural Metal Manufacturers.

1.4.5 UL 305 - Panic Hardware.

1.5 Submittals

1.5.1 Submit under provisions of Division 1.

1.5.2 Shop Drawings: Indicate locations and mounting heights of each type of hardware.

1.5.3 Submit manufacturer's parts lists, templates.

1.5.4 Product Data: Provide data on specified hardware.

1.5.5 Samples: Submit 1 sample of hinge, lockset, latchset, closers, thresholds, flushbolts, astragal, IDOT Deadbolt, and weatherstripping illustrating style, color, and finish.

1.5.6 Samples: May be incorporated into the work or returned to supplier.

1.5.7 Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.6 Project Record Documents

1.6.1 Submit under provisions of Division 1.

1.6.2 Record actual locations of installed cylinders and their master key code.

1.7 Operation and Maintenance Data

1.7.1 Submit under provisions of Division 1.

1.7.2 Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 Quality Assurance

1.8.1 Perform work in accordance with the following requirements:

(a) ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.9 Quality Assurance

1.9.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

1.9.2 Hardware Supplier: Company specializing in supplying commercial door hardware with 5 years documented experience.

1.9.3 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

1.10 Delivery, Storage, and Handling

1.10.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.10.2 Package hardware items individually; label and identify package with door opening code to match hardware schedule.

1.10.3 Deliver keys to Owner by security shipment direct from hardware supplier.

1.10.4 Protect hardware from theft by cataloging and storing in secure area.

1.11 Coordination

1.11.1 Coordinate work with other directly affected Sections involving manufacturer or fabrication of internal reinforcement for door hardware.

1.12 Warranty

1.12.1 Provide five year warranty under provisions of Division 1.

1.12.2 Warranty: Include coverage of door closures.

1.13 Maintenance Materials

1.13.1 Provide maintenance materials under provisions of Division 1.

1.13.2 Provide special wrenches and tools applicable to each different or special hardware component.

1.13.3 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.14 Basis of Payment

1.14.1 Payment for the work specified under this Section and as required shall be included in the Contract lump sum price for the Item, PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Manufacturers

2.1.1 Entrance Lockset x lever action x stainless steel x US 32D x removable core x Box Strike.

- |    |              |                |
|----|--------------|----------------|
| 1. | L9453 x 03   | Schlage        |
| 2. | 8847 x CRE   | Yale           |
| 3. | ML2048 x LSM | Corbin Russwin |

2.1.2 Exit Devices: Rim type x stainless steel x US 32D. Provide compatible F08 heavy duty exit device trim for exterior doors.

- |    |               |                |
|----|---------------|----------------|
| 1. | Double doors: |                |
|    | a. ED5400     | Corbin Russwin |
|    | b. 8100       | Adams Rite     |

2.1.3 Hinges x 4-1/2 x 4-1/2.

- |    |         |          |
|----|---------|----------|
| 1. | BB 1191 | Hager    |
| 2. | FBB 191 | Stanley  |
| 3. | BB 4101 | Lawrence |

2.1.4 Closers x delayed action x AL - size as recommended by manufacturer. Install closers on room side, using parallel arms where necessary.

- |    |                             |                |
|----|-----------------------------|----------------|
| 1. | DC6000 Series               | Corbin Russwin |
| 2. | 4010 / 4110 Smoothee Series | LCN            |
| 3. | 7500 Series                 | Norton         |

HO - indicates hold open

2.1.5 Kick Plates - 10" x 2" LDW x US 32D x 16GA.

- |    |           |
|----|-----------|
| 1. | Brookline |
| 2. | Ives      |
| 3. | Hiawatha  |
| 4. | Rockwood  |

2.1.6 Thresholds - set in sealant 5" x 1/2" Clear Anodized Aluminum Thermally Broken Saddle x frame width.

- |    |                 |                |
|----|-----------------|----------------|
| 1. | S282A x AL      | Reese          |
| 2. | 252 x 3AFG x AL | Pemko          |
| 3. | 8425 x AL       | National Guard |

2.1.7 Door Bottom - Mill Aluminum with thermoplastic rubber.

- |    |         |                |
|----|---------|----------------|
| 1. | DB594AU | Reese          |
| 2. | 222APK  | Pemko          |
| 3. | 15NA    | National Guard |

2.1.8 Weatherstrip – Clear Anodized Aluminum.

- |    |        |                |
|----|--------|----------------|
| 1. | DS 69C | Reese          |
| 2. | 110 NA | National Guard |
| 3. | 332 CR | Pemko          |

2.1.9 Overhead Stop – Hold Open.

- |    |           |               |
|----|-----------|---------------|
| 1. | 70H x 26D | Glynn Johnson |
|----|-----------|---------------|

2.1.10 Astragals x Full Height Door - Clear Anodized Aluminum with thermoplastic rubber.

- |    |                               |                |
|----|-------------------------------|----------------|
| 1. | Doors with two active leaves: |                |
| a. | 137NA (SET)                   | National Guard |
| b. | 303CS                         | Pemko          |

2.1.11 IDOT standard outside deadbolt: Heavy duty, high security padlock locking bolt with a 3/4" throw adjustable from 3/4" to 2-3/8" shall be provided mounted on the exterior of doors. Doors shall be reinforced as necessary for installation of the outside deadbolt. Heavy duty padlock for the doors will be provided by IDOT.

2.1.12 Substitutions: Under provisions of Division 1.

2.2 Keying

2.2.1 Supply 4 keys for each lock.

2.2.2 Keys shall match Owner's keying system.

2.2.3 Serial numbers shall be stamped or engraved on all keys.

2.3 Finishes

2.3.1 Finishes: Identified in schedule at end of section.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

### 3.2 Installation

3.2.1 Install hardware in accordance with manufacturer's instructions and requirements of NAAMM.

3.2.2 Use templates provided by hardware item manufacturer.

3.2.3 Conform to ANSI A117.1 for positioning requirements for the handicapped.

### 3.3 Field Quality Control

3.3.1 Field inspection will be performed under provisions of Division 1.

3.3.2 Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.3.3 Provide two copies of certification to Engineer.

### 3.4 Protection of Finished Work

3.4.1 Protect finished work under provisions of Division 1.

3.4.2 Do not permit adjacent work to damage hardware or finish.

### 3.5 Hardware Schedule per Door

<u>Door</u>	<u>Hardware Req'd</u>
D1	1-1/2 PR Butts x NRP 1 Entrance Lockset 1 Closer x 110 degrees x HO 1 Kickplate 1 Weatherstripping 1 Door Bottom 1 Threshold 1 IDOT Deadbolt
D2	3 PR Butts x NRP 1 Exit Devices 2 Closer x 110 degrees x HO 1 Overhead Stop 2 Kickplates 1 Weatherstripping 2 Door Bottoms 1 Threshold 1 Astragal

END OF THIS SECTION

## **DIVISION 9 - FINISHES**

### **SECTION 9A - PAINTING**

#### 1. GENERAL:

##### 1.1 Description

1.1.1 This item of work includes the furnishing, preparation and application of painting and related items to complete the work indicated on drawings and described in these specifications.

1.1.2 All work under this Section shall be subject to the applicable provisions of Section 100 of the Standard Specifications. Refer to Division 1 for additional requirements.

1.1.3 Terms used in this Section shall be as defined in ANSI/ASTM DIG.

##### 1.2 Reference Standards

1.2.1 The work shall be in conformance with the applicable standards/regulations of:

- (a) Society of Protective Coatings.
- (b) National Fire Protection Association (NFPA).
- (c) American National Standards Institute (ANSI).
- (d) Occupational Safety and Health Act (OSHA).
- (e) SSPC SP10 "Near White Metal Blast Cleaning", Society of Protective Coatings.
- (f) Military Specification MIL-L-81352A.

1.2.2 The term "finishes" as used herein means all painting and coating systems materials, including primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

1.2.3 Consult the specifications for work and materials of other trades to determine the provisions regarding their finishing. Surfaces left unfinished by the requirements of other specifications shall be painted or finished as part of this work. Work requiring finish and not specified shall be finished same as specified for similar work. Finishing specified hereinafter shall be in addition to shop and prime coats specified in other sections.

The work under this section shall be done by a firm with not less than 5 years of experience in commercial painting and finishing. Documentation of this experience shall be included together with the product data submitted for approval.

##### 1.3 Quality Assurance



1.3.1 Painting shall conform to applicable Section 1008, PAINT MATERIALS and MIXED PAINTS, of the Standard Specifications.

1.3.2 The paints to be used in the work shall be products of Tnemec Co., Inc., or approved equal. The types of paint products to be used in the work shall be identified by the manufacturer's name and number.

1.3.3 The products of manufacturers other than those herein named, which are approved equal to the products specified, may be substituted, except that, all paints applied to a surface shall be products of one manufacturer. Data showing equivalent performance of each paint product to be submitted for review at least 30 calendar days before the painting is to begin, and no painting shall proceed until the substituted products have been accepted.

1.3.4 All paints and painting materials shall be delivered to the work in the original and unopened containers plainly marked with the name, brand, shelf life, and analysis of the product, and the name of the manufacturer.

#### 1.4 Delivery and Storage of Materials

1.4.1 Deliver materials in original containers with seals unbroken and labels intact. Do not deliver or store on the site materials other than those approved for use. Empty containers shall have labels canceled.

1.4.2 Store materials outside the building. Keep storage place neat and clean and correct all damage thereto or to its surroundings.

1.4.3 Materials shall not be mixed or applied in any room having finished floor installed without providing adequate protection. Only materials used during the course of one day may be kept within the building. Remove oily rags and waste from building every night and take every precaution to avoid danger of fire.

#### 1.5 Submittals

1.5.1 Submit product data under provisions of Section 1A.

1.6 Shop Drawings: Submit the following for approval:

1.6.1 Copies of manufacturer's technical information, including paint label analysis and application instructions, certification of coating, primer and finish coat for the material and service for each coating system proposed for use.

1.6.2 Copies of Contractor's proposed surface preparation and work area protection procedures in each area of the work.

1.6.3 List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.

1.6.4 Copies of manufacturer's complete color charts for each coating system.

#### 1.7 Certification Required

1.7.1 Work shall be performed by a QP1 and QP2 Certified Contractor under program by the Society for Protective Coatings (SSPC) for all protective coating applications and hazardous paint removal projects, as required.

## 1.8 Basis of Payment

1.8.1 The work shall be paid as part of the Contract lump sum price for

### PUMP STATION GENERAL WORK

which shall be payment in full for the work described herein.

## 2. PRODUCTS:

### 2.1 Colors

2.1.1 Unless otherwise indicated, colors will be selected by the Engineer during the submitted review process.

2.1.2 Complete color charts shall be submitted of proposed paint manufacturers to the Engineer for final paint color selections.

### 2.2 Color Coding

2.2.1 Piping and electrical conduit shall be color coded with colors as selected by the Engineer. Electrical conduits shall be painted the color of the wall/ceiling against which it is run. Conduits are not required to be painted if they are not running against a wall or ceiling.

### 2.3 Non-Slip Floor Coating

2.3.1 Non-slip floor abrasive coating shall be Series 66 Hi-Build Epoxoline as manufactured by Tnemec Co., Inc., or equal. Bare concrete shall be primed at a dry film thickness of 2.0-3.0 mils. The first coat shall have a dry film thickness of 2.0-3.0 mils which includes silica sand to provide a non-skid surface. The second coat shall have a dry film thickness of 2.0-3.0 mils. The epoxy coating shall be applied in accordance with the manufacturer's recommendations.

## 3. EXECUTION:

### 3.1 Preparation

3.1.1 Inspect surfaces with regard to their suitability to receive a finish after preparatory work. The application of finish shall be an indication of the Contractor's acceptance of the surface.

3.1.2 Clean surfaces to be painted of loose dirt and dust before painting is started. Adjacent surfaces shall also be clean before starting painting. Do preparatory work necessary to produce a surface suitable to receive the specified finish.

3.1.3 Wash uncoated metal surfaces with mineral spirits to remove dirt and grease before applying paint materials. Blast profile shall not exceed 30% of total dry film thickness of coating. Preparation shall conform to primer manufacturer's requirements. Prime surfaces as soon as practical after preparation. Do not leave prepared, uncoated surfaces overnight. Touch up shop coats damaged by welding or abrasion.

3.1.4 Prior to painting, all surfaces shall be prepared and cleaned as specified and required. Surfaces shall be dry before any paint is applied. Special surface preparation work shall be as directed by the manufacturer of the paint specified to be applied to the surface. Paint shall not be applied before the prepared surfaces are approved.

3.1.5 Prior to painting steel, all welds, beads, blisters or protuberances, other than identification markings, shall be ground smooth. Pits and dents shall be filled, and other imperfections shall be removed. All rust, mill scale, oil, grease and dirt shall be removed by sandblasting in the shop in accordance with Society of Protective Coatings Specification No. SP-10, Near White (SSPC-SP-10). Cleaned metal shall be primed the same day immediately after sandblasting to prevent rusting.

3.1.6 Prior to painting other metals, all welds, beads, blisters or protuberances, other than identification markings, shall be ground smooth and other imperfections shall be removed. All nonferrous metals, galvanized steel and stainless steel whether shop primed or field primed, shall be solvent-cleaned in accordance with SSPC-SP-1 prior to the application of the primer. Nonferrous metal shall be treated with Oakite 747 LTS or equal before prime coat is applied.

3.1.7 Pipe covering and duct covering shall have all adhering debris removed and indentations or unsightly spots smoothed out to an even surface and shall be brushed clean.

3.1.8 Concrete surfaces and concrete masonry shall be brushed and washed. All loose dirt, free lime, form oil, curing compounds and other foreign matter shall be removed by approved methods. Concrete surfaces requiring repair shall be patched and surfaces to receive paint shall be spackled and repaired. Concrete surfaces to be painted shall be acid-etched as recommended by the manufacturer of the coating to be applied to produce a slightly granular surface required for adherence of the paint to the concrete unless otherwise indicated. Concrete and concrete masonry shall be thoroughly dry prior to painting.

## 3.2 Protection of Non-Finish Items

3.2.1 Furnish and lay drop cloths or other means of protection for finished surfaces during the work.

3.2.2 Before painting, remove hardware, accessories, plates, lighting fixtures and similar items or provide ample protection of such items. Upon completion of work in each area, replace above items. Use only skilled mechanics for removing and replacing items.

3.2.3 If finished surfaces are damaged, entirely remove the stains or replace the damaged material, making good any damage to other work in connection therewith, without additional cost to the State.

### 3.3 Application

3.3.1 The following items shall not be painted, unless otherwise specified: ducts, covering over ducts, registers, grilles, dampers and linkage, name and identification plates and tags, floor gratings, brass valves, stainless steel, wood, cast-iron piping installed underground.

(a) The following items shall be furnished with the manufacturer's standard prime and finish coats applied in the shop: pumps, motors, air compressors, wall fans, control and SCADA panels, panelboards, transformers, unit heaters, aluminum fascia, motor control centers, hoisting equipment.

(b) The following items shall be shop primed and field painted: structural steel and wrought metals, pipelines, hangers and supports, valves, valve operators and stands, guard housings, steel lintels, hollow metal doors and frames.

(c) All items not shop primed or shop finished shall be field primed and finished where exposed to view. The work shall generally include, but not be limited to, the following: interior concrete block, interior concrete walls, columns, beams and ceilings, covering over insulation on piping, electrical conduit, small piping and copper tubing, exterior PVC piping.

3.3.2 The work shall include all touch-up and remedial painting as required until the completion and acceptance of the final work.

3.3.3 Spray painting shall not be allowed.

### 3.4 Installation

3.4.1 Furnish equipment for the proper execution of the work. Erect and place same in such a way as not to interfere with work of other trades. Upon completion, dismantle and remove same from the job site.

3.4.2 Employ skilled mechanics to ensure good workmanship. Thoroughly mix materials immediately before application of paint. Surfaces shall be clean, dust free, dry and adequately illuminated. Each coat shall be thoroughly dry before applying succeeding coat.

3.4.3 Finished work shall be uniform and of approved color, smooth and free from runs, sags, and defective application. Edges of paint adjoining other materials or colors shall be sharp and clean, without overlapping. Before applying succeeding coats, primers and undercoats shall be completely integral and performing the function for which they are specified. Prepare and touch up scratches, abrasions, or other disfigurement and remove any foreign matter between successive coats.

3.4.4 Blast cleaned metal surfaces shall be coated immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Blast cleaned surfaces shall be coated not later than eight hours after cleaning under ideal conditions or sooner if conditions are not ideal.

3.4.5 Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination. Clean contaminated surfaces before applying next coat. Ensure method of cleaning contaminated surface follows manufacturer's recommendations.

3.4.6 Primers and undercoats of paint and enamel shall be tinted or shaded different colors than the finish coats. Each coat of material shall be inspected and approved by the Engineer before application of the succeeding coat. Otherwise, no credit for the coat applied will be given and the work in question shall be recoated. Inform the Engineer when each coat is ready for inspection and approval.

3.4.7 Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

3.4.8 Painting shall not be done when the temperature is below 10 degrees C (50 degrees F) and when satisfactory results cannot be obtained due to high humidity or excessive temperatures. Paints or other finishes shall not be applied to wet or damp surfaces.

3.4.9 All painting shall be done in accordance with the paint manufacturer's recommendations.

3.4.10 All wall surfaces which will be concealed by equipment shall be painted before equipment installation.

3.5 Cleaning

3.5.1 Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.5.2 Rubbish, debris, empty paint cans and discarded materials shall be placed in metal containers and removed from the site.

3.6 Schedule

3.6.1 Material Painting Schedule

Primer Class of Work	Field or Shop Finish Coats			
	Shop Coat	1st	2nd	3rd
Nonferrous Metal and Galvanized Steel:				
Interior		A	A	A
Exterior		A	A	C
Steel and Iron:				
Interior	B	B*	A	A
Exterior	B	B*	A	C
Submerged or constantly Wetted	B	B*	D	D
Asphaltic Coated Steel		E*	A	A
Concealed in Masonry	B	B*		
Exposed to Potable Water Wrapped in Insulation	B	B*	B	F
Exterior, Exposed to Process Wetting and Drying	B	B*	D	D

Concrete	D	D
Pipe and Duct Insulation: Exposed	A	A

\*Touch-up bare metal with primer.

### 3.6.2 Paint Schedule

(a) Alphabetical designations in the following list are given solely for the purpose of indicating the type and quality of materials desired. Equivalent material from other approved manufacturers may be substituted.

<u>Symbol</u>	<u>Product Name and Number</u>	<u>Volume Solids %</u>	<u>Dry Film Thickness (Mils) Per Coat</u>	
			<u>Micrometers</u>	
A	Tnemec Series 69 Hi-Build Epoxoline II	69	51-76 um	(2.0-3.0 mils)
B	Tnemec Series 140-1225 Chicago Biege Pota-Pox Plus	69	102-152	(4.0-6.0)
C	Tnemec Series 74 Endura-Shield	54	51-76	(2.0-3.0)
D	Tnemec Series 69 Hi-Build Epoxoline II	69	76-127	(3.0-5.0)
E	Tnemec Series 90-97 Tneme-Zinc	63	64-89	(2.5-3.5)
F	Tnemec Series 140-WH02 Pota-Pox Plus	69	102-152	(4.0-6.0)
G	Tnemec Series 69 Hi-Build Epoxoline II	69	178-254	(7.0-10.0)
H	Tnemec Series 51-792 PVA Sealer	28	25-51	(1.0-2.0)
I	Tnemec Series 6 (flat) 7 (gloss) Tneme-Cryl	43	51-76	(2.0-3.0)

### 3.6.3 Notes

- (a) Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, these areas shall be given one field coat of Tnemec Series 69 Hi-Build Epoxoline II.
- (b) Stainless steel, where indicated shall be protected by two coats of clear acrylic lacquer conforming to the requirements of Military Specification MIL-L-81352A. Surface preparation shall consist of removing all oil and foreign matter by wiping clean with cloth and lacquer thinner.
- (c) Applicable to insulated and uninsulated pipes: Steel pipe not available with a shop coat shall be prime coated in the field immediately after installation.
- (d) Piping shall be painted up to and including the flanges attached to mechanical equipment. Electrical conduit shall be painted up to and including the flexible conduit connected to equipment.
- (e) All steel pipes, ductile iron fittings and flanges located at the wet well, intermediate floor and discharge floor shall be shop finish painted before shipment. Provide field touch-up paint as required.

### 3.6.4 General Color Scheme

General color scheme shall be as follows:

- Grade floor – gray non-slip.
- (b) Interior steel frame, metal trim and ceiling - white.
- (c) Exterior concrete fascia – white.
- Exterior metal trim - light gray.
- Exterior piping and appurtenances - Turbine blue.
- Interior piping - Turbine blue.
- Electrical conduits - light gray.

END OF THIS SECTION

## DIVISION 9 - PAINTING

### **SECTION 9B - REMOVAL AND DISPOSAL OF LEAD BASED PAINT**

#### 1. GENERAL:

##### 1.1 Description

1.1.1 The work specified herein includes furnishing all equipment and material to remove and dispose of all paint, which is all to be assumed to be lead based, from the floor of the interior of the pump room and concrete stairway landings below grade.

## 1.2 Design Requirements

1.2.1 Contractor shall be responsible for design of Lead Abatement Program, Health and Safety Plan, implementations and use.

## 1.3 Submittals

1.3.1 Shop Drawings: Indicate materials and equipment to be used.

1.3.2 Manufacturer's Instructions: Indicate special procedures and conditions requiring special attention.

## 1.3.3 Submittals Required

(a) Certification of Lead Abatement Contractor and Lead Abatement Supervisor, including list of former clients and telephone numbers.

(b) Blasting materials and additives.

(c) Health and Safety Plan, specific to the site.

(d) Final Report by a Certified Hazardous Materials Manager (CHMM).

(e) Name and Qualifications of Environmental Consultant.

## 1.4 Certifications Required

1.4.1 Work shall be performed by a State Licensed Lead Abatement Contractor. Work shall be supervised by the Contractor's Licensed Abatement Supervisor.

1.4.2 Contractor shall submit written certification prior to work proceeding.

1.4.3 Work shall be performed by a QP1 and QP2 Certified Contractor under program by the Society for Protective Coatings (SSPC) for all protective coating applications and hazardous paint removal projects, as required.

## 1.5 Scheduling

1.5.1 Schedule Work to not coincide with new construction.

1.5.2 Describe removal procedures and schedule.

1.5.3 Perform noisy work in accordance with city ordinance.

## 1.6 Project Conditions

1.6.1 Conduct paint removal to minimize interference with adjacent and occupied building areas and plant operation.



1.6.2 Contractor shall obtain required permit from authorities at no additional costs to DEPARTMENT.

## 1.7 Submittals

1.7.1 Submit drawing showing extent of the area to be covered under this Section.

## 1.8 Basis of Payment

1.8.1 This work will be paid for at the contract unit price per square meter or square foot for REMOVAL AND DISPOSAL OF LEAD BASED PAINT which shall be payment in full for the work described herein.

## 2. PRODUCTS:

### 2.1 Manufacturers - Blasting Additive

2.1.1 BLASTOX by the TDJ Group.

2.1.2 Substitutions: None.

2.2 Blasting additives shall be BLASTOX, which is added to the non-recyclable abrasive blasting material to reduce the leachate potential of the waste product below the Federal Standard for hazardous material.

### 2.3 Examination

2.3.1 Contractor to verify existing site conditions.

### 2.4 Preparation

2.4.1 Provide, erect, and maintain temporary structures for protection of the existing facilities.

2.4.2 Provide, erect, and maintain temporary barriers to prevent spread of dust, odors, and noise to permit continued Department occupancy.

2.4.3 Erect and maintain weatherproof closures for exterior openings.

## 3. EXECUTION:

### 3.1 General

3.1.1 Contractor shall perform all work in accordance with 29 CFR 1910, 29 CFR 1920, 29 CFR 1926 and all applicable state and Federal Laws.

3.1.2 Contractor shall cover and protect existing equipment so that no blasting material or moisture shall enter the existing facilities or equipment while removal work is proceeding. Contractor shall filter the exhaust air with a HEPA filter with a minimum of 0.3 Micron filter before discharge to the atmosphere.

Contractor shall monitor continuously and continuously record the discharge air for lead concentrations for the time that Abatement begins until satisfactory final cleaning. Contractor shall submit air monitoring records to Engineer. Air monitoring shall be conducted by a qualified Environmental Consultant with all costs paid by the Contractor.

3.1.3 Contractor shall clean-up site on a daily basis so that no debris is tracked off the site by its Department or public personnel.

3.1.4 Contractor shall completely remove existing lead based paint from walls, floors and ceilings. All debris and materials shall be removed from the site. Final clean-up shall be based upon a lab analysis of the air sample from the pump station to be less than Federal Standards allow for completed Lead Abatement Program.

### 3.2 Final Report

3.2.1 Contractor shall submit a Final Report of the Lead Abatement program including:

- (a) Names and addresses of licensed personnel performing work including license designation and number.
- (b) Air monitoring records of exhaust air conducted by Environmental Consultant.
- (c) Manifests of disposal of lead paint material and landfill forms.
- (d) The lead leachate potential or TCLP of the lead based paint material that is disposed. Results to be verified by a NAVLAP accredited testing lab. Include accreditation of testing lab.
- (e) Final Report to be signed and reviewed by a Certified Hazardous Material Manager. Report is to be complete with notes of any deficiencies and corrective action by Contractor. Report will not be complete until corrective actions are complete.
- (f) Record of any correspondence or conversations with any area resident or the general public by the contractor or its personnel.
- (g) Field and lab test results of final clean-up.

3.2.2 Final Report will not be completed until all corrective actions are completed.

### 3.3 Schedule

3.3.1 Pump Room Floor: Approximately 1,620 ft<sup>2</sup>

3.3.2 Concrete Stairway Landings Below Grade: Approximately 120 ft<sup>2</sup>

END OF THIS SECTION

## **DIVISION 10 - SPECIALTIES**

### **SECTION 10A - SPECIALTIES**

#### **1. GENERAL:**

##### **1.1 Description**

1.1.1 This item of work includes the furnishing and installation of bulletin board, fire extinguishers, first aid kit, service desk, nameplate, pump dolly and related items to complete the work shown and specified.

1.1.2 Refer to Division 1 for additional requirements.

##### **1.2 Related Sections**

1.2.1 Section 5E - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.

1.2.2 Section 9A – Painting.

##### **1.3 Submittals**

1.3.1 Submit shop drawings and product data under provisions of Section 1A.

##### **1.4 Delivery, Storage and Handling**

1.4.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

##### **1.5 Guarantee**

1.5.1 Provide guarantee under provisions of Section 1A.

##### **1.6 Basis of Payment**

1.6.1 Specialties shall be paid for as part of the Contract lump sum price for PUMP STATION GENERAL WORK which shall be payment in full for work described herein.

#### **2. PRODUCTS:**

##### **2.1 Bulletin Board**

2.1.1 Furnish and install one (1) two-panel bulletin board with glass doors as shown. Bulletin board panels shall be 1/4" cork mounted on hardboard. Doors shall have 1/4" glass and shall be continuously hinged with flat key tumbler locks. Overall dimensions shall be approximately 40" high, 60" long, 3" deep.

##### **2.2 Station Identification Plate**

2.2.1 Furnish and secure in position and location, one cast bronze tablet for each such required tablet. The tablet shall be made by a firm specializing in bronze tablet work and shall be of best grade of statuary bronze. Lettering shall be arranged as directed and of a style to be selected. All lettering and designs to be of embossed type, milled and polished. Background shall be pebble finish, left rough. A full-size rubbing shall be submitted for approval before casting.

2.2.2 Lettering shall read as shown on drawing.

## 2.3 Staff Gauges

2.3.1 Two staff gauges, calibrated in feet and tenths of a foot, shall be provided in the wet well to show the water depth in the well.

2.3.2 Each gauge shall be porcelain enameled iron rod. The rods shall be professional type, 2-1/2" wide minimum, with large bold markings of a height for the full height of the wet well.

2.3.3 Each staff gauge shall be attached and supported in the well using corrosion-resistant hardware at locations to avoid conflict with level controls, etc.

## 2.4 Shop Desk

2.4.1 A metal shop desk shall be provided. The desk shall have a 43 inch high work surface and shall be approximately 53 inches high by 34.5 inches wide by 30 inches deep. The unit shall have a rear top shelf riser, a 3.5 inch high drawer on nylon rollers and a large storage compartment with locking door and an adjustable shelf. The unit shall have 14 ga. corner posts and a minimum 20 ga. top and shall have a gray enamel painted finish.

## 2.5 First Aid Kit

2.5.1 Furnish and install a first aid kit with brackets for wall mounting as directed. The kit shall be No. 99814C as manufactured by Johnson and Johnson or equal.

## 2.6 Fire Extinguishers

2.6.1 Furnish and install two fire extinguishers as directed. The extinguishers shall be multipurpose Dry Chemical Type with a U.L. rating of 20A: 120B: C, 20 pound capacity in enameled steel containers. The extinguishers shall be installed with wall brackets of size required for type and capacity of extinguisher indicated.

## 2.7 Pump Dolly

2.7.1 Furnish two pump dollies for moving pump at floor El.+9,5' and -26.5' for the low flow pump.

2.7.2 Dolly shall be shop wagon Stock No. 7045902 manufactured by Little Giant and distributed by C&H Distributors, LLC with the following design:

(a) Dolly shall be 48"x30" with 18" deck height and 3,000 lbs capacity, 12 gauge steel deck, flush edges, double grip T-bar handle, 1" axle and roller bearing wheels.

(b) Dolly shall easily be mobile while carrying heavy loads.

## 2.8 Clock

2.8.1 Clock shall be synchronous motor type, 12" face, 120 V. 60 Hz.

## 2.9 Trash Can

2.9.1 Trash can shall be made of polyethylene and the capacity shall be approximately 20 gallons.

## 3. EXECUTION:

### 3.1 Installation

3.1.1 Install the specified specialties in accordance with manufacturer's recommendations and instructions to permit intended performance.

3.1.2 The manufacturer or supplier of the specified specialties shall furnish a qualified field engineer for whatever period of time may be necessary to assist and direct the contractor in the proper installation of the equipment furnished, to observe and check initial performance, and whose duty shall include the instruction of the plant operating personnel in the proper operating and maintenance procedures.

### 3.2 Painting

3.2.1 The specified specialties shall be painted in accordance with applicable AWWA standard specified and with Section 9A of these specifications.

### 3.3 Testing

3.3.1 The specialties shall be tested in place by the Contractor, and any defects in specialties or connections shall be corrected to the satisfaction of the Engineer.

END OF THIS SECTION

## DIVISION 10 - SPECIALTIES

### **SECTION 10B - FIBERGLASS REINFORCED PLASTIC PRODUCTS AND FABRICATIONS**

#### 1. GENERAL:

##### 1.1 Related Documents

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

## 1.2 Summary

1.2.1 This section includes the following FRP Products design, fabrications, and installation:

1. FRP Stair treads.
  1. FRP Grating.
  2. Grating Fasteners.
  3. FRP Ladders & Cages.
  4. FRP Structural Shapes.

## 1.3 Scope of Work

1.3.1 Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced plastic (FRP) products as specified herein.

## 1.4 Quality Assurance

1.4.1 The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.

1.4.2 Substitution of any component or modification of system shall be made only when approved by the Architect or Engineer.

1.4.3 Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

1.4.4 In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

## 1.5 Design Criteria

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

1.5.2 Design of FRP live loads on grating shall not be less than 100 pounds per sq. ft. Grating deflection at the center of a simple span not to exceed the lesser of 0.375 inch or clear span divided by 125.

1.5.3 Design of FRP live loads on grating at EL. -26.5 shall be not less than 300 psf uniform load, a 2,000 lb concentrated wheel load or a 500 lb/ft concentrated line load for a 36" span.

1.5.4 Structural members shall be designed to support all applied loads. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the loads.

## 1.6 Submittals

1.6.1 Shop drawings of all FRP structural members, handrails, gratings, plate, ladders and appurtenances shall be submitted to the Engineer for review.

1.6.2 Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating.
2. Design tables showing limits for span length and deflection under various uniform and concentrated loads.
3. Materials of construction.
4. Chemical resistance table

1.6.3 Detail shop drawings showing:

1. Dimensions.
2. Sectional assembly.
3. Location and identification mark.
4. Size and type of supporting frames required.

1.6.4 All shop drawings shall be sealed by Structural Engineer registered in the State of Illinois.

1.7 Shipping and Storage Instructions

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

1.7.2 Items shall be covered and protected from exposure to sun or ultra violet light during storage.

1.7.3 All materials and equipment necessary for the fabrication and installation of the grating, plate, handrails, stair treads, structural shapes and building panels shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

1.7.4 Identify and match-mark all materials, items, and fabrications for installation and field assembly.

2. PRODUCTS:

2.1 General

2.1.1 Materials used in the manufacture of the FRP products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.

2.1.2 All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.

1. Resins shall be VINYL ESTER resin for ladders and cages and other members that may be submerged in the wet well or discharge chamber and in continuous contact with sewage.

2. Resins for members for exterior or dry service shall be either polyester or vinyl ester resin.

2.1.3 After fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating to prevent intrusion of moisture.

2.1.4 All exposed surfaces shall be smooth and true to form.

#### 2.1.5 FRP Manufacturers:

1. Strongwell-Chatfield Division, Chatfield, MN.
2. Composite Structures International, Inc.
3. Bedford Plastics, Inc.
4. Augusta Fiberglass.
5. Ultra, Inc.
6. Or approved alternative manufacturer.

#### 2.1.6 Grating Fastener Manufacturers:

1. GFI Grating Fasteneres, Inc.
2. Strongwell.
3. Composite Structures International, Inc.
4. Augusta Fiberglass.
5. Ultra, Inc.
6. Or approved alternative manufacturer.

## 2.2 Gratings

### 2.2.1 General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected by cardboard to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

2.2.2 All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

2.2.3 Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.



2.2.4 Resin shall be Vinyl Ester, Isophthalic Polyester, Polyester or Modified Acrylic, with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

2.2.5 All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

All grating products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D635.

All mechanical grating clips shall be manufactured of Type 316SS (stainless steel).

Pultruded I-bar grating with bearing bars at 1 ½ in o.c. and cross bars at maximum 12 in o.c.

Measurements: Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work.

Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication. Provide additional support bars, hold-downs or framing as required for cutouts shown on plans.

Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

Stair treads shall have antislip nosing.

The grating cover plate shall be attached to the completed panel of grating by chemical means (epoxy) to ensure integral action of the panel and plate

Non-slip surfacing: Covered grating shall be having a gritted surface, integrally molded into the plate prior to bonding to the grating.

## 2.3 Grating Fasteners

2.3.1 Grating fasteners shall be Type 316 stainless steel saddle clips or C-clips.

2.3.2 Fasteners shall allow grating panels to be secured to structural steel beam supports without field drilling, welding or otherwise damaging steel coating. Each outside panel edge and/or corner of gratings supported by structural steel I-beams or channel beams shall be secured to structural steel support with stainless steel G-clips specifically designed for securing grating shapes to steel members without drilling or damaging steel surface coating as manufactured by GFI Grating Fasteners, Inc. or equal. Hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

2.4 Structural Shapes and Plate

2.4.1 Structural shapes and plate shall be made from a premium grade polyester or vinyl ester resin.

2.4.2 Structural shapes and plates shall be manufactured by the pultrusion process.

2.4.3 Structural FRP members composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% resin to glass ratio. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats shall be used internally for transverse strength.

2.4.4 Pultruded structural shapes are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	$2.5 \times 10^6$ (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)
Flexural Modulus	D-790	$1.8 \times 10^6$ (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	$2.8 \times 10^6$ (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	$4.5 \times 10^5$ (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	$8.0 \times 10^{-6}$ ( $1.4 \times 10^{-6}$ )	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

2.4.5 Structural members shall be designed to support all applied loads. Deflections in any direction shall not be more than L/150 of span for structural members. Connections shall be designed to transfer the loads.

2.5 Fiberglass Ladders & Cages

2.5.1 Ladders shall be fiberglass reinforced plastic (FRP) constructed of siderails, rungs, cage straps, cage loops and brackets.

2.5.2 Resins for ladders and cages shall be vinyl ester resin.

2.5.3 All finished surfaces of FRP items and fabrication shall be smooth, resin-rich, free of voids, and without dry spots, due to wear or weathering. All pultruded structural shapes shall be further protected for ultraviolet (UV) light.

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

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

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

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

2.5.4 Ladders shall be fully shop assembled. All rungs shall penetrate the wall of the tube side rails and shall be connected to the rails with both epoxy and rivets to provide both a chemical and mechanical lock, respectively.

### 3. EXECUTION:

#### 3.1 Preparation

3.1.1 Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

#### 3.2 Inspection and Testing

3.2.1 The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

3.2.2 All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Department.

3.2.3 Members and components shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

#### 3.3 Installation, General

3.3.1 Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.

3.3.2 Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels. All field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

3.3.4 Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.

3.3.5 At all unsupported cutouts, install hold downs at uncut bearing bars beyond cutout area and install support bars from hold down to hold down. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products.

3.3.6 Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

DIVISION 10 - SPECIALTIES

**SECTION 10C – CARBON FIBER REINFORCED POLYMER (CFRP) LAMINATE**

1. GENERAL:

1.1 Related Documents

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

1.2 Summary

1.2.1 This section includes the following CFRP Products:

1. Carbon Fiber Reinforced Polymer (CFRP) Laminate.
2. Epoxy Adhesive.

1.3 Scope of Work

1.3.1 Furnish all labor, materials, equipment and incidentals necessary to install the carbon fiber reinforced polymer (CFRP) laminate as specified herein.

1.3.2 The system shall consist of a pultruded carbon fiber reinforced polymer (CFRP) laminate with an epoxy resin matrix designed for strengthening concrete and compatible epoxy adhesive.

1.4 Quality Assurance

1.4.1 The material covered by these specifications shall be furnished by a reputable and qualified manufacturer of proven ability who has regularly engaged in the manufacture and installation of CFRP systems.

1.4.2 Substitution of any component or modification of system shall be made only when approved by the Architect or Engineer.

1.4.3 In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

## 1.5 Submittals

1.5.1 Shop drawings of all CFRP laminate and adhesive shall be submitted to the Engineer for review.

### 1.5.2 Manufacturer's catalog data showing:

1. Dimensions.
2. Tensile strength.
3. Modulus of Elasticity.
4. Dimensions.
5. Surface preparation and application instructions.

## 2. PRODUCTS:

### 2.1 General

2.1.1 Materials used in the manufacture of the Carbon Fiber Reinforced Polymer (CFRP) laminate and adhesive products shall be new stock of the best quality and shall be free from all defects and imperfections that might affect the performance of the finished product.

#### 2.1.2 CFRP Laminate

1. Sika CarboDur by Sika Corporation (Specifications are based on Type S 512, S 812 and S1012).
2. Or approved alternative manufacturer.

#### 2.1.2 Adhesive

1. Sikadur 30 Epoxy by Sika Corporation.
2. Or approved alternative manufacturer.

### 2.2 CFRP Laminate

#### 2.2.1 General

1. Laminate shall be carbon fiber reinforced polymer with an epoxy resin matrix.

#### 2.2.2 Laminate shall have the following minimum material properties:

Tensile strength:  $4.06 \times 10^5$  psi  
Modulus of elasticity:  $23.2 \times 10^6$  psi  
Elongation at break: 1.69%  
Design strain 0.85%  
Thickness: 0.0047 in.

### 3. EXECUTION:

#### 3.1 Preparation

3.1.1 Surface must be clean and sound. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles and other bond inhibiting materials from the surface.

3.1.2. Existing uneven surfaces must be filled with an appropriate mortar (e.g. mixed Sikadur with the addition of 1 part sand). Maximum allowable deviation in 6 feet shall be limited to  $\frac{1}{4}$ " but no greater than  $\frac{1}{8}$ " per foot. Grind smooth and flush any sharp edges (i.e. fins, form-marks, etc).

Verify adhesive strength of concrete after surface preparation by a random pull-off testing (ACI 503R) in presence of inspector. Minimum tensile strength, 200 psi with concrete substrate failure.

Cut CFRP as recommended by manufacturer.

#### Inspection and Testing

3.2.1 The Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

3.2.2 All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Department.

Members and components shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

#### Installation, General

Apply neat mixed epoxy adhesive onto concrete with trowel or spatula to a nominal thickness of  $\frac{1}{16}$ " or as recommended by the manufacturer and approved by the Engineer.

Using appropriate hard rubber roller, press the laminate into the epoxy resin until the adhesive is forced out on both side. Remove excess adhesive.

Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

**DIVISIONS 11, 12 & 13 - NONE REQUIRED**

**DIVISION 14 - CONVEYING SYSTEMS**

**SECTION 14A - HOISTING EQUIPMENT**

1. GENERAL:

1.1 Section Include

1.1.1 Hand-operated chain hoist.

Location	Capacity (Ton)	Operating Lift (Feet)
Pump Room	1	48

1.2 System Description

1.2.1 Design Requirements:

1.2.1.1 Design and fabrication of hoist shall be in accordance with the applicable requirements of HMI-200.

1.2.1.2 Operating chains of hoist shall loop not more than 4 ft above the finished operating floor.

1.3 References: Equipment shall meet the requirements of the following specifications unless more stringent requirements are otherwise specified:

1.3.1 ANSI B30.16 - Safety Standard for Overhead Hoists.

1.3.2 HMI 200 – Standard Specification for Hand-Operated Chain Hoist.

1.4 Submittals

1.4.1 Product Data:

1.4.1.1 Details of hoist.

1.4.1.2 Operation and Maintenance data.

1.4.2 Submit in accordance with Section 1A.

1.5 Quality Assurance

1.5.1 Proportion parts of mechanism for stresses that occur during continuous operation, during installation, and during fabrication.

1.6 Basis of Payment

1.6.1 Hoist shall be paid for as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK which shall be payment in full for work described herein.

**2. PRODUCTS:**

2.1 Manufacturers

2.1.1 ACCO Wright.

2.1.2 Budgit Hoists.

2.1.3 CM Hoist.

2.1.4 Substitutions: Under provisions of Section 1A.

2.2 Hoist

2.2.1 Hook suspended type, with rated capacity and operating lift as noted.

2.2.2 Operating chain and lift chain shall be zinc plated.

2.2.3 Hoist shall have corrosion resistant.

2.2.4 Provide chain container to be mounted as shown on drawing.

2.3 Marking

2.3.1 Permanently mark capacity of hoist.

**3. EXECUTION:**

3.1 Installation

3.1.1 Install hoist as shown on Drawings, in accordance with approved submittals and manufacturer's recommendations.

3.2 Field Quality Control

3.2.1 Field load test hoist in accordance with OSHA, ANSI, and local requirements.

END OF SECTION

**DIVISION 15 - MECHANICAL**

**SECTION 15A - GENERAL MECHANICAL PROVISIONS**

**1. GENERAL:**

1.1 Section Includes

1.1.1 The scope of work under this Division shall be all mechanical work required for the project work as shown or specified.

1.1.2 The mechanical work shall include the furnishing and installing of various items of mechanical equipment and appurtenances. Unless otherwise specifically indicated, electrical work shown on the electrical drawings shall be provided under Division 16.



Any additions or modifications to the work shown on the electrical drawings required for the proper installation or operation of work under this Division shall be provided under this Division, at no additional cost to the Department, in conformance with the requirements of Division 16. The Contractor shall be responsible for ascertaining the extent of electrical connections required for items furnished under this Division, for ascertaining the extent of electrical work shown on the electrical drawings and for coordinating the electrical work accordingly.

1.1.3 The specifications and drawings are intended to generally define the work required, but they do not include every equipment and installation detail. The work shall include all items and appurtenances required to fully complete the work, whether specifically identified or not, such that the electrical systems are complete and operational.

1.1.4 Furnishing and installing of work under this Division shall comply with Division 1 requirements relating to the furnishing and installing of work.

## 1.2 Code Compliance

1.2.1 Unless otherwise indicated, in the absence of more stringent requirements in the Specifications or on the Drawings, the work shall be in compliance with the requirements of applicable codes, as a minimum.

## 1.3 Standards

1.3.1 Wherever the following abbreviations are used in these Specifications, or on the Drawings, they are to be construed the same as the respective expressions represented:

### MHSWP.S. Manual for Highway Storm Water Pumping Station

AASHTO	<u>American Association of State Highways and Transportation Officials</u>
ANSI	<u>American National Standards Institute</u>
ASME	<u>American Society of Mechanical Engineers</u>
ASTM	<u>American Society for Testing and Materials</u>
AWG	<u>American Wire Gauge</u>
AWWA	<u>American Water Works Association</u>
IPCEA	<u>Insulated Power Cable Engineers Association</u>
IES	<u>Illuminating Engineering Society of North America</u>
NEC	<u>National Electrical Code</u>
NEMA	<u>National Electrical Manufacturers Association</u>
NESC	<u>National Electrical Safety Code</u>

UL	<u>Underwriters' Laboratories</u>
HIS	<u>Hydraulic Institute Standard</u>
FM	<u>Factory Mutual</u>
ASHRAE	<u>American Society of Heating, Refrigerating and Air Conditioning Engineers</u>
SMACNA	<u>Sheet Metal and Air Conditioning Contractors' National Association</u>

1.3.2 Wherever a reference is made to a standard or standard specification, the reference shall be to the edition current at the time of bidding, including any revisions or amendments.

#### 1.4 Verification of Contract Drawings

1.4.1 The Contractor shall familiarize himself with the details of the total construction insofar as they may affect the work under this Division, including floor elevations, physical dimensions of structures, materials of construction and the nature of work required under other Divisions. No additional compensation will be granted for failure to consider the total project work.

1.4.2 The contract drawings (Drawings) for electrical work are generally diagrammatic and do not necessarily depict all items to scale. The Drawings indicate the general locations of major elements of the work, however, field conditions or interferences, may require changes in the installation. The Contractor shall coordinate his work to avoid interferences and shall obtain approval prior to making any changes from the installation shown.

1.4.3 Prior to installation, the Engineer may make reasonable minor changes in the locations of the installation without additional cost to the State.

1.4.4 The electrical work shown on the electrical drawings (or on electrical portions of multi-trade drawings) shall be provided under Division 16. Any changes in the electrical installation required for the proper installation or operation of items provided under this Division shall be provided under this Division in full conformance with the requirements of Division 16. In other words, if a change to the electrical work is required to accommodate equipment provided under Division 15, that change shall be the responsibility of Division 15 and it must be in full compliance with the requirements of Division 16.

#### 1.5 Coordination

1.5.1 The Contractor shall coordinate the work under this Division with the work of other trades. This shall include an orderly exchange of information and shall be accomplished such that the total work is not delayed and that interferences are avoided.

#### 1.6 Workmanship

1.6.1 The mechanical work shall be performed in a neat and workmanlike manner in accordance with the best practices of the trade.

1.6.2 Unless otherwise indicated, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

## 1.7 Protection of Work

1.7.1 All mechanical work, including equipment and appurtenances, shall be protected from damage until final acceptance. Equipment shall be covered to protect against dirt, moisture, paint and the like. The work shall be protected from mechanical injury by appropriate covering or shielding.

1.7.2 Prior to final acceptance, protective measures shall be removed and equipment and items shall be cleaned as required to deliver the installation to the State in clean, undamaged condition.

## 1.8 Clean-up and Safety

1.8.1 The work site shall be maintained in a clean condition, free of hazards, all in conformance with the requirements of Article 107 of the Standard Specifications. Special care shall be taken to assure that systems are not left in a hazardous condition.

## 1.9 Materials and Equipment

### 1.9.1 Quality

(a) All materials, equipment and appurtenances shall be new, shall be suitable for the application and shall be the product of established, reputable manufacturers.

### 1.9.2 Standards

(a) The construction, sizes, ratings and capacities of items shall be in conformance with the requirements of the codes and with ASTM and ASME standards, as applicable.

### 1.9.3 UL and/or FM Label

(a) Unless otherwise indicated, materials and equipment shall bear the UL and/or FM label whenever such labeling is available for the type of material or equipment being furnished.

### 1.9.4 Other Requirements

(a) Refer to Division 1 for other requirements relating to materials and equipment.

## 1.10 Erecting and Jointing Interior Piping

### 1.10.1 Description

(a) This section includes furnishing of supports and hangers and installation of all interior piping and supports.

(b) Piping of the materials, coatings and linings shown or specified shall be installed and supported at the locations specified or where shown.

1.10.2 Delivery, Storage and Handling

- (a) All products and materials shall be delivered, stored and handled as specified in Division 1.
- (b) Extreme care shall be taken in loading and unloading the pipe and fittings. The work shall be done slowly using skids or suitable power equipment keeping the pipe under control at all times.
- (c) Under no condition is the pipe to be dropped, bumped, dragged, pushed or moved in any way which will cause damage to the pipe, lining or coating.
- (d) When handling the pipe with a crane, a suitable pipe hook or sling shall be used around the pipe. Under no condition is the sling to be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends, lining and coating.
- (e) Any piping or fittings damaged in the process of delivery, storing, handling, or laying shall be replaced or repaired as approved.

1.10.3 The interior of pipelines shall be cleaned of all dirt and superfluous material of every description in an approved manner.

1.10.4 All bolts shall be primed by dipping with a bituminous coating, except the threads, which are coated immediately prior to installation of the nuts.

1.10.5 All threads shall be coated with a suitable pipe dope, Masters Metallic Compound, graphite and engine oil, or equal, before jointing.

1.10.6 Installed piping shall be free of sags or bends.

1.10.7 Piping shall be installed to allow for expansion and contraction without stressing pipe, joints or connected equipment.

1.10.8 The fire rated integrity shall be maintained where pipes pass through fire rated walls, partitions, ceilings, and floors.

1.10.9 Pipelines shall be fitted and installed in a neat and workmanlike manner in accordance with approved shop drawings.

1.10.10 Flanged joints shall be made with bolts or bolt studs with a nut on each end.

1.10.11 Welding of pipe joints shall conform with the requirements of ANSI B31.1 unless otherwise specified. All off site welding of steel pipe shall conform to the appropriate requirements.

- (a) Pipe and fittings with wall thickness of 4.8 mm (3/16-inch) and larger shall have ends beveled for welding. Parts to be welded shall be securely held in place and in proper alignment during welding.

- (b) The abutting pipe ends shall be separated before welding to permit complete fusion to the inside wall of the pipe without overlapping.
- (c) Welding shall be continuous around the joint and completed without interruption.
- (d) Welds shall be of the single vee butt type, of sound weld metal thoroughly fused into the ends of the pipe and into the bottom of the vee.
- (e) Welds shall be free from cold shuts, pinholes, oxide inclusions or other defects.

1.10.12 Anchors and stands shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment.

Where adjustable supporting devices are not required, pipelines 75 mm (3 inches) in diameter and smaller shall be supported on cast-iron, malleable iron, or steel hooks, hook plates, rings or ring plates.

#### 1.10.13 Hangers and Supports

- (a) Pipe hangers shall be provided at each change in pipe direction, on both sides of pipe mounted valves and equipment and on both sides of pipe loops and expansion absorbing devices.
- (b) Brackets shall be used for the support of piping from vertical surfaces.
- (c) Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment.
- (d) Hangers and supports shall be installed to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- (e) Hangers shall be adjusted to distribute loads equally on the attachment and to achieve any indicated slope of the pipe.

1.10.14 For sleeve type couplings, equally tighten diametrically opposite bolts on the coupling to bring the gaskets up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.

1.10.15 All piping shall be installed in accordance with the manufacturer's recommendations and approved Shop Drawings and as specified in Division 1.

1.10.16 After installation of the interior piping and supports, control equipment and all appurtenances, the units shall be subjected to a field running test, as specified in Division 1, under actual operating conditions. Where field welding of pipe joints shown, specified, permitted, or required meet the requirements of ASME/ANSI B31.1 -Power Piping, Chapter VI Section 137.4 Hydrostatic Testing. Testing of pipelines shall be in accordance with the requirements of Division 15A Section 12.

## 1.11 Leakage Tests

1.11.1 Leakage tests shall be performed for any signs of leakage in all pipelines and structures required to be watertight.

1.11.2 Leaks shall be repaired by replacing broken pipe or joint assemblies found to leak at no addition to the Contract Price.

## 1.12 Testing

1.12.1 All mechanical equipment and systems provided under this Division shall be adjusted and tested. The Contractor shall adjust, repair or replace faulty or improper Division 15 work or equipment discovered during testing.

1.12.2 Tests may be made progressively as portions of the work are complete.

1.12.3 Tests shall be made in the presence of the Engineer.

1.12.4 A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted for the record.

1.12.5 The Contractor shall perform all tests necessary to assure proper functioning of materials and equipment. Specific special required tests shall be as described in individual equipment specifications, however, the absence of a specific test requirement does not relieve the Contractor from responsibility to adequately test the equipment and systems for proper operation.

1.12.6 Except where otherwise specifically indicated, testing must be complete prior to final inspection. All instruments, tools, etc., required for the tests shall be provided by the Contractor. Additional testing may be requested by the Engineer during final inspection to spot-check test results or to demonstrate proper functioning of the systems. These tests shall be performed by the Contractor at no additional cost to the State.

## 1.13 Record Drawings

1.13.1 Alterations and additions to the mechanical installation depicted on the contract drawings made during the execution of the work shall be neatly and plainly marked in red on a set of Record Drawings kept at the contractor's field office for the project. These drawings shall be updated as the work progresses and shall be available for inspection during the course of the work.

1.13.2 Record Drawings shall be prepared and submitted in accordance with Division 1.

## 1.14 Data to be Filed with the Department

1.14.1 Certain data, as specified herein, shall be furnished to the Department when installation and testing are complete, before final acceptance.

1.14.2 The data shall be compiled in 216 x 279 mm (8-1/2 x 11-inch) format in high-quality heavy-weight, hard cover binders with piano-style metal hinges or in an alternate approved format.

Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders. The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled.

1.14.3 Four sets of the data files shall be provided.

1.14.4 As a minimum, the data files shall include:

(a) A table of contents.

(b) Approved, final shop drawings and product data for all equipment and materials incorporated in the work under this Division.

(c) Manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer.

1.14.5 All data shall be neat and clearly legible. The table of contents and tabulations of set points and other recorded test data shall be typed. Sloppy, illegible, inaccurate, or incomplete data will not be accepted.

1.14.6 See Division 1 for further requirements.

#### 1.15 Final Acceptance Inspection

1.15.1 When the work is complete, tested and fully operational, and only after the Record Drawings have been reviewed and accepted, the Contractor shall schedule a Final Acceptance Inspection with the Engineer.

1.15.2 The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall be as further described in Section 105 of the Standard Specifications.

#### 1.16 Guarantees

1.16.1 Guarantees shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

#### 1.17 Maintenance

1.17.1 During the course of the construction work and until final acceptance, the Contractor shall be responsible for maintenance and operational integrity of the facility as specified in Division 1.

#### 1.18 Basis of Payment

1.18.1 Work required to comply with this Division shall be paid as specified under each individual Section, which shall be payment in full for the work described.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 15 - MECHANICAL

**SECTION 15B - BASIC MECHANICAL MATERIALS AND METHODS**

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.2 Concrete

1.2.1 Concrete for equipment bases and other work under this Section shall be provided under this Section in conformance with Division 3.

1.3 Cutting and Patching

1.3.1 All cutting and patching of building materials required for work under this Section shall be provided under this Section.

1.3.2 Cutting and patching shall be provided under this Section in conformance with Division 1.

1.4 Fasteners

1.4.1 Fasteners used to mount pipe supports and other items attached to the structure shall be suitable for the weight supported and shall be compatible with the structure material, i.e. wood screws shall be used for wood, toggle bolts shall be used for hollow masonry, expansion bolts or power-set studs shall be used for solid masonry or concrete and clamps shall be used for structural steel.

1.5 Support and Anchors

1.5.1 This section includes requirements for providing all hanging and supporting devices of construction shown, specified, or required for pipelines, apparatus, HVAC system, plumbing, miscellaneous system, and equipment other than electrical equipment.



## 1.5.2 Submittals

- (a) All submittals, including the following, shall be provided as specified in Division 1.
- (b) Shop drawings shall be submitted to show the quantity, type, design and location of all supports, hangers and anchors required.

1.5.3 Supporting devices adequate to maintain the pipelines, apparatus, and equipment in proper position and alignment under all operating and testing conditions with due allowance for expansion and contraction shall be provided.

1.5.4 Supporting devices shall be designed in accordance with the best practice and shall not be unnecessarily heavy. Supporting devices shall accommodate loads imposed during leakage tests for the test pressures specified. The required strength of supporting devices shall be based on the combined weight of the piping and connected equipment, the weight of the denser of the fluids used in operations or testing and the weight of insulation where applicable. Supports shall be installed with a working safety factor of not less than 5. Installation shall conform to requirements of Division 5 - Metals.

1.5.5 Springs shall be provided where necessary. Hangers and supports shall be of standard design where possible and shall be best suited for the service required. Proper pipe protection saddles shall be included for hangers and supports on pipes which are covered with insulation. Where required, supports shall be screw adjustable after installation unless approved otherwise.

1.5.6 All supporting devices shall be designed to minimize interference with access and movement. Eliminate the potential for injuries due to protruding supporting devices.

1.5.7 Base piping support, hanger rod size, brackets and spacing shall meet the requirements of ANSI/ASME B31.1, MSS SP-58, SP-69, SP-89 and SP-90 except as modified herein.

1.5.8 All products and materials shall be delivered, stored and handled as specified in Division 1.

1.5.9 Structural and miscellaneous steel, metal castings, ductile iron pipe and fittings, steel pipe and fittings, and supports meeting the requirements of Division 5 - Metals shall be used.

1.5.10 Overhead hangers shall be supported using threaded rods properly fastened in place by suitable screws, clamps, inserts, or bolts, or by welding. Hangers shall be subjected to tensile loading only. Where lateral or axial movement may occur, suitable linkage shall be provided to permit sway.

1.5.11 Suspended piping shall be supported by adjustable ring or clevis hangers and threaded rods from heavy duty concrete inserts or other fastening devices, except as otherwise specified or noted.

1.5.12 Brackets shall be of welded steel and designed for the following load classifications:

<u>Maximum Load</u> <u>Load Classification</u>	<u>per Bracket</u>
Light	340 kg (750 pounds)
Medium	680 kg (1,500 pounds)
Heavy	1,361 kg (3,000 pounds)

When medium or heavy brackets are bolted to vertical surfaces, backplates of adequate size and thickness shall be furnished and installed to distribute the load against the vertical surfaces. When the use of backplates is not practicable, the brackets shall be fastened to the vertical surfaces in such a manner that the safe bearing strength of the vertical surfaces will not be exceeded.

1.5.13 Piping shall be connected, supported and guided to permit and control pipe expansion and contraction and to accommodate building expansion, contraction and settling without damage to the piping or support system.

(a) Anchors shall be furnished and installed when specified, shown, or required for holding the pipelines and equipment in position or alignment. Anchors shall be designed for rigid fastening to the structures, either directly or through brackets.

(b) Anchors shall be cast-iron chair type anchors for piping with steel straps, except where anchors form an integral part of pipe fittings or where an anchor of special design is required.

(c) Inserts shall be galvanized concrete. Inserts shall be designed to permit the rods to be adjusted horizontally in one plane and to lock the rod nut or head automatically. Inserts shall be recessed near the upper flange to receive reinforcing rods. Inserts shall be designed so that they may be held in position during concrete placing operations. Inserts shall be designed to carry safely the maximum load that can be imposed by the rod which they engage.

1.5.14 Hanger and supports shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1 and Section 15A.

1.5.15 When specified, hangers and supports shall be galvanized as specified in this Division.

1.5.16 Hangers, supports, anchors, and similar devices shall be painted as specified in Division 9.

1.5.17 Field welds, bolted connections and abraded areas shall be cleaned and painted as specified in Division 9.

## 1.6 Basis of Payment

1.6.1 The work required to comply with this Division shall be paid as specified under each individual Section, which shall be payment in full for the work described.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 15 - MECHANICAL

**SECTION 15C - PIPING AND APPURTENANCES**

1. GENERAL:

1.1 Section Includes

1.1.1 The work specified herein includes furnishing and installing all piping, fittings, valves and accessories, except work specified in Division 15G required for a complete and satisfactorily working installation as shown and specified.

1.2 Related Sections

- 1.2.1 Section 9A – Painting.
- 1.2.2 Section 15A - General Mechanical Provisions.
- 1.2.3 Section 15B - Basic Mechanical Materials and Methods.
- 1.2.4 Section 15D - Pumping Equipment.

1.3 Submittals

1.3.1 Submit shop drawings and product data under provisions of Sections 1A and 15A.

1.3.2 Submit detailed drawings and data on pipe fittings, valves, slide gate, actuators and appurtenances and as specified under individual subsection.

1.3.3 Pipe and equipment manufactures' submittals as specified under individual subsection.

1.4 Delivery, Storage and Handling

1.4.1 Delivery, storage and handling shall be as specified under Section 1A.

1.5 Guarantee

1.5.1 Provide guarantee under provisions of Section 1A.

1.6 Basis of Payment

1.6.1 The piping and appurtenances work, except magnetic flow meter, shall be paid as part of the contract lump sum price for

## PUMP STATION MECHANICAL WORK

which shall be payment in full for the work described herein.

The work specified under this Section and as required for the magnetic flow meter shall be paid for at the Contract unit price each for FLOW METER, which price shall be considered as payment in full to complete all work under this item.

## 2. PRODUCTS:

### 2.1 Water Piping

#### 2.1.1 General

(a) All piping shall be generally arranged and aligned as shown and specified. Where special conditions are encountered in the field, the arrangement and alignment of piping shall be as directed by the ENGINEER.

(b) Piping shall be installed as directly as possible between connecting points insofar as the work of other trades permit. Where interference occurs with another trade whose work is more difficult to reroute, the Contractor shall revise the routing as required to avoid subject interferences. Piping shall be carefully installed to provide for proper alignment, slope and expansion.

(c) To allow for expansion and contraction, pipe shall be guided and supported in such manner that pipe lines shall not creep, sag or buckle. Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping. Pipe support shall not be limited to support indicated on the drawings.

(d) Small tubing to gauges, controls, or other equipment, installed on any apparatus shall not be coiled nor excessive in length but shall be installed neatly, carefully, bent at all changes in direction, secured in place and properly fastened to equipment at intervals to prevent sagging.

(e) Prior to the start of any piping installation work, the Contractor shall prepare and submit for approval detailed piping installation drawings. These shall be prepared on the basis of actual equipment being furnished and actual dimensions of walls, openings and other significant elements.

(f) Piping and appurtenances shall conform to applicable Section 1006, METALS, of the Standard Specifications.

#### 2.1.2 Steel Pipe

Pipe shall be fabricated of ASTM A36 steel and shall conform to AWWA C200, Standard for Steel Water Pipe 6" and Larger and AWWA M11 Steel Pipe Design and Installation, latest edition.

Dimensions for steel pipe shall be in accordance with ANSI B36.10. Wall thickness shall be a minimum of 0.5 inches.

(b) All flanges for steel pipe, except blind flanges, shall be of the slip-on welding type with hubs meeting the dimension requirements of ANSI B 16.5 Class 150 without raised face and made of metal meeting the requirements of ASTM A 181 Class 60 or ASTM A105. Flanges shall be attached to the barrel of the pipe with two continuous fillet welds. Blind flanges shall be plain faced in accordance with ANSI B16.5 Class 150.

(c) Pipe shall be installed in maximum lengths of 10 feet.

#### 2.1.3 Ductile Iron Pipe and Fittings

(a) Ductile iron pipe shall meet the requirements of AWWA C151, Class 53.

(b) Ductile iron fittings shall have flanged joints as shown or specified.

(c) Fittings shall be provided as shown and specified and shall be ductile iron meeting the requirements of AWWA C110.

(d) Pipe shall be installed in maximum lengths of 10 feet.

#### 2.1.4 Flanged Connections

(a) Flanged connections shall be made as shown and specified. All flanges shall be drilled in conformance with the 125/150 ANSI Standard template.

(b) Class 150 pound steel flanges shall be smoothed finished (flat faced) for connection to dissimilar metals such as cast iron.

(c) Flanged joints shall be made with bolts or bolt studs with a nut on each end. Bolts, stud bolts, and nuts shall meet the requirements of ASTM A 307 Grade B and ASME B16.1 and Section 5E. Bolts shall have a 1/4-inch projection beyond the nut when joint with gasket is assembled.

(d) Rubber gaskets for flanged joints shall meet the requirements of AWWA C207 as modified and supplemented herein. Gaskets shall be 1/8-inch thick. Gaskets shall be full face.

#### 2.1.5 Wall Pipe

(a) Cast iron or fabricated steel wall pipe shall be furnished and installed for all storm water piping passing through walls, as shown. Wall pipe material, thickness and coatings shall have the same as the connected piping.

(b) Wall pipe shall meet the requirements of AWWA C110.

(c) Wall pipe shall have an integrally cast intermediate collar located at the center of the wall.

2.1.6 Temporary bulkheads shall be provided at the ends of pipeline sections where adjoining pipelines have not been completed and are not ready to connect. Temporary bulkheads shall be removed when they are no longer needed.

#### 2.1.7 Polyvinyl Chloride (PVC) Pipe and Fittings

(a) PVC pipe and fittings shall be Schedule 80 meeting the requirements of ASTM D 1784 Class 12454-B and ASTM D 1785.

(b) Joints shall be ASTM D 2855 solvent welded joints utilizing ASTM D 2564 solvent cement.

#### 2.1.8 Submittals

(a) All submittals, including the following, shall be provided as specified in Division 1 with the following stipulations.

(b) The following shop drawings shall be submitted:

1) Flanged, screwed, welding and mechanical coupling fittings and pipe, couplings, harnessing and special fittings. When special designs or fittings are required, the Work shall be shown in large detail and the special or fitting shall be completely described and dimensioned.

2) Fully Dimensioned layout of pipe, fittings, couplings, sleeves, expansion joints, supports, anchors, harnessing, valves and equipment. Pipe size, type and materials shall be labeled on drawing and a schedule shall be included.

3) Cross sections showing elevation of pipe, fittings, sleeves, couplings, supports, anchors, harnessing, valves and equipment.

4) Catalog data for pipe, couplings, harnessing and fittings.

(c) The following certifications shall be submitted:

1) Certificate of compliance for pipe, fittings, gaskets, couplings, sleeves, cleanouts, harnessing, specials, and coatings in accordance with this Division.

2) Welders' certifications.

#### 2.1.9 Quality Assurance

(a) Certified welders, having current certificates conforming to the requirements of the ANSI code shall perform all welding on steel pipelines.

#### 2.1.10 Painting and Coating

(a) All pipe and fittings shall be lined and coated in accordance with the piping schedule. All bolts, nuts, couplings and the like shall be coated after the joint has been made.

- (b) Steel pipe, wall pipe, ductile-iron pipe and fittings shall be shop coated on the inside and outside with one coat of liquid epoxy primer Symbol B as specified in Section 9A, 4.0 mils minimum dry thickness, for use in exposed locations, such as inside buildings, where finish painting or insulating is required.
- (c) Pipe for use not exposed to view shall also be coated with liquid epoxy primer Symbol B as specified in Section 9A.
- (d) Immediately after facing and drilling, the back of the flanges and bolt holes shall be coated with liquid epoxy primer coating meeting the requirements of AWWA C210.
- (e) The weight and class designation shall be conspicuously painted in white on the outside of each pipe, fitting, and special casting after the shop coat has hardened.
- (f) Painting shall be in accordance with Section 9A and meeting the requirements of AWWA C210.
- (g) Galvanizing: Provide galvanizing in accordance with ASTM A 53 where shown or specified.
- (h) PVC pipe and fittings shall not be painted or coated.
- (i) Sleeve-type Couplings:
  - 1) Couplings shall be shop coated with liquid epoxy primer in accordance with Section 9A and meeting the requirements of AWWA C210.
  - 2) An additional shop coat of liquid epoxy primer shall be provided on the interior of the middle ring.
  - 3) The exterior of sleeve-type couplings shall be finish coated after installation with the same coating specified in Division 9 for the pipeline of which it is a part.
  - 4) Shop coats and finish coats shall be compatible.

## 2.2 Knife Gate

### 2.2.1 General

#### Submittals

- 1) The following Shop Drawings shall be submitted:
  - i. Complete detailed drawings of knife gate.
  - ii. Working drawings shall be submitted, including arrangement and erection drawings of the gate, operator, control equipment; electrical connection diagrams, and complete description of the control system, and operating characteristics.
- 2) The following certifications shall be submitted:

- i. Manufacturer's certified performance and material specifications, as specified.
- ii. Complete calculations shall be submitted for motor operator indicating the force required to operate the gate, the operator force provided, full load and locked rotor current, and horsepower.

3) Operation and maintenance manuals shall be submitted for the gate and gate operator.

2.2.2 Knife gate shall be of wafer face-to-face design with full diameter flanges having through pipe flange bolt holes to permit independent upstream or downstream pipe flange removal without affecting the shut-off or body shell pressure rating of the valve.

- (a) Body shell pressure rating shall be 20 psig cwp.
- (b) Shut-off pressure rating shall be 20 psig cwp.

2.2.3 The knife gate body shall be tested at 1.5 times the rated pressure and the knife gate at 1.1 the rated pressure while in the fully shut position with zero leakage permitted past the seat or to the exterior of the valve.

- (a) Knife gate body material shall be cast 316 stainless steel.
- (b) Gate shall be type 316 stainless steel.

2.2.4 Resilient seat ring material shall be type 316 stainless steel and seat material shall be natural or synthetic rubber material suitable for the application. The packing shall be a mixture of PTFE fibers and grease compounded to permit ease of handling but with sufficient fluidity to transmit equal sealing pressure across the full length of the packing chamber.

2.2.5 The actuator support structure of the valve shall be fabricated of carbon steel. If external support of the actuator is required to insure overall valve performance, the valve manufacturer shall include suitable located support brackets with instructions for proper support and alignment. The valve yoke shall be of sufficient strength to withstand five times the maximum operating torque and thrust.

- (a) The drive stem shall be of chrome steel.
- (b) The stem drive nut shall be of bronze.
- (c) Yoke bearings shall be cast bronze.
- (d) All mechanical fasteners shall be cadmium plated.

2.2.6 The knife gate shall be furnished with a resilient seat which seals around the edge, not the face, of the gate and shall be mechanically retained without the use of adhesives and replaceable. The seat design shall provide drip-tight shut-off at the fully rated pressure difference in either direction.

2.2.7 The packing shall be a square braided PTFE impregnated synthetic fiber material.



2.2.8 The knife gate shall have scraper blades on both sides of the gate to wipe the faces of the gate clean of any media prior to contact with the packing.

2.2.9 Both faces of gate shall have a surface finish of 16 microinch to insure ease of operation and seal performance.

2.2.10 The gate shall be guided for the full length of the stroke and supported to withstand full rated shut-off pressure in either direction for the full length of valve stroke. The interior of the valve port shall be contoured to insure self cleaning of the valve. The resilient seat in the bottom port area of the valve shall be flush with the port area and shall not form a cavity in which debris can collect.

2.2.11 knife gate furnished electric motor actuator shall be suitable for the knife gate design.

2.2.12 All non-stainless steel metal surfaces shall be painted with a zinc free primer.

### 2.3 Motor Operated Actuator for Knife Gate and Slide Gate

2.3.1 General: The electric actuator shall include a motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, de-clutch lever, and auxiliary handwheel, reversing motor starter and space heaters, as a self-contained unit. The actuator shall meet AWWA-C-540-93 specifications. A 3-pole disconnect switch shall be built in the motor starter or furnished with the actuator for field mounting. Unless otherwise noted the actuator shall be designed to operate the valve at the rate of 12 inches per minute.

2.3.2 Enclosures: The actuator motor and all electrical enclosures shall be explosion proof for the knife gate NEMA 7 and shall be NEMA 4 for the outdoor slide gate.

2.3.3 Motor: The motor shall be 460 volts, 3 phase, 60 hertz specifically designed for the actuator service and shall be of high starting torque, totally enclosed, non-ventilated construction non-explosion proof for slide gate and explosion proof for knife gate, Class B insulation, 85°C rise, 40°C ambient. Motor leads shall be brought into the control compartment or limit switch compartment for external connections.

The motor shall be of sufficient size to open or close the valve from any position and under any condition of operation the valve may be subjected to. The motor duty rating shall be sufficient for one complete cycle (open-close-open, or reverse) without exceeding its temperature rating and shall not be less than 30 minutes continuous. The motor shall be prelubricated and all bearings shall be of the anti-friction type. The motor speed shall not exceed 188.5 radian per second (1,800 rpm).

Electric Actuator Gearing: The actuator gearing shall be a double reduction unit with the capability of changing the output speed with a relatively fast, simple gear change. The power gearing shall consist of spur or helical gears and worm gearing. The spur or helical gearing and worm shall be of hardened alloy steel and the worm gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. All other gears shall be made of bronze or steel.

2.3.5 Position Limit Switch: Position limit switches and associated gearing shall be an integral part of the valve actuator.

Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease-lubricated, and enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train. The limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. The trip points of the switches shall be adjustable over the entire range of the valve travel. They shall not be subject to breakage or slippage due to over-travel. Limit switches shall be of the heavy duty, open contact type with a rotary wiping action.

**Torque Switch:** Each valve actuator shall be equipped with a double torque switch which is responsive to loads encountered in both the opening and closing direction. Each side of the switch shall have a graduated dial and shall be adjustable. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be designed to shut off the actuator motor in the event that abnormally high torque is realized in either direction of travel. The torque switch is utilized as a protective device in valve applications requiring position seating. For torque seated valves, such as wedge gate and globe valves, the closing torque switch shall shut off the actuator motor when a predetermined torque is reached, corresponding to the required seating torque of the valve.

**2.3.7 Manual Operation:** A handwheel shall be provided for manual operation with an arrow to indicate "open" rotation. The handwheel shall not rotate during motor operation. A fused motor shall not prevent manual operation. When in manual operating position, the unit will remain in this position until the motor is energized. The actuator will automatically return to electric operation when the motor is energized. The actuator will remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation is accomplished by a positive de-clutching lever which disengages the motor and related gearing mechanically but not electrically with no damages to clutch a gear mechanism. It shall not be possible for the unit to be simultaneously in manual and motor operation.

**2.3.8** Provide stem protector for rising stem in suitable length and diameter to allow for full extension of the stem. Stem protector shall couple to the top of the actuator by means of a national pipe thread (NPT) and shall be capped and vented.

**2.3.9 Hammerblow Device:** The valve control shall have a built-in lost motion device that travels sufficiently enough to allow the motor to reach full speed before imparting a hammerblow to start valve in motion in either the closing or opening direction. This lost motion device also must permit motor to attain full speed before load is encountered, and load should be shared equally by two lugs cast integrally on the drive sleeve. Lost motion device is not to be provided for those valves used in inching, throttling, regulating, or modulating service.

**2.3.10 Motor Starter:** The motor starter shall be 3 phase AC full voltage reversing, rated 600V AC operated at 480V, 60 Hz unless otherwise noted. The starter shall include two 3 pole contactors mechanically and electrically interlocked, fused control transformer with 120V secondary, 120V, 60 Hz coils, 3 phase thermal overload relay, and auxiliary contacts. Heavy duty industrial type control station rated 10 amperes at 480 VAC, with local-off-remote selector switch, open-close-stop pushbuttons and open-closed indicating lights shall be provided on the motor starter, except where the valve actuator is inaccessible from the operating floor the control station shall be remotely mounted from the actuator. Terminal blocks shall be provided for all external wiring connections. Each terminal shall be properly marked.

2.3.11 Space Heater: Space heaters shall be provided in the motor enclosure and starter or limit switch enclosure. The heaters shall be 120V, 60 Hz, with sufficient capacity to prevent condensation in the enclosures.

2.3.12 Power Input: The power input to the actuator shall be 480V, 3 Phase, 60 Hertz.

## 2.4 Slide Gate

### 2.4.1 General

(a) This section includes requirements for furnishing and installing the slide gate, operator and all appurtenances necessary for a complete installation.

(b) Gate operator shall be complete, including a suitable enclosure, with all appurtenances necessary for the operator to perform its intended function as specified under subsection 2.3, Motor Operated Actuator for Knife Gate and Slide Gates of this Section.

(c) Slide gate shall be stainless steel. Quantity of gate, guide, size, location and type shall be as shown or specified. Each gate shall be provided with the type of operator specified in the Slide Gate Schedule.

(d) Slide gate shall be designed to limit deflection under maximum loading to 1/360 of the span. Slide gate shall be designed for the seating or unseating pressures specified, measured to the center of the gate.

(e) Submittals:

1) Working drawings shall be submitted, including arrangement and erection drawings of the gate, operator and control equipment; structural design data, if requested; and operating characteristics.

2) The following certifications shall be submitted:

i. Manufacturer's certified performance and material specifications, as specified.

ii. Complete calculations shall be submitted for motor operator indicating the force required to operate the gate, the operator force provided, full load and locked rotor current, and horsepower.

3) Operation and maintenance manuals shall be submitted for the slide gate and gate operator.

### 2.4.2 Stainless Steel Slide Gate

(a) The stainless steel slide gate shall be of ASTM A276, Type 304 stainless steel with a thickness of not less than 1/4 inches, reinforced with Type 304 stainless steel structural shapes, capable of withstanding the water pressure in either direction with the water level at maximum operating level.

(b) The gate and guide shall be fabricated of Type 304 stainless steel. Gate shall be reinforced as required to keep gate deflection within specified limits. The slide gate shall be entirely of stainless steel construction.

(c) The gate shall be designed for flush bottom closure. Bottom and side seals shall be resilient ( $50 \pm 5$  Durometer A) neoprene. The bottom seal shall be installed across the bottom of the gate or frame, mating with the side seals to keep leakage within specified limits. Provide replaceable seals, securely mounted with stainless steel retainer bars bolted to the gate with stainless steel bolts.

(d) Guides shall consist of slotted side pieces with a flush type bottom cross piece. Fabricate pieces of castings or structural with integral anchoring ribs, shop assembled into a rigid assembly for embedment in concrete. Side slots shall be provided of the width and depth required for support and free operation of the gate without binding.

(e) Bearing surfaces shall be 3/8-inch minimum thickness, installed in a recess or keyed into the guide, designed to hold the polymer bearing surface in position against the gate.

(f) Where guides extend above concrete side walls, guides shall be supported by stainless steel structural members or by the gate operator support structure.

#### 2.4.3 Slide Gate Operator And Lifting Stem

(a) Operator shall be rising stem, unless otherwise specified. Stem shall be securely fastened to the gate by means of a casting, mounting block or angles secured to the gate. Acme-threaded stem shall have 16 microfinish or better. Gate stem attachment shall be provided with provisions for keying or pinning the stem to the gate attachment.

(b) Stem shall be designed for the maximum operating torque of the operator and the weight and service of the gate. The length over radius of gyration ( $l/r$ ) ratio of the stem shall be limited to 200, and the stem diameter shall be limited to 1.50 inches. Stems shall be stainless steel meeting the following applicable standards.

1) Stainless Steel      ASTM A 276, Type 304 or 304L  
ASTM A 582, Type 303

(c) Stem shall be provided with a stem cover of schedule 40, ASTM A53 galvanized pipe. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

(d) Provide a freeze proof cold weather and corrosion-resistant padlock with padlock chain and keys to be installed through the handwheel operator and around the stem to prevent unauthorized operation of the slide gate. Padlock housing shall be a sturdy one-piece aluminum alloy casting. All other parts shall be nonferrous metal to prevent rust. Locks shall have an 11-disc locking mechanism. Padlock chain shall be heavy-duty flat-link, zinc-plated chain.

#### 2.5 Pipe Supports and Anchors

2.5.1 Pipe supports and anchors shall be furnished and installed as shown on the Drawings or as specified in Division 15B.

## 2.6 Sleeve-Type Couplings

2.6.1 Couplings shall be provided with rolled steel followers, steel sleeves, rubber compound gasket and high strength bolts and nuts.

2.6.2 Use gaskets that are not affected by the fluid service of the pipeline.

2.6.3 Couplings shall have a minimum pressure rating equal to the test pressure of the pipeline.

2.6.4 Middle rings shall be provided without a pipe stop, and at least 1/2-inch thick and 10 inches wide for 36-inch pipe, with follower rings of the proper thickness.

2.6.5 Unless shown or specified otherwise, harnessing for sleeve-type couplings shall be designed, furnished and installed in accordance with the applicable portions of AWWA Manual M11, Chapter 13 - Supplementary Design Data and Details, 13.10 - Joint Harness. Harnessing shall have a design pressure equal to or greater than the test pressure of the pipeline on which it is installed.

All surfaces shall be shop coated with liquid epoxy primer. The inside coating of the middle ring shall be given an additional shop coat of liquid epoxy primer. Finish coat shall be as specified in Section 9A for the pipe of which it is a part.

### Stainless Steel Flap Valves

**Flap valves shall be provided in the discharge chamber for each main pump.**

**Flap valves shall be fabricated and supplied with all the necessary parts specified or otherwise required for a complete, properly operating installation.**

**2.7.3 Flap valves shall be constructed entirely of stainless steel. All hardware shall be stainless steel.**

2.7.4 The body frame shall be made of structural members or formed plate welded to form a rigid one-piece frame. The body material shall be stainless steel ASTM A-240, Type 304L. The frame shall be of the flange back design suitable for mounting on a standard flange. The flange shall be flat faced and drilled 125 lbs. Standard for pipe flange mounting.

**The cover, or flap, shall be stainless steel ASTM A-240, Type 304L structural members or formed plate.**

**A resilient seat, EPDM ASTM D-2000 attached to the frame with a stainless steel retainer.**

**The hinge arms shall be stainless steel ASTM A-240, Type 304L. Each hinge arm shall be made of structural members or formed plates and shall have a 2-hinge arm arrangement, with 2 pivot joints per arm, an adjustable lower pivot with limited rotation and an adjustable upper hinge lug arrangement to permit adjustment of the valve opening sensitivity.**

**Hinge bushing shall be ultra high molecular weight polyethylene ASTM D-4020. Fasteners shall be ASTM F593 GR1 for Type 304.**

**A stainless steel leaf spring attached to the body and extended over the cover shall be provided to safely limit the travel of the cover during pump discharge operation. A rubber pad shall be provided at the spring to cover the contact point.**

#### Pressures Gauges

2.8.1 Provide eight (8) ½ % accuracy pressure gauges with stainless steel movements with Bourdon tube and socket type as per manufacturer's recommendations for service and pressure. All gauges, unless otherwise specified, shall have dials not less than 4 1/2" in diameter, with white faces and black graduations.

2.8.2 Gauges shall be liquid filled (Glycerline or silicone), such as Ashcroft 1279. Discharge gauge shall be 0 to 75 ft.

#### 2.9 Ball Valve

2.9.1 Ball valve shall be bronze ball valves full port with two-piece body, chrome plated, blowout proof stem, full port and reinforced TFE seats and seals.

2.9.2 The ball and stem shall be stainless steel (ASTM A276 GR 316). End connections shall be threaded type.

#### Copper Tubing and Joints

2.10.1 Copper tubing for compressor air service piping shall be Type K, hard temper, ASTM B88. The fitting shall be wrought copper pressure fittings, ANSI B16.22. The joints shall be solder, Grade 95TA, ASTM B32.

### 3. EXECUTION:

#### 3.1 Transportation and Delivery

3.1.1 Every precaution shall be taken to prevent injury to the pipe during transportation and delivery to the site. Extreme care shall be taken in loading and unloading the pipe and fittings. Such Work shall be done slowly with skids or suitable power equipment, and the pipe shall be under perfect control at all times. Under no condition shall the pipe be dropped, bumped, dragged, pushed, or moved in any way which will cause damage to the pipe or coating. When handling the pipe with a crane, a suitable pipe hook or sling around the pipe shall be used. Under no condition shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to the pipe ends.

3.1.2 If any pipe or special is damaged in the process of transportation, handling or laying, such pipe or pipes shall be replaced or repaired by the Contractor at its own expense.

3.1.3 The Contractor shall furnish and install suitable blocking and stakes to prevent the pipe from rolling. The type of blocking and stakes, and the method of installation, shall be approved by the Engineer.

### 3.2 Piping Installation General

3.2.1 The dimensions shown on the Drawings for the location of pipelines have been established with the intent that there will be no interferences. The Contractor shall check all dimensions shown on the Contract Drawings prior to the installation of Work and shall notify the Engineer promptly of any interferences or errors discovered. If interferences are found to exist prior to or during construction, changes in the location of pipelines to avoid such interferences shall be made at no extra cost to the Department and in a manner as reviewed by the Engineer.

3.2.2 Elevations and dimensions locating pipelines are shown on the Drawings to the centerlines of the pipe unless otherwise indicated.

3.2.3 Piping connections and dimensions to equipment are subject to changes as reviewed by the Engineer to suit the types of equipment furnished.

3.2.4 Piping suspended from ceilings shall be installed to provide maximum head room consistent with good installation.

3.2.5 The layout of the piping and fittings shall be carefully checked to determine that the related equipment can be properly assembled to produce a workable arrangement. Defective or improperly fabricated Work shall be rejected and replaced with Work which, when completely assembled, shall result in an arrangement which shall function as intended and as shown on the Drawings.

3.2.6 All pipelines shall be straight and true in alignment, grade and location indicated, designated or required, and all installation shall be made in a workmanlike manner to the satisfaction of the Engineer. The pipe and fittings shall be adequately braced and blocked or tied, hung or supported for satisfactory installation.

3.2.7 As soon as pipes are in place, all open ends shall be capped until permanent connections are made. All pipelines shall be securely supported when required either by hanging from beams with suitable pipe hangers or supported on walls by suitable wall brackets. Where it is necessary, install hangers or supports after concrete is poured or other masonry Work finished. Anchor bolts with expansion shields shall be used.

3.2.8 Where pipes pass through masonry walls, floors and partitions, the juncture shall be made as shown on Plans. Where no details are shown, the Contractor shall either rough in the piping before the concrete is poured or the masonry completed, or shall provide suitable plugs, sleeves or forms for piping. After the pipes have been installed, the openings shall be filled solid; suitable allowance being made, however, for the expansion and contraction of the piping. The cutting of concrete for pipe shall be avoided wherever possible, and in no case where such cutting is necessary shall reinforcing rods be cut or disturbed, and no such cutting shall be done without the permission of the Engineer. All openings made for pipe Work shall be neatly patched in a workmanlike manner.

3.2.9 Horizontal runs shall be given as steep a pitch with even grade toward the outlet as conditions will permit, and care shall be taken in laying out piping that there is no interference with the proper location of piping for other purposes or other equipment. No change shall be made in the general location shown for piping, or in the method of running and connecting same, except with the written approval of the Engineer.

When any change is made, a record of the location of all pipes so changed shall be kept by the Contractor and a copy of such record shall be given to the Engineer showing the location of all piping.

### 3.3 Protection of Piping System

3.3.1 Install and maintain pipe and equipment which is clean and free from rust, dirt, scale, etc.

3.3.2 Install temporary airtight covers at all pipe and equipment openings. Special attention shall be given to vacuum and air piping and each pipe section shall be individually inspected prior to placing. No piping shall be placed when wet, nor shall any free moisture be present inside any air piping during installation.

### 3.4 Pipe Supports and Hangers

3.4.1 Pipe supports and hangers shall be in accordance with Section 15A.

### 3.5 Welding

3.5.1 All welding of piping and/or special fittings shall be done in conformity with the current ANSI B31.1, "Pressure Piping". A certification of the welder's qualifications, in conformity with the requirements of this code, shall be submitted to the Engineer.

3.5.2 Tee connections in welded piping shall be made with a factory fabricated butt welding tee or with weld-o-let of butt, socket or threaded type. When weld-o-lets are used, the branch connection shall be one-half the diameter of the main or less. Scarf welding or direct butt welding of side connections shall not be permitted. Tees fabricated from pipe shall not be permitted.

3.5.3 Long radius welding elbows shall, whenever possible, be used for changing direction of welded pipelines. Mitered joints shall be subject to approval by the Engineer.

### 3.6 Flanged Joints

3.6.1 All flanged joints shall be made temporarily with gaskets in place using a minimum number of bolts to support the piping. Any misalignment of the assembled piping shall be adjusted or corrected in a manner approved by the Engineer.

3.6.2 Tightening of flange bolts to "pull up" misaligned flanges will not be permitted and shall not be done. The misaligned flanges shall be machined to fit, or approved spacer pieces and gaskets shall be installed if necessary and directed by the Engineer. The temporary assembly of the flanged piping shall demonstrate that there will be no undue stresses in the piping or at the connections to the equipment. The temporary assembly shall be approved by the Engineer before the joints are tightened. Flanged joints shall then be completed and made watertight and the tension in the flange bolts, when tightened, shall not exceed 15,000 psi at the minor diameter of the bolt threads.

### 3.7 Sleeve Type Couplings



3.7.1 For sleeve type couplings, diametrically opposite bolts shall be equally tightened on the connection so that the gaskets will be brought up evenly all around the pipe. Final tightening shall be done with torque wrenches set for the torque recommended by the coupling manufacturer.

### 3.8 Testing

3.8.1 Where applicable, pipes shall be flushed clean and tested and any leaks shall be made tight.

### 3.9 Painting

3.9.1 Piping, fittings and appurtenances shall be painted in accordance with Section 9A - Painting.

### 3.10 Supports for Present Piping

3.10.1 Wherever Contractor is required to expose, suspend or reroute present piping, supports for such piping shall be provided as is required for new piping in accordance with paragraph 3.04 Pipe Supports, this Section.

### 3.11 Wrecking and Repair

3.11.1 The Contractor shall do its own excavation for piping as required to complete the Work. If excavation is required below present concrete slabs, the backfill materials shall be sand flushed in place or class B concrete fill as required by the Engineer. The concrete used to repair the structure shall be Class A concrete. Where reinforcing is cut, dowels shall be used for laps. Junctures between the present portions of slabs remaining and new slabs shall be uniformly saw cut.

3.11.2 All such repair procedures shall be subject to review by the Engineer.

### 3.12 Installation of Slide Gate

3.12.1 Slide gate shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.12.2 Floor stand shall be accurately centered over the gate. Stand shall be solidly bolted to the floor or support structure, with through-bolts wherever possible. Approximately 3/4 inch of nonshrink cement grout shall be placed beneath stand mounted on concrete or similar construction to assure uniform support.

### 3.12.3 Field Tests

(a) After installation of the gate, control equipment and all appurtenances, the units shall be subjected to a field running test, as specified in Division 1, under actual operating conditions.

(b) Slide gate shall be tested for leakage, strength, and opening and closing against the maximum heads practicable to obtain under operating conditions. Any leaks around the frame or gate shall be stopped.

The maximum allowable amount of seepage through any slide gate shall not exceed 0.2 gpm per foot of seating perimeter.

### 3.13 Installation of Pipe and Fittings

3.13.1 All pipe and fittings shall be installed in accordance with the specifications contained herein and in Division 15A and 15B and in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

### 3.14 Installation of Flap Valves

3.14.1 Installation of flap valves shall be in accordance with the manufacturer's recommendations.

#### 3.15 Installation of Soldering (Copper Tubing)

3.15.1 Joints shall be made in strict conformance with procedures of ASTM B828.

3.15.2 Tubing shall be cut with square ends and reamed to prevent burrs, out-of-round or improperly sized ends.

3.15.3 After cutting, all surfaces to be soldered shall be thoroughly cleaned to a metal-bright finish, free from dirt, grease or other material before fluxing and soldering. This cleaning shall be performed by using emery cloth, sandpaper or steel wool. Clean the outside end of the tubing for a length of ½-in greater than the depth of the fitting. The inside of the fittings shall be cleaned in a similar manner. Apply non-corrosive flux and assemble the joint. Acid solder or acid flux will not be allowed.

3.15.4 The surfaces to be joined shall be heated up slowly and uniformly to the melting point of the solder. The surface being soldered shall be maintained above the melting point of the solder for sufficient time to draw the solder completely into the joint. When the solder congeals to a plastic state the excess metal shall be removed with a cloth brush, leaving a fillet around the end of the fitting. Full penetration of the solder uniformly throughout the entire socket is required. The soldered joints shall be allowed to cool in still air. Quenching will not be permitted.

3.15.5 Any type of crack, pinhole, area of incomplete penetration, or similar defect will not be accepted. Peening for closing up defects will not be permitted.

3.15.6 Heating torches of sufficient size equipped with multiple tips or ring burners for use on combination torches, shall be used for heating of large fittings of 2-in diameter and larger prior to soldering.

3.15.7 Remove all external and internal loose solder and flux after joint cools.

#### 3.16 Schedule

##### 3.16.1 Valve Schedule

<u>Facility/Service</u> <u>Remarks</u>	<u>Size</u> <u>Valve Type</u>	Joint Inches	Actuator <u>Type</u>	<u>Type</u>
Pump Discharge	Check	36	F	NA
Recirculation Rising Stem	Knife Gate	36	F	E Non-

Note:

(1) Abbreviations used in the schedule are as follows:

Joints

F Flanged

NA Not Applicable

3.16.2 Slide Gate Schedule

<u>Size WxH</u> <u>Service</u>	<u>Seating Head</u>	<u>Unseating Head</u> (feet)	<u>Actuator</u> (feet)	<u>Remarks</u> (feet)
Discharge Channel	17x5	10	10	E Flush bottom

Note:

(1) Abbreviation used in the schedule is follows:

Actuator

E Electric Motor (Nonmodulating)

3.16.3 Inside Piping Schedule

Service	<u>Size</u> (Inches)	Pi Material <sup>(1)</sup>	<u>Protective</u> <u>Coatings</u> <sup>(3)</sup>		Joints <sup>(2)</sup>	Remarks
			Int.	Ext.		
Pump Discharge	36	St	P	P	F	
Recirculation	36	DI	P	P	F	
Drain Pipe	6	CI	--	--	H	

Maintenance Pump	4	PVC	--	--	SW	Schedule 80
Low Flow Pump Discharge	12	St	--	E	W	Existing
Air Compressor	3/8, 1/2	C	--	--	S	

NOTES:

- (1) St Steel
- DI Ductile Iron
- PVC Polyvinyl Chloride
- CI Cast Iron**
- C Copper Tubing
  
- (2) F Flanged
- H Hub & Spigot
- SW Solvent welded
- W Welded
- S Solder
  
- (3) P Shop Finish Painted
- E Epoxy Painted

END OF THIS SECTION

**SECTION 15D - PUMPING EQUIPMENT**

1. GENERAL:

1.1 Description

1.1.1 This section includes requirements for furnishing and installing submersible mixed flow type and all appurtenances necessary for a complete installation.

1.1.2 Pumping units include main pumps as shown on the Drawings and specified.

1.1.3 The main pumps shall be submersible mixed flow type in design; close coupling with a submersible motor to form an integrated submersible pump/motor unit capable of installation in a discharge column (tube).

Seating and removal of the pump in the discharge column shall be accomplished by a simple vertical linear motion and be automatic, required no entry of personnel. The main pump shall be completed with power cable, signal cable, stainless steel lifting cable, appurtenances as specified herein and all accessories recommended by the manufacturer for proper operation under the specified conditions and indicated arrangement.

1.1.4 Unless otherwise indicated, all pumps of a specified type shall be identical, the product of the same manufacturer. Refer to Division 15A.

1.1.5 Furnish one spare main pump. The spare main pump assembly shall not be included in any lump sum work and will be paid for at the contract lump sum work for COMPLETE SPARE MAIN PUMP ASSEMBLY which shall be payment in full for the work specified.

1.1.6 Furnish one spare low flow pump. The spare low flow pump assembly shall not be included in any lump sum work and will be paid for at the contract lump sum work for COMPLETE SPARE LOW FLOW PUMP ASSEMBLY which shall be payment in full for the work specified.

1.1.7 Spare main pump assembly shall be delivered and stored at Owner's designated storage facility.

1.1.8 Spare low flow pump assembly shall be stored at floor El. 9.5 as indicated on the drawing.

1.2 Operating Conditions

1.2.1 The main pumps shall be capable of a draw down to a low water level of EL. – 41.0' without cavitation occurring. Manufacturer's certification of the preceding shall be provided as part of the submittal data.

1.2.2 The main pump and the spare main pump shall operate at the capacities and heads and over the range of operating conditions specified without overloading, cavitation, and vibration. The pumps shall conform with the following requirements:

<u>Items</u>	<u>Requirements</u> <u>Main Pumps (MP1- MP8) &amp; Spare</u>
Capacity at primary rating point (design point)	30,000 gpm
Total head at primary rating point (design point)	49 ft
Overall efficiency, wire to water, at rating point, minimum, percent	70
NPSHR not to exceed	38 ft
Capacity at secondary rating point, minimum	34,000 gpm

Total head at secondary rating point, feet	38 ft
Overall efficiency, wire to water, at secondary head, minimum, percent	60
NPSHR not to exceed	44 ft
Diameter of sphere that will pass through pump, maximum	2-3/4 inch
Pump discharge column diameter	48 inch
Pump speed, maximum, rpm	890
Motor horsepower, maximum	410 kW (550 hp)
Motor efficiency at full load, minimum, percent	91.1
Motor power factor at full load, minimum	0.78
Locked rotor kVa/hp, maximum, NEMA code letter	F

Efficiency as listed above shall be overall efficiency, i.e., pump efficiency times motor full load efficiency. For the shop test, the overall efficiency shall be calculated from the measured shop test data and shall be within 95 % of the approved catalog submittal values. Motor efficiency shall be as determined by IEEE 112-E Test Standard, Method B as set forth by NEMA MG 1-12.53a.

1.2.3 Each pump shall have a continuously rising characteristic curve from the rating point to shutoff which passes through the rating point, and which meets or exceeds the specified heads and capacities, all within the Hydraulic Institute tolerances.

1.2.4 Submersible units shall be capable of sustaining full reverse runaway speed without damage.

1.2.5 Motors shall be capable of operating pumps at any point on the curve without overloading and without using the service factor.

1.2.6 In order to match the existing low flow pump, the spare low flow pump shall be Yeomans Series 9000 Model 8x8x18x5 SC submersible pump, 2,500 gpm @59' TDH, 60 HP, 1160 RPM, 460V, 3Ph and 60Hertz motor.

1.2.7 Provide adequate length of power and control cables from pump to the control panel for the two existing low flow pumps..

### 1.3 Related Sections

- 1.3.1 Section 3A - Cast-In-Place Concrete.
- 1.3.2 Section 3B – Grout.
- 1.3.3 Section 5A - Structural Steel.
- 1.3.4 Section 5C - Bolts, Anchor Bolts, Expansion Anchors and

Concrete Inserts.

- 1.3.5 Section 9A – Painting.
- 1.3.6 Section 15A - General Mechanical Provisions.
- 1.3.7 Section 15B - Basic Mechanical Materials and Methods.
- 1.3.8 Section 15C - Piping and Appurtenances.
- 1.3.9 Section 16C - Major Electrical Equipment.
- 1.3.10 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.

1.4 Submittals

1.4.1 All submittals, including the following, shall be provided as specified in Division 1.

1.4.2 Submit a list of not less than five (5) installations where pumping equipment of the type and approximate size specified herein have been in successful operation for at least five (5) years.

1.4.3 Submit location of the nearest permanent service headquarters of the pump and motor manufacturers.

1.4.4 Submittal data shall include:

(a) Complete manufacturer's specifications and descriptive bulletins for all equipment including size, capacity, description and make of pumps.

(b) Complete description, illustrations, wiring diagrams of automatic controls and starting equipment.

(c) Complete motor data, as specified.

(d) Pump performance curves for the specified conditions including head, input kilowatts, and overall efficiency, as a function of capacity from zero to maximum capacity.

(e) Drawings of the equipment, including arrangement and erection drawings of the equipment and equipment operating characteristics in such detail as to give all dimensions necessary to accurately locate through the floors and walls all openings for pipes, anchor bolts and fittings for motors, pumps, motor and pump control center openings, and conduit between the associated equipment. This includes drawings, indents, pockets, and clearances necessary in the floors and walls for proper installation of the equipment specified.

(f) General arrangement drawing of pumping unit, base elbow and guide cable or rail system. Include equipment weight and anchor methods and materials.

(g) Cross section drawing of pumping unit.

(h) Parts list with materials of construction identified.

(i) Motor performance characteristics.

- (j) Spare parts list.
- (k) Painting procedure.
- (l) Six certified copies of the Shop Test results.

1.4.5 Submit copies of all manufacturers' guarantees and warranties obtained by the contractor to be transferred to the State of Illinois, Division of Highways, at the time of acceptance of this project by the State of Illinois.

1.4.6 Motor data shall include:

- (a) Manufacturer.
- (b) Nameplate rated kilowatts (horsepower).
- (c) Rated voltage.
- (d) Full load rpm.
- (e) Full load current.
- (f) Full load power factor.
- (g) NEMA design letter.
- (h) NEC code letter or inrush current.
- (i) Insulation class.
- (j) Service factor.
- (k) Recommended starting restrictions, including allowable starts per hour.
- (l) Recommended maximum KVAR rating of power factor correction capacitors.

1.5 Quality Assurance

1.5.1 General

- (a) Pumping equipment shall be produced by a manufacturer who regularly engages in the design, manufacture, assembly and production of submersible sewage pumping equipment of the size and type as specified for not less than five years.
- (b) Motor units and wet well wiring shall be rated for service in hazardous Class I, Division 1, Group D locations.
- (c) All materials used in the construction of the equipment herein specified shall be new and of the highest available grade and of properties best suited to the Work required.
- (d) One manufacturer shall be responsible for providing pumping equipment, including pump motor and all accessories.
- (e) Unless otherwise indicated, all pumps of a specified type under this Section shall be identical, the product of the same manufacturer.
- (f) To ensure that all equipment is properly coordinated and will function in accordance with the intent of these Specifications, the Contractor shall obtain all the equipment specified herein from the pump manufacturer in whom shall be vested unit responsibility for the proper function of the complete system, including pumps, motors, electrical, control equipment and accessories as shown and specified.



Contractor, however, shall retain overall responsibility for equipment coordination, installation, testing and operation.

#### 1.5.2 Contractor's Responsibility

(a) If the power demand of pumping units proposed to be provided for this Project exceeds the minimum horse power as specified and shown in the Drawings, it is the Contractor's sole responsibility, without additional cost to the Department, to upgrade all affected electrical facilities such as, but not limited to, wiring, conduits, motor controls, switchgear, transformers and incoming facilities to be able to operate all the pumping units satisfactorily and to meet the Specifications.

#### 1.5.3 Manufacturer's Certifications

(a) Submit manufacturer's certification that he has carefully examined all of the Contract Documents in detail, including the arrangement and conditions of proposed structures affecting the performance of the pumping equipment units, and the detailed requirements of manufacturing and subsequent installation of the pumping equipment units.

(b) Submit manufacturer's certification that there are no omissions, ambiguities or conflicts in the Contract Documents or in the pumping station piping layout that affect the pumping units, as shown on the Drawings which have not already been clarified in writing by the Department.

(c) Submit manufacturer's certification that they have reviewed the location and discharge piping design, the discharge valve locations and types, the loads imposed on the pumping units from the connections, the pumping unit locations such as the physical separation to each other and adjacent walls, the water to be pumped, and pumping station piping layout, as shown on the Drawings, and that any incidental modifications thereto will not affect the specified pumping unit performance and efficiency to be furnished under this Contract, and they will be solely responsible for furnishing and delivering pumping equipment that will perform and meet the requirements, as specified in the Contract Documents.

(d) Submit manufacturer's certification that they have inspected the storage of the pumping equipment and find no conditions that have adversely affected the equipment.

(e) Submit manufacturer's certification that they have supervised the installation of the pumping equipment and that the pumping equipment has been properly installed.

(f) Submit manufacturer's certification that they have inspected the pumping equipment after 1000 hours of operation and certify the pumping equipment is operating satisfactorily.

#### 1.5.4 Data to be filed with the Department

(a) Record Drawings: The Contractor shall keep one record copy of all Specifications, Plans, Addenda, Supplementary Drawings, Working Drawings, Change Orders and Clarifications at the site in good order. Specifications, Plans, Supplementary Drawings and Working Drawings shall be annotated to show all changes made during the construction process. These shall be available to the Department at all times and shall be delivered to the Department upon completion of the work.

(b) Four bound copies of operating and maintenance instructions, diagrams, parts, lists, requirements and other information pertinent to the operation of the various systems and equipment shall be furnished to the Department. Refer to Division 1.

#### 1.5.5 Source Quality Control

(a) Shop tests shall be performed on each pumping unit in accordance with the test code of the Hydraulic Institute, except as modified herein. The pumps shall be tested in the position that they will be installed.

(b) Tests shall be conducted at rated speed to determine the curves of head, electric input kilowatts, and overall efficiency, wire to water, as a function of capacity. A minimum of six points shall be taken. One point shall be as near as possible to each specified condition of head and capacity and the remaining points at capacities necessary to provide a uniform distribution of data. Capacity shall be expressed in liters per second (gallons per minute) and head shall be expressed in mm (feet). Raw test data, calculated results and sufficient information for computation and plotting of the curves shall be furnished with the certified shop test curves.

(c) Certified test curves shall be furnished for approval prior to shipment. All tests shall be witnessed by the manufacturer by a Registered Professional Engineer registered in the state in which the shop tests are performed. The witnessing Registered Professional Engineer shall sign and seal each copy of the curve and test data sheets. Six copies of the curves along with the certified drive unit test data, shall be furnished for approval. Shipment of the pumping units shall not be made until the test data and curves are approved.

(d) Curves shall be drawn to such scale that values can be read accurately within 1%. The efficiency curves submitted shall constitute a guarantee within 1% on the scale, for all deliveries between 3/4 rated capacity and 1-1/4 rated capacity.

(e) In addition to the hydraulic test, the pump manufacturer shall perform the following inspections and tests on each pump before shipment from factory:

1) Impeller, motor rating and electrical connections shall first be checked for compliance with the Specifications.

2) A motor and cable insulation test for moisture content or insulation defects shall be made.

3) Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.

4) The pump shall be run for 30 minutes submerged, a minimum of 6 ft. under water.

5) After operational test 1.5.5(e)4, the insulation test 1.5.5.(e)2, is to be performed again. A written report, stating the foregoing steps have been done, shall be submitted prior to shipment.

(f) The Contractor shall provide transportation, lodging and reasonable expenses to and from all factory pump testing for two (2) representatives of the State to witness such testing. State of Illinois shall designate these individuals.

The Contractor shall notify the State of a scheduled test date two months prior to said date and shall arrange an exact suitable date not less than two weeks prior to the test.

The pump tests shall be performed in the domestic United States. However, if this cannot be done, the Contractor shall hire an approved witness and pay all necessary expenses if the test cannot be performed in the domestic United States.

1.6 Guarantee

1.6.1 Refer to Division 1.

1.7 Delivery, Storage and Handling

1.7.1 Products and materials shall be delivered, stored and handled as specified in Division 1.

1.8 Spare Parts

1.8.1 The following spare parts shall be provided for two sets for main pump:

- (a) One set of mechanical seals - upper and lower.
- (b) One set of cable entry grommets.
- (c) One set of Motor Bearings.
- (d) One set of Wear Rings.

1.8.2 A complete set of special wrenches, spanners, eyebolts and other special tools shall be furnished sufficient to completely dismantle and reassemble each kind and size of pumping unit. Tools shall be forged steel, case hardened, full finished, and furnished with a metal tool case with a handle and provision for padlocking.

1.9 Basis of Payment

1.9.1 The pumping equipment shall be paid as part of the contract lump sum price for

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which shall be payment in full for the work described herein unless otherwise noted.

2. PRODUCTS:

2.1 Main Pump Specifics

2.1.1 Pump Construction

(1) Major pump components shall be ASTM A48 Class 35 cast iron, with smooth surfaces devoid of blow holes and other irregularities. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber o-rings. All exposed bolts and nuts shall be of ASTM A276 Type 304 stainless steel. All external surfaces other than stainless steel, shall be protected by a two-component epoxy resin finish.

The impeller shall be open design, stainless steel ASTM A744, Grade CD-4MCU, dynamically balanced and trimable between minimum and maximum diameters to obtain different performance curves. The required impeller shall be factory trimmed to meet the specified pumping head and capacity ranges.

For ease of maintenance, the impeller shall have a cylindrical O.D. fit to pull out the impeller without breaking any flanges or dismounting a wear ring. There shall be a sliding fit between the impeller and the shaft with a key. The fastening of the impeller to the pump shaft shall be by a front disk locking assembly.

The bowl and the intake bell mouth shall be one piece casting without any vanes in front of the impeller area. The conical outlet of the bowl shall provide smooth hydraulic velocity and directional transition into the bell mouth and impeller; thus insuring long pump life.

The pump shaft shall be of ASTM A276 Type 403 stainless steel. Lesser corrosion resistant materials (carbon steel) shall not be used unless protected and completely isolated from the pumped media by a stainless steel shaft sleeve. The use of a bellows seal in itself is not considered a sufficient means of isolating a carbon steel shaft from the pumped media and is not acceptable.

The pump shall be supplied with a replaceable, ASTM A276 Type 316Ti stainless steel wear ring system. The wearing ring shall be capable of being replaced without disassembling the pump/motor assembly.

The pump shall be equipped with two tandem mechanical seals operating independently. The upper mechanical seal shall operate in a pressure compensating oil chamber and consist of one stationary ring of cast chrome steel and a rotating ring of carbon. The oil chamber shall be equipped with drain and inspection plug with positive anti-leak for easy access from external to the pump. The lower mechanical seal shall be of a bellows type and consist of two rings both of silicon carbide or tungsten carbide. Through the use of a leakage collection system, no leakage past the upper mechanical seal shall be allowed to penetrate into the lower bearing assembly but shall be directed and collected into a separate seal leakage chamber where leakage can be monitored and excesses drained.

#### 2.1.2 Pump Motor

(1) The pump motor shall be squirrel cage, induction in design, housed in a completely watertight air-filled chamber. The motor shall have a minimum service factor of 1.10, allow 10 starts per hour and be protected from overheating by the use of thermal sensors. These shall be used in conjunction with and supplemental to external motor overload protection and wired into the control circuit. The motor shall be protected with a moisture resistant Class F insulation capable of resisting temperatures to 155 degree C. Motor shall meet ATEX/IEC EX demands.

The pump/motor shaft shall rotate on a minimum of two permanent lubricated and adequately sized bearings with a B10 bearing life of minimum 70,000 hours at design conditions.

To insure maximum motor protection even in the event of accident, the pumps cable entry design shall insure that no entry of moisture internal to the pumps terminal board and or motor is possible even if the cable is damaged or severed below the water levels.

Cable entry designs only sealing externally around the cable (single grommet) and not sealing the internally, shall not be acceptable.

Each unit shall be provided with an adequately designed cooling system. The motor shall be cooled by the pumped water flowing along the stator housing when the pump is working. A water jacket or any external cooling system shall not be acceptable.

(5) Motor shall be 4,160 V, 3 Phase and shall be in accordance with Subsection 2.20 of Section 16B Electric Motors.

### 2.1.3 Pump Discharge Piping and Mounting Column

A matching discharge and pump mounting column shall be furnished by the pump supplier. The discharge piping and mounting column shall be permanently installed in the wet well. The design shall be such that the pump units may be installed in the mounting column with adequate clearance to prevent binding when lowered into place on the conical support seat at the bottom of the tube. The pumps shall not require any bolts, nuts or rigid fastenings for mounting in the mounting column. No portion of the discharge column shall bear directly on the floor of the sump. The column shall be supported as shown on the Drawings.

The support of the pump assembly shall be of a conical fit and shall be a part of the bowl outlet. An o-ring shall be provided in this area so that the entire weight gives an effective seal between the pump and discharge column. The conical seat is preferred to ensure that the pump can be lowered in place even when the sump is full of water. This conical support design safely prevents rotational movement of the unit. A locking device located on the external surface of the pump casing which might cause a misalignment when lowering the pump into place on a flat pump support is not acceptable.

The discharge piping and mounting column shall be fabricated of ASTM A36 steel and shall conform to AWWA C200, Standard for Steel Water Pipe 6" and Large. Wall thickness shall be a minimum of 0.5 inches. The discharge pipe connecting to pump tube shall be shop welded or field welded. If field welded is performed, the coating shall be restored to both interior and exterior after welding.

The discharge pipe and mounting column shall be coated inside and outside with liquid epoxy primer Symbol B as specified in Section 9A and meeting the requirements of AWWA C210.

A watertight seal shall be provided for the motor power cable, control and signal cables in the blind flanges of each discharge piping system. Provide heavy duty, stainless steel cable support grips for the power, control and signal cables. After installation of respective pumps, all slack shall be removed from hoisting cables and electric cables. Support grips shall be securely fastened to the underside of the blind flange for easy removal of pump and cables. Contractor shall submit shop drawings for Engineer's approval depicting the watertight seals and cable support system for the pump cables.

Provide pump proper tube support at pump room floor El.+9.5 as shown on the drawings. The pump manufacturer shall provide final design of the tube support for Engineer's Review.

The Contractor shall provide an affidavit stating that the pipe and fitting comply with all applicable provisions of these Specifications.

#### 2.1.4 Protection Monitoring System

- (1) Each pumping unit shall be equipped with a monitoring system to protect critical machine functions during operation.
- (2) Three thermostats, one per phase, shall be provided in the motor windings to protect against overheating by initiating an alarm on high temperature.
- (3) Two moisture sensors shall be provided to protect against damage from water contamination. The sensors shall be arranged to initiate the alarm upon sensing moisture in the oil chamber and leakage into the stator housing.
- (4) A bearing temperature sensor shall be provided in main bearing for bearing temperature protection and alarms.
- (5) Monitoring devices designed to be compatible with the sensors and motor controls shall be provided. The monitoring devices shall be located in the motor control center. The monitoring system shall be intrinsically safe.

#### 2.1.5 Pump Lifting System

Provide a stainless steel Type 316 cable lifting system for each pump unit to restrain power and control cables securely during pumping operations and arranged for installation in a closed discharge column.

The cable lifting system shall consist of a turnbuckle, shackles, and carrier cable spacers. The component parts of the cable lifting system shall be constructed of stainless steel with the exception of the spacers which shall be made of rubber. The turnbuckle shall be fixed to the top of the discharge column, and the carrier cable shall be attached to the pump lifting bail. The bail shall be designed to provide mechanical strain relief for the power and control cables and to allow safe handling of the pumps as required during shipping, installation and maintenance.

#### 2.1.6 Power Cables (Low Flow Pumps)

- (1) The power cable shall be designed specifically for use with submersible pumps. The cable shall be sized according to the National Electrical Code (NEC) and the Insulated Cable Engineers Association (ICEA).

The outer jacket shall be lubricant resistant chloroprene rubber, and the copper conductors shall be insulated with ethylene-propylene rubber (EPR). The filler and conductor separator materials shall be rated for 600 volts and 90 degree C (194 degree F) with a 40 degree C (104 degree F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.

#### 2.1.7 Power Cables (Main Pumps)

- (1) The power cable shall be designed specifically for use with submersible pumps. The cable shall be sized according to the National Electrical Code (NEC) and the Insulated Cable Engineers Association (ICEA).

The outer jacket shall be lubricant resistant chloroprene rubber, and the copper conductors shall be insulated with ethylene-propylene rubber (EPDM). The filler and conductor separator materials shall be rated for 10,000 volts and 90 degree C (194 degree F) with a 70 degree C (158 degree F) ambient temperature and shall be approved by Factory Mutual (FM). The cable length shall be adequate to reach the junction box without the need for splices.

#### 2.1.8 Cable Entry

The cable entry water seal design shall preclude specific torque requirements and ensure a watertight and submersible seal.

The cable entry shall be comprised of one cylindrical elastomer grommet, flanked by two stainless steel washers, all having a close tolerance fit against the cable outside diameter and the cable entry insider diameter. This design shall provide the sealing function. The cable strain relief function shall be provided by a separate strain relief clamp located above the cable seal and acting independently from seal function. When the cable entry is mounted onto the junction box, the cable entry will be 100% watertight during immersion of up to 65 feet of depth, while providing sufficient strain relief to prevent the cable from pulling out when handling, installing, or operating the pump. The assembly shall bear against a shoulder in the pump top and direct the cable axially upwards.

#### 2.1.9 Cable Junction Box

The junction chamber shall contain one terminal board, providing connections for both the power cables and signal wires. The terminal board shall be watertight and sealed from the motor by an elastomer compression seal (O-ring). Connection between the cable conductors and stator leads shall be made with threaded, compressed type binding posts, permanently affixed to the sealed terminal board and perfectly leakproof.

The junction box shall contain a collection cavity placed so that any leakage into the junction box shall terminate in the collection cavity. A mechanical float switch shall be mounted at the lowest point in the collection cavity. This sensor shall be wired to provide an alarm in the event of water intrusion into the cable junction box.

### 2.2 Operation and Control

2.2.1 Pump controls shall be provided in accordance with Division 16.

2.2.2 Pumps shall function in rising water and in falling water as shown on the drawings.

#### 2.2.3 Float Level Detectors

(1) The float level detecting devices shall be located in the wet well as shown and as specified in Subsection 2.3.6, Section 16C. One float shall be supplied for each control level.

### 2.3 Bolts, Studs and Nuts

2.3.1 All bolts, studs and nuts shall have American National form right-hand machine cut threads which shall be in conformity with the current ANSI B1.1, "Screw Threads", Coarse Thread Series, class 2 Fit, unless otherwise specified.

2.3.2 Bolts heads and nuts shall be semi-finished and shall be in conformity with ANSI B18.2, "Wrench-Head Bolts and Nuts and Wrench Openings", Heavy Series, unless otherwise specified. All nuts shall be hexagonal in shape.

2.3.3 Stainless steel anchor bolts, flange bolts, studs and nuts shall be in conformity with the current ASTM Designation: A193, Grade B8 (AISI 304), Class 1 and ASTM A194, Grade 8 (AISI 304), AISI 316 or approved equal.

### 3. EXECUTION:

#### 3.1 General

3.1.1 All equipment shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Divisions 1 and 15A. The manufacturer shall inspect the pump installation and shall certify that the pumps have been installed properly. Information submitted for approval shall include a letter of intent to provide this certification. All wiring and piping shall be completed and all necessary adjustments to equipment shall be made to provide a complete operational pumping installation.

3.1.2 The manufacturer shall have joint responsibility with the Contractor for the proper installation of the equipment, and jointly with the Contractor shall furnish a written statement to the Department certifying that the equipment as installed complies with the Plans and Specifications, will perform as specified, and is properly installed.

#### 3.2 Field Quality Control

##### 3.2.1 Representative of the Manufacturer

(a) The services of a qualified representative of the manufacturer shall be provided to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance.

##### 3.2.2 Installed Testing

(a) After installation of the pumping units, control equipment and all appurtenances, each unit shall be subjected to a field running test under actual operating conditions. Water for these tests shall be the responsibility of the Contractor. Field tests shall be performed in the presence of and as directed by the Engineer. Tests shall demonstrate that under all conditions of operation each unit:

- 1) Has not been damaged during transportation or installation.
- 2) Has been properly installed.



- 3) Has no physical or mechanical defects.
- 4) Has been properly connected.
- 5) Is free of overheating of any parts.
- 6) Is free of overloading of any parts.

(b) The pumps shall be tested to demonstrate that the pumps and control system operate as specified. Any defects in the equipment or failure to meet the requirements of the Specifications shall be promptly corrected.

(c) The following shall be checked on start-up:

- 1) Current draw and voltage on all legs of each pump shall be observed and recorded to see if there is any imbalance.
- 2) Megger testing shall be performed and logged on all pumps.

Pump controls and terminations shall be checked.

4) At a minimum, each pump shall be run in recirculation a minimum of 30 minutes.

### 3.3 Painting

3.3.1 All pumping equipment shall be painted as specified in Division 9.

### 3.4 Schedule

3.4.1 Refer to Drawing M7.

END OF THIS SECTION

## DIVISION 15 - MECHANICAL

### **DIVISION 15E - VENTILATION**

#### 1. GENERAL:

##### 1.1 Section Includes

The work specified herein includes furnishing and installing the ventilating system including fans, louvers, dampers, air inlets and outlets and all associated appurtenances and work as indicated and as specified herein.

## 1.2 Related Sections:

- 1.2.1 Section 4A - Unit Masonry.
- 1.2.2 Section 5C - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.
- 1.2.3 Section 15A - General Mechanical Provisions.
- 1.2.4 Section 15B - Basic Mechanical Materials and Methods.
- 1.2.5 Section 16A - General Electrical Provisions.
- 1.2.6 Section 16B - Basic Electrical Materials and Methods.

## 1.3 References

All reference standards shall be from the latest edition.

- 1.3.1 AMCA 99 Standards Handbook.
- 1.3.2 AMCA 210 Laboratory Methods for Testing Fans for Rating Purposes.
- 1.3.3 AMCA 300 Test Code for Sound Rating Moving Air Devices.
- 1.3.4 AMCA 301 Method of Publishing Sound Ratings for Air Moving Devices.
- 1.3.5 NFPA 90A Installation of Air Conditioning and Ventilating Systems.
- 1.3.6 SMACNA HVAC Ductwork Construction Standards - Metal and Flexible.

## 1.4 System Description

1.4.1 Ventilation system consisting of dampers, louvers, supply and exhaust fans for the Electrical Control Room, Pump Room, Access Stairway Enclosure, Intermediate Levels and Wet Well areas shall be provided. The Electrical Control Room and the Pump Room ventilation system will operate above 90 degree F. In addition, whenever the Pump Room, Access Stairway Enclosure, Intermediate Levels and Wet Well areas gas sensor detects combustible gas level above the L.E.L. (lower explosive limit) set point, ventilation system will operate. In addition, when the access stairway lights are turned on, the ventilation system for the Access Stairway Enclosure, Intermediate Levels and Wet Well areas will operate.

1.4.2 All fan and damper motors associated with the Electrical Control Room shall be chemical duty rated. All fans and damper motors associated with the Pump Room, Access Stairway Enclosure, Intermediate Levels and Wet Wells shall be rated for use in Class I, Division I areas.

## 1.5 Submittals

- 1.5.1 Submit shop drawings and product work data under provisions of sections 1A and 15A.
- 1.5.2 Submit detailed drawings and design data.

## 1.6 Guarantee

1.6.1 Provide guarantee under provisions of Section 1A.

1.7 Delivery, Storage and Handling

1.7.1 Delivery, storage and handling shall be as specified under Section 1A.

1.8 Definitions:

1.8.1 Low Pressure (Three pressure classifications):

(a) 1/2 inch WG positive or negative static pressure and velocities less than 2,000 fpm.

(b) 1 inch WG positive or negative static pressure and velocities less than 2,500 fpm.

(c) 3 inch WG positive or negative static pressure and less than 2,500 fpm.

1.9 Basis of Payment:

1.9.1 The pump station ventilation work shall be paid at the Contract lump sum price for

#### PUMP STATION MECHANICAL WORK

which shall be payment in full for the work described herein.

2. PRODUCT:

2.1 Ductwork Work

2.1.1 General

(a) Unless otherwise indicated all ductwork work shall be low pressure type (3 inch WG).

(b) Unless otherwise indicated, all ductwork work shall be ASTM A167, Type 316L.

(c) 316L stainless steel and flexible connections shall be used where vibration isolation, such as at fan connections, is required.

2.1.2 Stainless Steel Ductwork

(a) 316L stainless steel ductwork shall conform to A240/A240M-05a Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

(b) All connectors and bar stock shall be steel alloy 316L.

(c) Stainless steel ductwork shall be ANSI Type 316L with No. 4 directional polish.

(d) Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

### 2.1.3 Flexible Ductwork Connections

(a) Fabricate in accordance with SMACNA HVAC Ductwork Construction Standards - Metal and Flexible, as indicated.

UL Listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 36 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip.

### 2.1.4 Ductwork Supports

(a) Provide 316L stainless steel fasteners, anchors, rods, straps, trim and angles for support of 316L s/s ductwork.

### 2.1.6 Ductwork Fabrication and Assembly

(a) Fabricate shop or manufactured ductwork fittings to match adjoining ductworks, and to comply with ductwork requirements as applicable to fittings.

(b) Except as otherwise indicated, fabricate elbows with centerline radius equal to 1.5 times associated ductwork width; fabricate mitered fittings to include turning vanes in elbows where shorter radius necessary.

(c) Limit combined angular tapers to 45 degrees for contracting tapers and 30 degrees for expanding tapers.

(d) Fabricate in 4-, 8-, 10-, or 12-ft lengths unless otherwise indicated or required to complete runs.

(e) Pre-assemble Work in shop to greatest extent possible to minimize field assembly of systems.

(f) Disassemble systems to extent necessary for shipping and handling.

(g) Match mark sections for re-assembly and coordinated installation.

(h) Fabricate of gauges and reinforcement complying with SMACNA - HVAC Ductwork Construction Standards.

### 2.1.7 Air Turning Devices

Multi-blade device with blades aligned in short dimension; 316L stainless steel construction with mounting straps.

### 2.1.8 Ductwork Access Doors for EF-1 and SF-1

- (a) Fabricate in accordance with SMACNA HVAC Ductwork Construction Standards - Metal and Flexible.
- (b) Review locations prior to fabrication.
- (c) Fabricate rigid and close-fitting doors of 316L stainless steel. Provide sealing gaskets and quick fastening locking devices.
- (d) Access doors smaller than 12 inches square may be secured with sash locks.
- (e) Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches.
- (f) Access doors with sheet metal screw fasteners are not acceptable.
- (g) Manufacturers- Subject to compliance with requirements provide duct access doors of one of the following:

Ruskin Mfg. Co.  
Ventfabrics, Inc.  
Or equal.

#### 2.1.9 Flexible Connections

Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Provide adequate joint flexibility to allow for thermal axial, transverse and torsional movement, and also capable of absorbing vibrations of connected equipment.  
Manufacturers – Subject to compliance with requirements provide flexible connections of one of the following:

Ventfabrics.  
Or equal.

#### 2.1.10 Fire Dampers

Manufacturers:

Greenheck.  
Louvers and Dampers, Inc.  
Ruskin.  
Or equal.

### 2.2 Dampers

General

Provide manual volume control dampers, gravity dampers and motorized dampers in locations shown on the Drawings.

No single damper shall be larger in size than 48-in in either dimension. Where a larger damper is required, multiple damper assemblies shall be provided.

Where multiple damper assemblies are provided, a common actuator may be used to drive a maximum of four dampers. Provide stainless steel connecting linkage as required. Where an assembly is constructed of more than four dampers, multiple actuators shall be provided.

## 2.2.2 Volume Control Dampers

### (a) Performance

Damper manufacturer's printed application and performance data including pressure, velocity and temperature limitations shall be submitted for approval showing damper suitable for pressures to 5" w.g., velocities to 3000 fpm and temperatures to 180 degrees F. Testing and ratings shall be in accordance with AMCA Standard 500.

### (b) Construction

Dampers shall consist of a heavy gauge aluminum channel frame with 5" depth; triple V type blades fabricated from heavy gauge aluminum; blades shall be completely symmetrical relative to their axle point, presenting identical resistance to airflow in either direction or pressure on either side of the damper.

### (c) Bearings and Linkages

1/2" diameter plated steel axles turning in synthetic (acetyl) sleeve bearings; external (out of the air stream) blade-to-blade linkages.

## 2.2.3 Damper Motor

Power for the motor shall be 120 VAC, single phase. All damper motors associated with the Electrical Control Room shall be chemical duty rated NEMA 4X. All damper motors associated with the Pump Room, Access Stairway Enclosure, Intermediate Levels and Wet Wells shall be explosion proof rated for use in Class I, Division I areas.

### Backdraft Damper

Manufacturers:

Greenheck model SEBR  
Or equal.

Parallel blade, counterbalanced backdraft damper.  
Provide in vertical or horizontal configuration as required by installation location.  
316 stainless steel construction with vinyl blade seals.  
Units shall be set for 0.10 IN. W. C.

### Duct Hardware

Manufacturers:

Ventfabrics, Inc.  
Young Regulator Co.  
Or equal

Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

#### 2.2.6 Control Dampers

Manufacturer:

Greenheck model VCD-33.  
Or equal.

Ultra low leakage damper.

16 gauge galvanized steel frame. Dampers installed in aluminum or stainless steel duct systems or unducted applications in areas specified to use aluminum or stainless steel ducts shall be provided with Hi-Pro polyester coating or be fabricated of 304 stainless steel frame and blades.

Airfoil shaped double skin blades completely symmetrical about the axle pivot point.

Blade axles in synthetic sleeve bearings.

Silicone blade seals.

Flexible stainless steel jamb seals.

External (out of the airstream) blade to blade linkage.

Suitable for pressures to 8-in. w.c. and velocities to 4,000-fpm with maximum AMCA leakage rate of 6 cfm/sq. ft at 4-in w.c.

#### 2.2.7 Insulated Control Dampers:

Manufacturer:

Greenheck model ICD-45.  
Or equal.

0.125-in aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin gaps.

Aluminum airfoil blades internally insulated with polyurethane foam and thermally broken.

Plated steel axle with dual bearings. Bearings shall have acetal inner sleeve and flanged outer bearing with no metal-to-metal or metal-to-plastic contact.

External (out of the airstream) blade to blade linkage.

Suitable for pressures to 8-in. w.c. and velocities to 4,000-fpm with maximum AMCA leakage rate of 8 cfm/sq. ft at 4-in w.c.

Damper Actuators:

Actuators shall be adequately sized for the damper size and air pressures anticipated in the system with a safety factor of two.

Actuators shall have ISO9001 quality certification and be UL listed under standard 60730-1 or UL listed under standard 873.

(c) Actuators used on dampers shall be designed to directly couple and mount to a stem, shaft or ISO style-mounting pad. Actuator mounting clamps shall be a V-bolt with a toothed V-clamp creating a cold weld, positive grip effect. Single point, bolt, or single screw actuator type fastening techniques or direct-coupled actuators requiring field assembly of the universal clamp is not acceptable.

Actuators shall be fully modulating/proportional, pulse width, floating/tristate, or two position as indicated in the sequence of operation and be factory or field selectable. Actuators shall have visual position indicators and shall operate in sequence with other devices if required.

Provide actuators with end switches or position feedback as indicated in the sequences of operation.

Actuators shall have an operating range of  $-22^{\circ}$  to  $122^{\circ}$ F.

Proportional actuators shall accept a 0-10 VDC or 0-20 mA input signal and provide a 2-10 VDC or 4-20 mA (with a 500 W load resistor) operating range.

Actuators shall be capable of operating on 24 or 120 VAC, or 24VDC and Class 2 wiring as dictated by the application. Power consumption shall not exceed 10 VA for AC, including 120VAC actuators, and 8 watts per actuator for DC applications. Power supply requirements are Contractors option.

Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation. End switches to deactivate the actuator at the end rotation or magnetic clutches are not acceptable.

For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Spring return actuators shall be capable of CW or CCW mounting orientation. Spring return models > 60 in-lbs. and non-spring return models > 90 in-lbs. will be capable of mounting on shafts up to 1.05-in diameter. Spring return actuators with more than 60 in-lb. of torque shall have a metal, manual override crank. Actuators using "on-board" chemical storage systems, capacitors, or other "on-board" non-mechanical forms of fail-safe operation are unacceptable. Upon loss of control signal, a proportional actuator shall fail open or closed as described below. Upon loss of power, a nonspring return actuator shall maintain the last position.

Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required. Dampers requiring greater torque or higher close off may be assembled with multiple low torque actuators. Dual mounted actuators using additional anti-rotation strap mechanical linkages, or special factory wiring to function are not acceptable. Actuators in a tandem pair must be "off the shelf," standard actuators ready for field wiring.

Damper actuators shall not produce more than 62 dB (A) when furnished with a mechanical fail-safe spring. Non-spring return actuators shall conform to a maximum noise rating of 45 dB(A) with power on or in the running or driving mode.

Proportional actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable. Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload, mechanical travel and mechanical load limit. The actuators shall also provide actuator service data, at minimum, number of hours powered and number of hours in motion.

Proportional actuators shall be capable of digital communication, as built.

All damper operators shall be oil submerged, geartrain type, inherently positive positioning.

The actuators shall be mounted externally of ducts or air handling equipment wherever possible for ease of service and isolated from internal temperatures.

Actuator enclosure:

Unless otherwise indicated, NEMA 4X.



In areas designated as Class 1, Division 1 or 2 hazardous environment, provide explosion proof enclosure.

Fail Position:

Outside Air Louvers/Intakes: Closed.

Return Air Dampers: Open.

Duct Mounted Control Dampers: Closed.

### Manual Dampers

Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA standars:

Manual dampers shall be of aluminum construction.

Manufacturer – subject to compliance with requirements, provide dampers of one of the following:

1. American Warming & Ventilating Inc.
2. Arrow Louver and Damper Corp.
3. Greenheck
4. Louvers & Dampers
5. Or equal

### 2.3 Intake Louvers

#### 2.3.1 General

Provide a fixed louver, with internal bird screen or insect screen as shown on the drawings.

#### 2.3.2 Fabrication

Frame shall be constructed of .080" 6063T5 extruded aluminum with .072" 6063T5 extruded aluminum blades. Finish shall be clear anodized.

#### 2.3.3 Bird Screen

Provide an internally-mounted bird screen. The screen shall be constructed of .051" x 3/4" diamond pattern expanded aluminum.

#### 2.3.4 Insect Screen

Provide an externally mounted insect screen. The screen shall be constructed 18 x 18 mesh stainless steel.

2.3.5 Finish: Provide louvers with Kynar finish. Finish color to be selected by Owner/Architect.

2.3.6 Extended Sill.

2.3.7 Manufacturers:

Greenheck  
Carnes  
Ruskin  
Or equal

## 2.4 Air Grilles or Registers

### Type

Construction: provide grilles constructed of aluminum or stainless steel to match ductwork materials.

Performance: provide grilles that do not exceed 0.10 pressure drop and 30 noise criteria ratings at airflow rate shown on the drawings.

Substrate Compatibility: provide grilles border styles that are compatible with adjacent substrate and specifically manufactured to fit into construction opening with accurate fit and adequate support.

Grille Face/Pattern: Provide grilles of the following face/pattern type.

Single Deflection: Provide grilles with  $\frac{3}{4}$ -in horizontal and vertical sets of blades.

Double Deflection: Provide grilles with  $\frac{3}{4}$ -in horizontal and vertical sets of blades.

Manufacturers:

Carnes.  
A-J Manufacturing Company.  
Titus.  
Or equal.

## 2.5 In-Line Vane Axial Fan - Belt Drive (SF-1)

### 2.5.1 General

(a) Fan selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.

(b) Each fan shall be belt drive in AMCA arrangement 9 only with hub positively secured with a steel taper lock bushing keyed to the fan shaft.

(c) Statically and dynamically balanced fans to eliminate vibration or noise transmission to occupied areas.

(d) Fan shall be equipped with lifting lugs.

(e) Motor support framework to be constructed of structural steel suitable to handle the weights of the motor and propeller. Motor supports within the fan housing to be welded to the fan casing. Bolted construction is not acceptable. All support framework to be coated and finishing as the fan housing.

(f) OSHA compliant belt guard and motor cover to be completely cover the motor pulley and belts.

## 2.5.2 Performance Ratings

Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

## 2.5.3 Sound Ratings

Conform to AMCA 301, tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

## 2.5.4 Fabrication

Conform to AMCA 99.

## 2.5.5 Rotor

Rotor blades and hub shall be heat-treated cast aluminum alloy A356-T6 with blade bases and hub sockets precision machined. Blades shall be attached to the hub with steel studs and self-locking nuts.

Rotor blade pitch shall be manually adjustable without removing the propeller from the fan shaft. A taper lock bushing shall be used to mount the propeller to the motor shaft.

The propeller diameter and casing inside diameter shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

## 2.5.6 Housing

The fan housing shall be fabricated from heavy gauge steel with prepunched flanges at both ends. A minimum of seven heavy gauge straightening vanes shall be welded to the fan housing downstream from the rotor.

Fan housing shall be constructed of rolled steel with a continuous seam weld. Housing to be coated with a minimum of 3 mils of permatector, and electrostatically applied and baked polyester urethane.

## 2.5.7 Finish color:

Factory finish color. Coating shall exceed 1.000 hour salt spray under ASTM B117 test method.

## 2.5.8 Motors

Motor shall meet or exceed EPACT efficiencies and shall be explosion proof rated for Class 1, Division 1 Group D area. Motors shall be heavy duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the air stream. Motors shall be readily accessible for maintenance.

## 2.5.9 Shafts and Bearings

Fan shaft to be constructed of stainless steel shafts and shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 400,000 hours at maximum cataloged operating speed. Bearing shall be fixed to the fan shaft using concentric mounting locking collars. Bearing shall have extended copper lube lines with Zerk fittings to allow for lubrication.

#### 2.5.10 Drive Belt and Pulleys

Drive belts and sheaves shall be sized for a minimum of 150% of fan operating brake horsepower and shall be readily and easily accessible for service. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

#### 2.5.11 Belt Guard

Fabricate to SMACNA HVAC Ductwork Construction Standards - Metal and Flexible; of 12 gage, 3/4 inch diamond mesh wire screen welded to aluminum angle frame or equivalent, prime coated. Secure to fan or fan supports with provision for adjustment of belt tension, lubrication and use of tachometer with guard in place.

#### 2.5.12 Identification

Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number, voltage, horsepower, and individual serial number for future identification.

#### 2.5.13 Vibration Isolation

Fans shall be isolated from the building structure by means of neoprene vibration isolators.

#### 2.5.14 Manufacturer Accessories:

Mounting brackets: ceiling hung  
Inlet Cone with access Door and companion flangs  
Outlet cone  
Inlet inspection section bolted door  
Outlet inspection section bolted door  
OSHA compliance motor and belts cover  
Guard inlet of fan housing.

### 2.6 Propeller Fans (EF-2, EF-3 & EF-4)

#### 2.6.1 Ratings

- (a) All propeller fans shall conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- (b) All propeller fans shall conform to AMCA 301, tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

#### 2.6.2 Fabrication

- (a) All propeller fans shall conform to AMCA 99.
- (b) Statically and dynamically balance fans to eliminate vibration or noise.
- (c) Each Exhaust fan shall be enclosed in a weatherproof wall housing with backdraft damper as scheduled.

### 2.6.3 Performance

Type: Axial flow, direct or belt driven propeller fan as scheduled.

Construction: fan panel shall be single piece construction of galvanized or painted steel with deep formed inlet venture and pre-punched mounting holes. Drive support frame shall be of heavy gauge steel construction.

Fan shall be securely attached to fan shafts and statically and dynamically balanced.

### 2.6.4 Wheel, Shaft and Drive

Propeller shall be constructed of cast aluminum blades securely fastened to cast hub. Hub shall be keyed to ground and polished shaft. Bearing shall be heavy duty pillow block bearings selected for minimum life of 100,000 hours at maximum rated speed of the fan. Drives shall be sized for a minimum of 150% of installed motor horsepower. Sheaves shall be of cast iron construction, motor sheaves shall be adjustable for system balancing. Fans shall be dynamically and statically balanced and tested before shipment.

### 2.6.5 Motor

Motor shall be permanently lubricated and shall operate from 460 VAC, three-phase power. Motor for EF-2 and EF-3 shall be explosion proof rated for a Class 1, Division 1 Group D area. Motor for EF-4 shall be TEFC. All motors shall be rated as premium efficient motors.

### 2.6.6 Frame

Motor drive frame assemblies and fan panels shall be galvanized steel. Drive frame assemblies shall be welded wire or formed channels and fan panels shall have pre-punched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be bolted construction or welded construction.

### 2.6.7 Wall Collar Assembly

(a) Wall collar shall be constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes. The drive side shall be protected by welded steel wire guards, coated with a thermal setting polyester urethane.

The wall collar shall be suitable for outdoor environments and provide the fan, motor and damper complete protection from the elements.

Accessories: Provide fans with the following accessories:

Dampers: Provide Dampers with scheduled louvers.

Wall Housing: Provide manufacturer's standard wall housing for scheduled fan size. Housing shall be constructed of galvanized steel with pre-punched mounting holes. Provide housing with motor side guard of welded steel wire construction.

Provide special coatings as scheduled.

Provide Long wall housing or short wall housing with OSHA guard.

## 2.7 Fan Exhaust Dampers Mounted in Wall Collars

### 2.7.1 General

Provide louver with birdscreen and backdraft dampers for fans EF-2 EF-3 and EF-4, size and location as shown on plans and in schedule. Dampers may be fan manufacturer's standard models.

### 2.7.2 Fabrication

05 mm (18 gage) aluminum 3.5 inch depth, roll formed aluminum blades 0.032" - 0.040" roll-formed aluminum, 3/16" diameter plated steel stub axles turning in acetyl bearings, extruded vinyl blade seals and internal 0.064" aluminum tie bar (on-blade). Finish shall be clear anodized.

#### Centrifugal Inline Belt Driven Fans (EF-1)

Manufacturers:

Greenheck.  
Carnes Company.  
Cook Company.  
Or equal.

Type: Inline centrifugal exhaust ventilator.

Construction: Fan housing shall be constructed of aluminum. Fan wheel shall be backward inclined, non-overloading of aluminum construction. Drives shall be sized for a minimum of 150% of driven horsepower.

Motors: Provide TEFC motors for all belt drive fans unless specified to be explosion proof, ODP for direct drive fans. Provide motors of scheduled horsepowers in accordance with Division 16.

Electrical: Provide factory-wired, fusible type disconnect switch in accordance with Division 16. Fans designated to be of spark-resistant construction and provided with explosion-proof motors shall be provided with a factory wired disconnect switch suitable for the environment in which it is installed and wired in accordance with Division 16.

Accessories: Provide fans with the following accessories:

Inlet and discharge collars.  
Vibration isolation kit for horizontal hanging installation.  
Provide special coatings as scheduled.

#### Temperature Sensors

Temperature Sensors shall be of the type and have accuracy ratings as indicated and/or required for the application and shall permit accuracy rating of within 1% of the temperature range of their intended use. Sensors must be capable of being calibrated.

All duct sensors shall be electronic resistance type.

Sensors used for mixed air application shall be the averaging type of sufficient length to extend diagonally across the entire duct and have an accuracy of 1%.

Duct sensors shall protrude into the air stream far enough to sense any temperature differences due to stratification, etc.

Outside air sensors shall have a minimum range of -20 °F to 110 °F and an accuracy of within 1 °F in this temperature range. Sensors shall be provided with a water-tight fitting and adequate protection from the effects of solar radiation.

Space temperature sensors located in the Administrative Spaces shall have digital space temperature and setpoint display with external setpoint adjustment and manual Occupied/Unoccupied override. Setpoint adjustment shall be software limited by OWS.

Space temperature sensors located in process spaces shall be provided with a NEMA 4X enclosure with corrosion resistant elements. Sensors shall have no setpoint adjustment or display. Space temperature setpoint shall be made via the OWS.

Space temperature sensors located in areas identified and Class 1, Division 1 or 2 shall be provided with an explosion proof enclosure with corrosion resistant elements. Sensors shall have no setpoint adjustment or display. Space temperature setpoint shall be made via the OWS.

Water temperature sensors shall be of the bulb type mounted within stainless steel wells filled with a heat conductive compound and in direct contact with the water within the pipe.

All field mounted sensors shall be labeled in accordance with Section 15190 with the name or identification number used in the control program.

#### Low Temperature Protection Thermostats

2.10.1 Provide low-temperature protection thermostats of manual-reset type with sensing elements 8'-0" or 20'-0" in length.

Provide thermostat designed to operate in response to coldest 1'-0" length of sensing element, regardless of temperature at other parts of element.

Support element properly to cover entire unit width. Provide separate thermostats for each 25 sq. ft. of coil face area or fraction thereof.

#### Line – Voltage / Low Voltage On – Off Thermostats

2.11.1 Bi-metal actuated open contact, or bellows actuated enclosed snap-switch type.

UL-listed at electrical rating comparable with application.

Heat anticipation.

#### Line Voltage Thermostats With Fan Switch

2.12.1 Provide thermostats as described above with three position manual switch labeled Manual-Off-Auto. Switch shall be integral part of thermostat and be capable of mounting on 2-gang switch box.

#### Temperature Control Panels (TCP)

2.13.1 Provide control panels with suitable brackets for either wall or floor mounting where indicated and elsewhere as required. Locate panel as required.

Provide standard NEMA 4X stainless steel cabinets of size required to contain temperature controllers; DDC, IDC, and IBC controllers; relays; switches; and similar devices; except limit controllers and other devices excluded in sequence of operations.

Mount required alarm lights, indicating devices and manual controls on face of panel.

### 3. EXECUTION:

#### 3.1 Ductwork

3.1.1 Low pressure ductwork work shall be fabricated and supported in accordance with SMACNA Ductwork Construction Standards - Metal and Flexible and ASHRAE handbooks. The ductwork gages, reinforcing and sealing shall be suitable for the operating pressures of the system.

3.1.2 Double nuts and lock washers shall be used on threaded rod supports. Hanger rods shall be galvanized steel, threaded at both ends or continuously threaded.

3.1.3 During construction, temporary closures of metal or taped polyethylene shall be provided on open ductwork work to prevent the entry of construction dust. For a facility in continuous operation, the closures may only be required during dust-generating construction operations, as directed by the Engineer.

3.1.4 Increase ductwork sizes gradually, not exceeding 15 degrees divergence whenever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

3.1.5 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of ductwork on centerline. Where not possible and where rectangular ductwork elbows are used, provide turning vanes.

3.1.6 The installation shall conform to the requirements of NFPA 90A and 90B, as applicable.

3.1.7 Provide ductwork with inside dimensions equal to sizes indicated on Drawings.

3.1.8 Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ductworks rigidly with ties, braces, hangers and anchors of type holding ductworks true-to-shape and preventing buckling.

3.1.9 After installation, seal ductwork to seal class recommended and method prescribed in SMACNA - HVAC Ductwork Construction Standards.



3.1.10 Complete fabrication at Project necessary to match shop-fabricated Work and accommodate installation requirements.

3.1.11 Locate ductwork runs, except as otherwise indicated, vertically and horizontally, avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details, and notations or, if not otherwise indicated, run ductwork in shortest route not obstructing usable space or block access for servicing building or its equipment. Hold ductworks close to walls, overhead construction, columns and other structural and permanent enclosure elements of building.

3.1.12 Coordinate ductwork installations with installation of accessories, dampers, equipment, controls, and other associated Work of ductwork system.

3.1.13 Support ductwork to comply with SMACNA - HVAC Ductwork Construction Standards, hangers and support section.

3.1.14 Where dissimilar metal ductworks meet, provide positive electrical isolation using insulating materials, sealants and fasteners.

3.1.15 Clean ductwork internally of dust and debris as it is installed. Clean external surfaces of foreign substances causing corrosive deterioration of metal.

3.1.16 Strip protective paper from stainless ductwork surfaces, and repair finish wherever damaged.

3.1.17 Unless otherwise indicated, ductworks shall be attached using rivets, bolts or sheet metal screws compatible with the ductwork material, i.e. stainless steel screws for 316L s/s ductwork.

3.1.18 Sealant shall be non-hardening, water resistant, fire resistive and compatible with the mating materials. The sealant shall be applied as recommended by the manufacturer, either used alone or with tape or heavy mastic.

3.1.19 Contractor shall verify the location of all ductwork runs and wall, floor and ceiling penetrations.

3.1.20 Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Install access doors where indicated and at each control damper.

## 3.2 Fans

3.2.1 Do not operate fans for any purpose until ductwork is clean, bearings lubricated, and fan has been test run under observation.

3.2.2 Install fans as indicated, with resilient mountings and flexible electrical leads. The isolation and vibration eliminator manufacturer and Contractor shall be responsible for the selection of the proper units for their loadings and quantities. They shall guarantee that each and every installation and their application shall have a vibration efficiency of 90% or greater.

3.2.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connections are parallel with minimum 1" flex between ductwork and fan while running.

3.2.4 Each fan shall be provided with the controls as indicated on the electrical drawings. Refer to Division 16.

3.2.5 Support fans in accordance with manufacturers instructions. As part of submittals, include drawings showing fan support design and construction materials.

3.3 Fan and Damper Schedule: See sheet M8.

#### Test and Adjustment

3.4.1 Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.

Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.

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

Test and adjust fan RPM to design requirements. For fans operating with pressure controlled VFDs, fan speed shall first be set to lowest output that allows design flow to most remote terminal served. Measured minimum required supply air pressure shall be identified to the Temperature Controls Contractor for establishing setpoint.

Test and record motor full load amperage.

Check all fans for correct rotation.

Test and record system static pressures, suction, discharge and external at all air handling equipment.

Test and adjust system for design outside air and recirculated air quantities.

Adjust and record all main supply and return air ducts and zones to proper design CFM.

Test and adjust each diffuser, grille and register to within 5% of design requirements. Record data and location. Use manufacturer's rating and calculations.

Adjust all grilles to minimize drafts in all areas.

Test and record all air temperatures - supply, return, mixed, and outside air.

END OF SECTION

DIVISION 15 - MECHANICAL

### **SECTION 15F - MISCELLANEOUS MECHANICAL ITEMS**

#### 1. GENERAL:

##### 1.1 Section Description

1.1.1 This Section shall include all work required for the furnishing and installing complete, the Items indicated on the Drawings, as specified herein and as follows:

- (a) Cable Supports.
- (b) Stilling Wells.
- (c) Compression Bells
- (d) Refer to Division 1 for additional requirements.

## 1.2 Related Sections

- 1.2.1 Section 15A - General Mechanical Provisions.
- 1.2.2 Section 15B - Basic Mechanical Materials and Methods.
- 1.2.3 Section 15C - Piping and Appurtenances.
- 1.2.4 Section 15D - Pumping Equipment.
- 1.2.5 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.

## 1.3 Submittals

- 1.3.1 Submit shop drawings and product data under provisions of Sections 1A and 15A.

## 1.4 Delivery, Storage and Handling

- 1.4.1 Delivery, storage and handling shall be in accordance with the provisions under Section 1A.

## 1.5 Guarantee

- 1.5.1 Provide guarantee under provisions of Section 1A.

## 1.6 Basis of Payment

- 1.6.1 Payment: The work specified under this Section and as required shall be included for payment in the Contract lump sum price for the item, PUMP STATION, MECHANICAL WORK.

## 2. PRODUCTS:

### 2.1 Cable Supports

- 2.1.1 The cable supports shall be constructed as indicated on the Drawings using the specified material. The cable support shall be complete and shall support all cables required for the main pumps whether or not shown on the Drawings. Mesh cable grips shall be stainless steel.

### 2.2 Stilling Wells

- 2.2.1 Stilling well shall be provided as indicated on the Drawings and as specified herein. Stilling well shall be provided for the Float Control Systems specified under Division 16.

2.2.2 Stilling wells for back-up float systems shall be constructed of 3/8" fiberglass consisting of 60% polyester resin and 40% glass material with stainless steel barrel slide bolt latch and stainless steel door hinges. Barrel shall stay firmly in place until the handle is lifted from the groove.

2.2.3 All hardware and metal parts shall be all stainless steel.

### 2.3 Compression Bells

2.3.1 Compression bells shall be provided for water level sensing in conjunction with separately mounted pressure sensing type level transmitters. The compression bell shall be fabricated with high strength non-corrosive plastics and shaped to provide a resistance to build up of foreign material. Stainless steel tube fitting shall be provided for air tube connection. Stainless steel straps shall be provided for mounting. Quantities, locations and mounting details shown on drawings.

2.3.2 The compression bells shall be manufactured by TESCO or equal.

## 3. EXECUTION:

### 3.1 Installation

3.1.1 Install the specified specialties in accordance with manufacturer's recommendations and instructions to permit intended performance.

3.1.2 The manufacturer or supplier of the specified specialties shall furnish a qualified field engineer for whatever period of time may be necessary to assist and direct the Contractor in the proper installation of the equipment furnished, to observe and check initial performance, and whose duty shall include the instruction of the plant operating personnel in the proper operating and maintenance procedures.

### 3.2 Painting

3.2.1 The specified specialties shall be painted in accordance with Section 9A of these specifications.

### 3.3 Testing

3.3.1 The specialties shall be tested in place by the Contractor, and any defects in specialties or connections shall be corrected to the satisfaction of the Engineer.

END OF THIS SECTION

## **DIVISION 16 - ELECTRICAL**

### **SECTION 16A - GENERAL ELECTRICAL PROVISIONS**

#### **1. GENERAL:**

##### **1.1 Description**

1.1.1 The scope of work under this Section shall generally be all electrical work required for the project work as specified or as indicated on the drawings.

1.1.2 The electrical work shall include the furnishing and installing of various items of electrical equipment and, unless otherwise indicated, shall also include the electrical connection of various items such as electric pump motors, fan motors and similar items furnished under other Sections. The Contractor shall be responsible for ascertaining the extent of electrical connections required for items furnished under other Sections and for coordination the electrical work accordingly.

1.1.3 The specifications and drawings are intended to generally define the work required, but they do not include every equipment and installation detail. The work shall include all items and appurtenances required to fully complete the work, whether specifically identified or not, such that the electrical systems are complete and operational.

1.1.4 Refer to Division 1 for other requirements relating to the furnishing and installing of work which shall apply to the work under this Division.

##### **1.2 Code Compliance**

Unless otherwise indicated, in the absence of more stringent requirements in the Specifications or on the Drawings, the work shall be in compliance with the requirements of the National Electrical Code.

##### **1.3 Standards**

1.3.1 Wherever the following abbreviations are used in these Specifications or on the Drawings, they are to be construed the same as the respective expressions represented:

AASHTO American Association of State Highways and Transportation Officials

ANSI American National Standards Institute

ASTM American Society for Testing and Materials  
AWG American Wire Gauge

FM Factory Mutual

ICEA Insulated Power Cable Engineers Association

IES Illuminating Engineering Society of North America

NEC	National Electrical Code
NEMA	National Electrical Manufacturers Assoc.
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

1.3.2 Wherever a reference is made to a standard or standard specification, the reference shall be to the edition current at the time of bidding, including any revisions or amendments.

#### 1.4 Verification of Contract Drawings

1.4.1 The Contractor shall familiarize himself with the details of the total construction insofar as they may affect the work under this Division, including floor elevations, physical dimensions of structures, materials of construction and the nature of work required under other Divisions. No additional compensation will be granted for failure to consider the total project work.

1.4.2 The contract drawings (Drawings) for electrical work are generally diagrammatic and do not necessarily depict all items to scale. The Drawings indicate the general locations of major elements of the electrical system, outlets, fixtures, pull boxes and the like, however, field conditions or interferences, may require changes in the installation. The Contractor shall coordinate his work to avoid interferences and shall obtain the approval of the Engineer prior to making any changes from the installation shown.

1.4.3 Prior to installation, the Engineer may make reasonable minor changes in the locations of the installation without additional cost to the State.

#### 1.5 Coordination

1.5.1 The Contractor shall coordinate the work under this Division with the work of other trades. This shall include an orderly exchange of information and shall be accomplished such that the total work is not delayed and that interferences are avoided. The Contractor shall coordinate all electrical systems into a complete operational package. The Contractor shall assign one contact person for all such co-ordination work, has an understanding and working knowledge of the electrical control systems on this project. This person shall oversee and assume proper operation of the complete electrical control system including all testing and calibration as outlined herein. The Contractor shall provide the name and phone numbers of this individual at the preconstruction inspection. This cost shall be incidental to Pump Station Electrical.

#### 1.6 Workmanship

1.6.1 The electrical work shall be performed in a neat and workmanlike manner in accordance with the best practices of the trade.

1.6.2 Unless otherwise indicated, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

## 1.7 Testing

1.7.1 All electrical equipment and systems provided under this Division shall be adjusted and tested. The Contractor shall adjust, repair or replace faulty or improper Division 16 work or equipment discovered during testing.

1.7.2 In addition, all electrical items provided under other Divisions and connected and/or adjusted under this Division shall be tested and if a failure occurs due to the connecting or adjusting methods used, the failure shall be remedied under this Division by repair, replacement, or change, as determined by the Engineer, at no additional cost to the Department.

1.7.3 Tests may be made progressively as portions of the work are complete.

1.7.4 Tests shall be made in the presence of the Engineer.

1.7.5 A written record of tests shall be maintained by the Contractor and, when complete, it shall be submitted to the Engineer for the record.

1.7.6 The Contractor shall perform all tests necessary to assure proper functioning of materials and equipment. As a minimum, the tests shall include the following:

(a) Before making final connections check the insulation resistance of all cables of 3-phase circuits that operate above 150 volts.

(b) Check wiring for proper phase sequencing including buses, feeder cables and transformers and assure proper connection at motors for proper rotation.

(c) Measure and record the line-to-line and line-to-neutral voltages at the line side of the service entrance, all panel buses or main terminals and at the primary and secondary terminals of all transformers furnished under this Division except for control transformers which are integral to motor starter units. Set the taps on transformers as required or as directed by the Engineer.

(d) Check and record the motor nameplate data for each 3-phase motor. Check the ratings of motor circuit protective devices and assure compatibility of the devices for the connected motors. In particular, assure that the motor starter overload elements are proper for the motor nameplate full load amperes.

(e) Set control relays, protective relays and instruments in accordance with manufacturer's recommendations. Record the set points.

(f) Check all control circuits for proper functioning of all devices and check all switches, contactors, pushbuttons, limit switches, thermostats, circuit breakers and the like for proper operation.

(g) Check all alarm circuits for proper operation and proper set points, as applicable. Record any appropriate set points.

(h) Measure and record the line currents of each phase of each 3-phase motor under load.

(i) Align and adjust lighting fixtures and assure proper operation of all controls, ballasts and lamps.

(j) All equipment must be properly calibrated for proper operation of the system.

(k) See paragraph 3.10 of this Section for further testing requirements.

1.7.7 Testing must be complete prior to final inspection. All instruments, tools, etc., required for the tests shall be provided by the Contractor. All equipment shall be properly calibrated for proper operation of the complete system. Additional testing may be requested by the Engineer during final inspection to spot-check test results or to demonstrate proper functioning of the systems. These tests shall be performed by the Contractor at no additional cost to the State.

1.7.8 The Contractor shall simulate the automatic operation of the complete pump station to assure proper operation. After assurance of proper operation, the Contractor shall demonstrate automatic operation including simulation to the Engineer's satisfaction.

1.7.9 Note that failure to test the equipment completely is not an allowance for an extension.

#### 1.8 Data to be Filled with the Department

1.8.1 Submit shop drawings and product data under provisions of Section 1A. Certain data, as specified herein, shall be furnished to the Department when installation and testing are complete, before final acceptance.

1.8.2 The data shall be compiled in 8-1/2 x 11-inch format in high-quality heavy-weight, hard cover binders with piano-style metal hinges or in an alternate format approved by the Engineer. Large drawings and other materials which would be opened or removed for reading shall be provided with heavy clear plastic pouches within the binders. The number of binders shall be as required to hold all required material without over-filling. Various sections, as appropriate shall have suitable dividers. All volumes shall be labeled.

1.8.3 Four sets of the data files shall be provided.

1.8.4 As a minimum, the data files shall include:

(a) A table of contents.

(b) Approved, final shop drawings and product data for all equipment and materials incorporated in the work under this Division.

(c) Manufacturer's maintenance manuals for all equipment furnished under this Division for which maintenance is recommended by the manufacturer.



- (d) A tabulation of cable insulation tests.
- (e) A tabulation of motor nameplate data.
- (f) A tabulation of required voltage tests.
- (g) A tabulation of required motor current tests.
- (h) A tabulation of relay and control device set points.
- (i) A tabulation of alarm set points.
- (j) A Study Report providing summary of results of power systems study under paragraph 3.9 of this Section including:
  - 1. Description, purpose, basis, and scope of study and single line diagram of power system.
  - 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short circuit duties and commentary regarding same.
  - 3. Protective device time versus current color coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
  - 4. Fault current calculations including definition of terms and guide for interpretation of computer printout.
  - 5. Tabulation of appropriate tap settings for relay units.
  - 6. Arc flash calculations and tabulation of incident energy level (calories/cm<sup>2</sup>) for each equipment location and recommended personal protective equipment (PPE).
- (k) Complete testing report for the testing of electrical systems under paragraph 3.10 of this Section.

1.8.5 All data shall be neat and clearly legible. The table of contents and tabulations of set points and other recorded test data shall be typed. Sloppy, illegible, inaccurate, or incomplete data will not be accepted.

## 1.9 Record Drawings

1.9.1 Alterations and additions to the electrical installation depicted on the contract drawings which are made during the execution of the work shall be neatly and plainly marked in red on a set of Record Drawings kept at the contractor's field office for the project. These drawings shall be updated as the work progresses and shall be available for inspection by the Engineer at all times during the course of the work.

1.9.2 When the work is complete, and before final acceptance, a set of Record Drawings shall be submitted to the Engineer for review and acceptance. The set shall include the marked field set and a set of reproducible drawings. A set of reproducible drawings will be supplied to the Contractor for use in preparing the Record Drawings. The drawings shall each be stamped "RECORD DRAWING", and shall be marked with the contractor's stamp, the date, and the signature of the contractor's supervising engineer or electrician.

1.9.3 The Record Drawings must be submitted and must be acceptable to the Engineer prior to final acceptance. There will be no deviation from this requirement.

#### 1.10 Guarantees

1.10.1 Guarantees shall be provided for equipment, materials and work provided under this Division as specified in Division 1.

#### 1.11 Basis of Payment

1.11.1 The work, except the Electric Service specified under Subsection 3.4 shall be paid for at the Contract lump sum price for PUMP STATION ELECTRICAL WORK, which shall be payment in full for the work described herein unless otherwise noted.

1.11.2 The work for Electric Service specified under Subsection 3.4 shall be paid under the pay item ELECTRIC SERVICE CONNECTION.

### 2. PRODUCTS:

#### 2.1 Materials and Equipment

##### 2.1.1 Quality

All materials, equipment and appurtenances shall be new, shall be suitable for the application and shall be the product of established, reputable manufacturers.

##### 2.1.2 Standards

The construction, sizes, ratings and capacities of items shall be in conformance with the requirements of the NEC and with NEMA standards, as applicable.

##### 2.1.3 UL Label

Unless otherwise indicated, materials and equipment shall bear the UL label whenever such labeling is available for the type of material or equipment being furnished.

##### 2.1.4 Service Equipment

Equipment which is used as electric service equipment shall bear a UL listing: "SUITABLE FOR USE AS SERVICE EQUIPMENT".

##### 2.1.5 Other Requirements

Refer to Division 1 for other requirements relating to materials and equipment.

### 3. EXECUTION:

#### 3.1 General

3.1.1 Provide other trades with advance information on locations and sizes of concrete pads, frames, boxes, sleeves and openings needed for the Work. Also provide information and shop drawings necessary to permit trades affected to install their Work properly and without delay.

3.1.2 Prior to submittal of shop drawings, coordinate electrical equipment, particularly motor control equipment and control panels, with all applicable equipment and systems furnished under other Divisions of the Specifications. Special attention shall be called to the requirements of Instrumentation and Controls specified under Division 15. Acknowledge in submittal drawings any designated instrument tag numbers when tag numbers are assigned in drawings or specifications. Acknowledge that coordination of all applicable equipment has been performed.

3.1.3 The electrical system design, including, but not limited to, the type, size and quantity of equipment and components, layout, installation and connections as shown on Plans and/or as indicated in the Specifications, is based on electrical, electro-mechanical and/or electronic equipment supplied by selected manufacturers. If equipment furnished by the Contractor requires a different electrical system than that specified hereinafter or shown on Plans, the Contractor shall make all necessary modifications to the electrical system design, subject to the Department's approval, to provide a complete electrical system ready for successful operation. The costs of making the modifications to the electrical system shall be entirely borne by the Contractor without extra cost to the Department. If equipment furnished by the Contractor necessitates changes to electric, gas and/or telephone utilities' service equipment, or to the Work specified under other Sections of the Specifications, then the cost for making the changes shall also be entirely borne by the Contractor without extra cost to the Department.

3.1.4 Locate all equipment such that they are readily accessible for operation, maintenance, repair and replacement. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place. In general, such equipment is not to be blocked or concealed except where specifically permitted. Do not route conduits across or through access or maintenance space of other equipment. Where equipment is permitted to be concealed, provide approved access door. Where equipment is concealed in fire-resistance rated walls or partitions, provide access doors having same fire-resistance rating as well as partitions in which door is placed.

3.1.5 Where electrical equipment is to be installed in limited space, provide additional drawings (scale - minimum 1/4 in. = 1 ft.) as necessary to show physical and dimensional relationship between electrical equipment and adjacent equipment furnished under other Divisions of the Specifications. Acknowledge locations of adjacent structural or mechanical systems, including ductwork, piping, or equipment accesses. Acknowledge clearances established by all codes and regulations are met or exceeded.

3.1.6 The installation shall be such that its components will function together as workable systems. It shall be complete, with all accessories necessary for its operation, and shall be left with all equipment properly adjusted and in working order. The Work shall be executed in conformity with the best practices and so as to contribute to efficiency of operation, minimum maintenance, accessibility and appearance.

3.1.7 Location of electrical equipment shown on Plans are approximate and are subject to minor changes as directed by and at no extra cost to the Department.

3.1.8 Perform equipment tests as per manufacturer's instructions except where otherwise specified

3.1.9 All wiring for the demolished equipment shall be disconnected and removed from the sources.

### 3.2 Protection of Work

3.2.1 All electrical work, including equipment, fixtures and appurtenances shall be protected from damage until final acceptance. Fixtures and equipment shall be covered to protect against dirt, moisture, paint and the like. The work shall be protected from mechanical injury by appropriate covering or shielding.

3.2.2 Prior to final acceptance, protective measures shall be removed and equipment and items shall be cleaned as required to deliver the installation to the State in clean, undamaged condition.

### 3.3 Clean-Up and Safety

3.3.1 The work site shall be maintained in a clean condition, free of hazards, all in conformance with the requirements of Article 107 of the Standard Specifications. Special care shall be taken to assure that electrical systems are not left in an exposed or otherwise hazardous condition. All electrical boxes, cabinets, pole handholes, etc., which contain wiring, either energized or non-energized, shall be closed or shall have their covers in place and shall be locked when possible, during off-work hours.

### 3.4 Electric Service

3.4.1 Work under this Section shall include all equipment, wiring and appurtenances required for both the complete, operational temporary and permanent electric service.

3.4.2 All electric utility's charges for removing the existing electric service and providing new service to the pump station shall be paid to the utility by the Contractor. The Contractor will be reimbursed the exact amount of these charges under a separate pay item, ELECTRIC SERVICE CONNECTION. For bidding purposes, this item shall be estimated at \$175,000.

3.4.3 The Drawings and Specifications indicate the general nature of work required for electric service. The Contractor shall verify the service requirements, shall ascertain the installation requirements and the items of equipment, wiring, appurtenances being furnished by the utility and shall provide all other material and work required for a complete installation.

3.4.4 Power metering cabinets shall consist of current transformers, potential transformers, and meter socket in a NEMA 3R enclosure. Coordinate the current and potential transformer ratings with the electric utility.

3.4.5 All electric service work must conform to the requirements of the electric utility.

3.4.6 The Contractor shall obtain approval of the electric utility for the electric service and metering prior to installation. Copies of approved documents and drawings shall be submitted to the Engineer for the record prior to installation.

3.4.7 Temporary operation will require that some of the existing electrical equipment be disconnected, relocated and reconnected as temporary systems. The following constraints shall be followed:

The new Com Ed transformers, poles, and service extension shall be installed and connected to the existing Com Ed power poles prior to removal of the existing Com Ed equipment. New equipment shall not be energized.

Conduit from new Com Ed transformers to 5kv switchgear shall be installed prior to removal of the existing Com Ed equipment.

Temporary electrical equipment will be required while the existing Com Ed equipment is being removed and the new 5kv switchgear and medium voltage solid state motor controllers are installed.

Contractor will be responsible for providing two (2) means of power for the existing motor control center while the new electrical equipment is installed via transformers and/or generators. Coordinate location of temporary electrical equipment with Engineer.

If temporary transformers are provided they should meet the following requirements:

2000kva minimum

4.16kv primary and 480v secondary

Provide with fiberglass box pads

If temporary generators are provided they shall meet the following requirements:

2000kw minimum

480v, diesel driven, standby rated

Contractor is responsible for providing all necessary cost and labor for the operation, maintenance, and servicing of the generator, including fuel and refueling.

Generator shall be tested and functional prior to any electric service changes.

Temporary 5kv cables shall be provided from new Com Ed transformers to temporary transformers (if temporary transformers are being provided). Coordinate with Com Ed for terminations of temporary cables on new transformers (if temporary transformers are being provided). Cables shall be sized for 400amps at 4.16kv (if temporary transformers are being provided).

Temporary 480v cables shall be provided from temporary transformers (and/or temporary generators) to existing motor control center. Core drill building wall close to grade for cables. Cables shall be sized for 3200amps at 480v.

Once temporary electrical equipment is in place the following sequence of work shall be followed to switch power from the existing Com Ed equipment to the temporary equipment:

One existing connection to the existing motor control center shall be disconnected while one of the temporary feeds is connected.

The new Com Ed service that has been connected to the existing motor control center shall be energized (if temporary transformers are being provided).

The existing motor control center shall be transferred to the temporary service that has been energized.

The second existing connection to the existing motor control center shall be disconnected while the second temporary feed is connected.

The second new Com Ed service that has been connected to the existing motor control center shall be energized (if temporary transformers are being provided).

The pump station is now on temporary power via the new Com Ed transformers (if temporary transformers are being provided).

The existing Com Ed equipment shall be removed – removals by Com Ed.

Piers shall be installed and the existing electrical room floor shall be jacked up followed by the existing electrical room walls and ceiling being removed and replaced. See drawing G4 for further requirements and constraints.

The new electrical equipment shall be installed. While new equipment is installed the floor shall be core drilled for conduit penetrations. Under floor area shall be excavated to install and connect the conduits penetrating the floor from the 5kv switchgear to the conduits routed from the new Com Ed transformers as well as the ground grid conductors in conduit. Area shall be backfilled with IDOT CLSM.

Once the new electrical equipment is installed power can be extended to the new equipment in the following sequence of work:

New 5kv conductors shall be pulled from the 5kv switchgear to the new Com Ed transformers.

One of the new Com Ed transformers shall be de-energized so the new conductors can be terminated. Coordinate with Com Ed for transformer terminations. Once the new cables are terminated the transformer shall be energized.

The second new Com Ed transformer shall be de-energized so the new conductors can be terminated. Coordinate with Com Ed for transformer terminations. Once the new cables are terminated the transformer shall be energized.

At this time the 5kv switchgear can be energized. The pump station will be still operating on temporary power while pumps are replaced and switched from 480v to 5kv.

The pumps shall be replaced one at a time as described in Section 1A paragraph 1.6.4 below so that there are 7 main pumps available at all times.

Once all main pumps have been switched over to the new electrical system the temporary electrical equipment will no longer be necessary. The following sequence of work shall be followed to remove the temporary equipment:

One of the Com Ed services shall be momentarily de-energized so that the temporary cables can be disconnected from the Com Ed transformer (if temporary transformers are being provided). Coordinate with Com Ed for terminations on transformer. Service shall be energized once temporary cables are disconnected.

The second of the Com Ed services shall be momentarily de-energized so that the second set of temporary cables can be disconnected from the transformers (if temporary transformers are being provided). Coordinate with Com Ed for terminations on transformer. Service shall be energized once temporary cables are disconnected.

Remove existing motor control center and temporary cable feeding it. Patch existing wall to match existing where temporary cables penetrated.

### 3.5 Telephone Service

3.5.1 Work under this Section shall include all equipment, wiring and appurtenances required for complete, operational telephone service and a telephone connection for SCADA system. The telephone service is existing and requires relocation to the new telephone panel as shown on Drawings. The existing telephone wiring inside the pump station shall be removed.

3.5.2 Charges by the telephone utility, if any, shall be paid to the utility by the Contractor under the pay item, PUMP STATION ELECTRICAL WORK. The installation and coordination of charges by the telephone utility shall be referred to Jack Ryder of IDOT Business Services, telephone number (847) 705-4011.

3.5.3 The Drawings and Specifications indicate the general nature of the work required for telephone service. The Contractor shall verify the service requirements, shall ascertain the installation requirements and the items of equipment, wiring and appurtenances being furnished by the utility and shall provide all other material and work required for a complete installation.

3.5.4 All telephone service work must conform to the requirements of the telephone utility.

3.5.5 The Contractor shall obtain approval of the telephone utility for the modification of the telephone wiring. Copies of approved documents and drawings shall be submitted to the Engineer for the record prior to installation

### 3.6 Final Acceptance Inspection

3.6.1 When the work is complete, tested and fully operational, and only after the Record Drawings have been reviewed and accepted by the Engineer, the Contractor shall schedule a Final Acceptance Inspection with the Engineer. The Contractor is cautioned to test for the proper operation of all equipment prior to the final acceptance inspection and to make any corrections necessary to establish proper operation. THE FINAL ACCEPTANCE INSPECTION SHALL NOT BE HELD WHILE FINAL CONNECTIONS AND CHECKS ARE BEING MADE.

3.6.2 The Final Acceptance Inspection shall be made for the complete work at the facility as a whole and shall be as further described in Division 1.

### 3.7 Maintenance

3.7.1 During the course of the construction work and until final acceptance, the Contractor shall be responsible for maintenance and operational integrity of the facility as specified in Division 1.

## 8 Modifications to Existing Facilities:

3.8.1 Modify, remove, or abandon certain parts of the existing electrical installation as shown and as specified herein.

- (a) Disconnect wires and conduit from equipment, including motors, which are to be removed.
- (b) Remove exposed conduit and wire, outlet boxes, devices, and similar items which are no longer required.
- (c) Remove wires from concealed conduit no longer required, cut off the conduit flush with the surface, and fill the ends with grout.
- (d) Install blank plates on abandoned outlet boxes concealed in the structure.
- (e) Break up and remove abandoned underground conduit runs which interfere with construction. Other underground conduit runs may be abandoned in place.

3.8.2 Materials and devices used to modify existing equipment, either for temporary or permanent use, shall be compatible with existing equipment and shall be suitable for the installation. Items shall conform to similar items specified herein, where applicable.

3.8.3 Patch holes and repair damage to existing facilities to the satisfaction of the Engineer.

3.8.4 Certain items of equipment such as motor starters and other reasonably salvageable materials will be retained by the State. Use care in removing such equipment and materials, and deliver them to locations within District 1 as designated by the Engineer. Prior to the removal of any equipment, the Engineer shall be contacted to designate items which are to be salvaged.

3.8.5 Concrete, damaged conduit, and other equipment and materials considered useless by the Engineer shall be removed and disposed of off the site. The bid price for the electrical work shall include an allowance for the salvage value of such materials and equipment.

### 3.9 Electrical Power Systems Studies

#### 3.9.1 Studies

Studies include following:

- Utility Company incoming service lines.
- Main switching station.
- Power transformers.
- Medium voltage switchgear.
- Medium voltage solid state motor controllers.
- Motor control centers.
- Power and lighting distribution panels.
- Cable, wire, and conduit systems.

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



### 3.9.2 Short Circuit Study

Provide complete report with printout data sheets using digital computertype programs as part of study.

Include utilities' short circuit contribution, resistance and reactance components of branch impedances, X/R ratios, base quantities selected, and other source impedances.

Calculate short circuit momentary duty values and interrupting duty values based on assumed 3-ph bolted short circuit at switch gear base medium voltage controller, switchboard, low voltage MCC, distribution panelboard, pertinent branch circuit panel, and other significant locations through system. Include short circuit tabulation of symmetrical fault currents and X/R ratios. List with respective X/R ratio each fault location, total duty on bus, and individual contribution from each connected branch.

### 3.9.3 Equipment Device Evaluation Study

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

### 3.9.4 Equipment Device Coordination Study

Provide protective device coordination study with necessary calculations and logic decisions required to select or check selection of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings. Objective of study to obtain optimum protective and coordination performance from these devices.

Include as part of coordination study, medium and low voltage classes of equipment from utility's incoming line protective device down to and including largest rated device in 480 v MCCs and panelboards. Include phase and ground overcurrent protection as well as settings of other adjustable protective devices.

Draw time-current characteristics of specified protective devices in color on log-log paper or computer printout. Include with plots complete titles, representative one-line diagram and legends, associated Power Company's relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. Indicate types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing in-rush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits, and significant symmetrical and asymmetrical fault currents. Provide coordination plots for phase and ground protective devices on system basis. Provide sufficient number of separate curves to indicate coordination achieved.

Provide separate selection and settings of protective devices in tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings. Tabulate recommended power fuse selection for medium voltage fuses where applied in system.

Notify ENGINEER of discrepancies, problem areas or inadequacies and provide suggested alternate equipment ratings and/or settings.

### 3.9.5 Arc Flash Study

Provide Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70E, "Standard for Electrical Safety in the Workplace", in order to quantify the hazard for selection of personal protective equipment (PPE).

Adjust system design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm<sup>2</sup>. Provide suggested alternate equipment and settings to minimize incident energy levels.

Provide incident energy level (calories/cm<sup>2</sup>) for each equipment location and recommended PPE.

Based on the results of the incident energy study provide and install a warning label (orange <40 cal/cm<sup>2</sup>) or danger label (red > 40 cal/cm<sup>2</sup>) for each piece of equipment. The label must be readable in both indoor and outdoor environments and contain the following information:

- Arc hazard boundary (feet and inches).
- Working distance (feet and inches).
- Arc flash incident energy at the working distance (calories/cm<sup>2</sup>).
- PPE category and description including the glove rating.
- Voltage rating of the equipment.
- Limited approach distance (feet and inches).
- Restricted approach distance (feet and inches).
- Prohibited approach distance (feet and inches).
- Equipment/bus name.
- Date prepared.

Provide one day of arc flash safety training, travel time excluded and at jobsite or classroom designated by OWNER, that contains the requirements referenced in OSHA 1910.269, OSHA 1910 Subpart S and NFPA 70E. Training shall include but not be limited to the following:

- Proper use of the system analysis data.
- Interpretation of hazard labels.
- Selection and utilization of personal protective equipment.
- Safe work practices and procedures.

### 3.9.6 Protective Device Testing, Calibration, and Adjustment

Comply with Section 16A-3.10.

## 3.10 Testing Electrical Systems

### 3.10.1 General

(a) Test Work and equipment installed to ensure proper and safe operation in accordance with intent of Drawings and Specifications.

Check interlocking and automatic control sequences and test operation of safety and protective devices.

Correct defects found by Work of this Section.

Cooperate with Power Company, supplier, and manufacturer representatives in order to achieve proper intended operation of equipment.

Test, adjust, and record operating voltages at each system level before energizing branch circuits.

Transformer taps shall be adjusted to obtain as near as possible nominal system voltage. Where transformer is under utility jurisdiction, obtain services of utility to correct voltage. Replace devices and equipment damaged due to failure to comply with this requirement.

Balance load among feeder conductors at each panelboard, switchboard or substation and reconnect loads as necessary to obtain reasonable load balance on each phase. Electrical unbalance shall not exceed 20%.

### 3.10.2 Switchgear Assemblies

Visual and Mechanical Inspections:

Inspect for physical damage.

Verify equipment supplied and connected in accordance with Specifications.

Inspect for proper alignment, anchorage, and grounding.

Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels.

Key interlock system shall be physically tested to ensure proper function.

Doors, panels, and sections shall be inspected for paint, scratches, and fit.

Mechanical operation of relays, switches, and other devices.

Electrical Tests:

Insulation Resistance Test: Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for 1 min. Test voltage and minimum acceptable values in accordance with Paragraph 3.9.2-C.2.

Test Values:

Bolt torque levels shall be in accordance with manufacturer's instructions.

Insulation resistance test shall be performed in accordance with following:

<b>Insulation Resistance Test Voltage</b>	
<b>Voltage Rating</b>	<b>Test Voltage</b>
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

Values of insulation resistance less than rated kv +1 in megohms shall be investigated and corrected.

### 3.10.3 Motor Control Centers

Visual and Mechanical Inspections:

Inspect for physical damage.

Verify equipment supplied and connected in accordance with Specifications.

Inspect for proper alignment, anchorage, and grounding.

Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels.

Key interlock system shall be physically tested to ensure proper function.

Doors, panels, and sections shall be inspected for paint, scratches, and fit.

Mechanical operation of relays, switches, and other devices.

Electrical Tests:

Insulation Resistance Test: Measure insulation resistance of each bus section phase-to-phase and phase-to-ground for 1 min. Test voltage and minimum acceptable values in accordance with Paragraph 3.9.2-C.2.

Test Values:

Bolt torque levels shall be in accordance with manufacturer's instructions.

Insulation resistance test shall be performed in accordance with following:

<b>Insulation Resistance Test Voltage</b>	
<b>Voltage Rating</b>	<b>Test Voltage</b>
150 – 600 v	1,000 v
601 – 5,000 v	2,500 v
5,001 v and above	5,000 v

Values of insulation resistance less than rated kv +1 in megohms shall be investigated and corrected.

### 3.10.4 Motor Controllers

Visual and Mechanical Inspections: Include following inspections and related work:

Motor Control Device Ratings and Settings: Verify ratings and settings as installed are appropriate for final loads and final system arrangement and parameters. Recommend final protective device ratings and settings where differences found. Use accepted revised ratings or settings to make final system adjustments.

Inspect for defects and physical damage and nameplate compliance with Drawings.

Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's written instructions.

Check tightness of electrical connections of devices with calibrated torque wrench. Use manufacturer's recommended torque values.

Clean devices using manufacturer's approved methods and materials.  
Verify proper fuse types and ratings in fusible devices.

#### Electrical Tests:

Perform following in accordance with manufacturer's written instructions.

Insulation resistance test of motor control devices conducting parts to extent permitted by manufacturer's written instructions. Insulation resistance less than 100 megohms not acceptable.

Use primary current injection to check performance characteristics of motor circuit protectors and for overload relays of controllers for motors 15 hp and larger. Trip characteristics not within manufacturer's published time-current tolerances not acceptable.

Make adjustments for final settings of adjustable trip devices.

Test auxiliary protective features such as loss of phase, phase unbalance, and undervoltage to verify operation.

Check for improper voltages at terminals in controllers having external control wiring when controller disconnect opened. Voltage over 30 v unacceptable.

Correct deficiencies and retest motor control devices. Verify system tests that specified requirements are met.

### 3.10.5 Instrument Transformers

#### Visual and Mechanical Inspection:

Inspect for physical damage and compliance with Drawings.

Check mechanical clearances and proper operations of disconnecting and grounding devices associated with potential transformers.

Verify proper operation of grounding or shorting devices.

#### Electrical tests:

Confirm transformer polarity electrically.

Verify connection at secondary CT leads by driving low current through leads and checking for this current at applicable devices.

Confirm transformer ratio.

Measure insulation resistance of transformer secondary and leads with 500 v megohm meter.

Measure transformer primary insulation with applicable overpotential tests.

Verify connection of secondary PT leads by applying low voltage to leads and checking for this voltage at applicable devices.

### 3.10.6 Metering and Instrumentation

#### Visual and Mechanical Inspection:

Examine devices for broken parts, indication of shipping damage, and wire connection tightness.

Verify meter connections in accordance with single line meter and relay diagram.

#### Electrical Tests:

Calibrate meters at midscale. Calibration instruments shall have precision no more than 50% of instrument being testing.

Calibrate watt-hour meters to 1/2%.

Verify instrument multipliers.

#### 3.10.7 Grounding System

##### Testing:

Subject completed grounding system to megger test at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

Measure ground resistance not less than 2 full days after last trace of precipitation, and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

Perform tests by 2 point method according to Section 9.03 of IEEE 81.

Maximum grounding resistance values are as follows:

Equipment Rated 500 kVA and Less: 10 ohms.

Equipment Rated 500 to 1000 kVA: 5 ohms.

Equipment Rated More than 1000 kVA: 3 ohms.

Unfenced Substations and Pad-Mounted Equipment: 5 ohms.

Manhole Grounds: 10 ohms.

Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

Report: Prepare certified test reports, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

#### 3.10.8 Ground Fault Systems

##### Visual and Mechanical Inspections:

Inspect for physical damage and compliance with Drawings and Specifications.

Inspect neutral main bonding connection to ensure following.

Zero sequence system grounded upstream of sensor.

Ground strap systems grounded through sensing device.

Ground connection made ahead of neutral disconnect link.

Inspect control power transformer to ensure adequate capacity for system.

Manual operate monitor panels (if present) for following:

Trip test.  
No trip test.  
Non-automatic reset.

Record proper operation and test sequence.  
Inspect zero sequence systems for symmetrical alignment of core balance transformers about current carrying conductors.  
Verify ground fault device circuit nameplate identification by actuation observation.  
Pickup and time delay settings shall be set in accordance with settings developed through coordination study and as approved by ENGINEER.

#### Electrical Tests:

Test in accordance with manufacturer's instructions.  
Measure system neutral insulation resistance to ensure no shunt ground paths exist, neutral-ground disconnect link removed, neutral insulation resistance measured, and link replaced.  
Relay pickup current shall be determined by primary injection at sensor and circuit interrupting device operated.  
Relay timing shall be tested by injecting 150% and 300% of pickup current into sensor. Total trip time shall be electrically monitored.  
System operation shall be tested at 55% rated voltage.  
Zone interlock system shall be tested by simultaneous sensor current injective and monitoring blocking function.

#### Test Parameters:

System neutral insulation shall be minimum of 100 ohms, preferably 1 megohm or larger.  
Relay pickup current shall be within 10% of device dial or fixed setting, and in no case greater than 1,200 amp.  
Relay timing shall be in accordance with manufacturer's published time-current characteristic curves, but in no case longer than 1 sec.

### 3.10.9 Transformers – Oil Filled 4,160 – 480/277 V

(a) Tests: Include following minimum inspection and tests according to manufacturer's written instructions. Comply with IEEE C57.12.90 for test methods and data correction factors for liquid-filled units.

Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers for dry-type transformers.  
Inspect bolted electrical connections for tightness according to manufacturer's published torques values or, if not available, those specified in UL 486A and UL 486B.  
Insulation Resistance: Perform megohmmeter tests of primary and secondary windings to winding and winding to ground.

- i. For Windings' Ratings 0 to 600 V: 1000-V, dc minimum test voltage; and 500 megohms for dry-type and 100 megohms for liquid-filled transformers.
- ii. For Windings' Ratings 601 to 5000 V: 2500-V, dc minimum test voltage; and 5000 megohms for dry-type and 1000 megohms for liquid-filled transformers.

iii. For Windings' Ratings 500 to 35,000 V: 5000-V, dc minimum test voltage; and 25,000 megohms for dry-type and 5,000 megohms for liquid-filled transformers.

Duration of each test: 10 minutes.

Temperature Correction: Correct results for test temperature deviation from 20°C standard.

Turns Ratio: Measure between windings at each tap setting. Measured ratios deviating more than 0.5% from calculated or measured ratio for an adjacent coil are not acceptable.

Winding Resistance: Measure for windings at nominal tap setting. Measured resistance deviation of more than 1.0% from that of an adjacent coil are not acceptable.

Liquid-Filled Transformer, Insulation Power-Factor Test: Determine overall dielectric loss and power factor for windings' insulation. Limit test voltage to line-to-ground voltage of windings being tested. Measured values exceeding following are not acceptable.

Oil-Filled Units: 1%.

Silicone-Filled Units: 0.5%.

High-Fire-Point, Hydrocarbon-Filled Units: 1%.

Test failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

### 3.10.10 Circuit Breaker 5 kV

#### (a) Visual and Mechanical Inspections:

1. Inspect for physical damage and compare nameplate data with Drawings and Specifications.

2. Inspect anchorage, alignment, and grounding.

3. Perform mechanical operator and contact alignment tests on breaker and operating mechanism in accordance with manufacturer's instructions.

4. Check tightness of bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions for proper ft-lb levels. Place mark on each tightened bolt to ensure completeness.

5. Check cell fit and element alignment.

#### (b) Electrical Tests:

1. Measure contact resistance.

2. Perform minimum pickup voltage tests on trip and close device.

3. Circuit breaker shall be tripped by operation of each protective device.

4. Perform insulation resistance test pole-to-ground, pole-to-pole, and across open pole.

5. Perform insulation resistance test to 1,000 vdc on control wiring. (Do not megger circuits connected to solid state relays.)

6. Perform Doble power factor test with breakers in open and closed position.

#### (c) Test Values:



1. Contact resistance shall be determined in microohms. Resistance values shall in no case exceed 500 microohms. Consult manufacturer for acceptable range.

2. Power factor and arc chute watts loss must be no greater than manufacturer's allowable value.

3.10.11 Cables (Over 600 V)

(a) Visual and Mechanical Inspections:

- Specifications.
1. Inspect exposed sections for physical damage.
  2. Verify equipment supplied and connected in accordance with manufacturer's minimum allowable bending radius.
  3. Inspect for shield grounding, cable support, and termination.
  4. Visible cable bends shall be checked against IPCEA or manufacturer's minimum allowable bending radius.
  5. Inspect for proper fireproofing in common cable areas.

(b) Electrical Tests:

1. Perform dc hypotential test.

i. Each conductor shall be individually tested with other conductors grounded. Shields shall be grounded.

ii. Terminations shall be properly corona suppressed by guard ring, field reduction sphere or other suitable methods.

iii. dc hypotential shall be applied in at least 8 equal increments until maximum test voltage reached. dc leakage current shall be recorded at each step after constant stabilization time consistent with system charging current decay.

iv. Graphic plot shall be made of leakage current versus voltage at each increment.

v. Test conductor shall be raised to maximum test voltage and held for total of 10 min. Readings of leakage current (Y axis) versus time (X axis) shall be recorded and plotted on 30-sec intervals for first 2 min and every min thereafter.

vi. Conductor test potential shall be reduced to zero and grounds applied for at least 10 min.

vii. Maximum test voltage shall be in accordance with manufacturer's specifications.

2. Perform shield continuity test by ohm meter method. Ohmic value shall be recorded.

(c) Test Values:

1. dc Hypotential Test Results:

i. Step voltage slope shall be reasonably linear.

ii. Absorption slope shall be flat or negative. Slope shall not exhibit positive characteristics.

2. Shield continuity test shall exhibit circuit continuity of shield and conductor.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

**SECTION 16B - BASIC ELECTRICAL MATERIALS AND METHODS**

1. GENERAL:

1.1 Description

1.1.1 Basic materials and methods specified herein shall be incorporated in the work wherever applicable unless specifically indicated otherwise.

1.1.2 The basic materials and methods specified herein are intended to define a minimum standard of quality and workmanship.

1.1.3 Refer to Division 1 for additional requirements.

1.2 Related Sections

1.2.1 Section 3A - Cast-In-Place Concrete.

1.2.2 Section 16A - General Electric Provisions.

1.2.3 Section 16C - Major Electric Equipment.

1.2.4 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.

1.3 References

Codes and Standards referred to in this Section are:

Fed. Spec.  
W-F-408 - Fittings for conduit, metal (rigid thick wall and thin wall)

ASTM B-3 - Specification for soft annealed copper wire

ASTM B-8 - Specification for concentric lay stranded copper conductors, hard medium, hard or soft

ASTM B-33 - Specification for tinned or soft or annealed copper wire for electrical purposes

ASTM B-189 - Specification for lead-coated and lead-alloy-coated soft copper wire for electrical purposes

IEEE 383 - Class 1E electric cables, field splices and connections for nuclear power generating stations, standard for type test for

ASTM D 635 - Test method for rate of burning and/or extent and time of burning of self-supporting plastics in a horizontal position

plastic	Fed. Spec. HH-I-595	-	Insulation tape, electrical, pressure sensitive adhesive,
	Fed. Spec. WC-596	-	Electrical power connectors
	NEMA WD-1-1965	-	General requirements for ac switches
	ANSI C82.2	-	Fluorescent lamp ballasts, methods of measurement of
	Fed. Spec W-P-115	-	Panel, power distribution
	UL 50	-	Cabinets and boxes
switches (600 volt maximum)	NEMA KS1	-	Enclosed and miscellaneous distribution equipment
	UL 1072	-	Medium Voltage Power Cables
	NEMA WC 8 / - ICEA S 68 516	-	Ethylene-Propylene-Rubber-Insulated Wire and Cable
	IEEE 48	-	High-Voltage Alternating-Current Cable Terminations
	IEEE 400	-	Insulation of Shielded Power Cable Systems
IEEE 404	-	-	Extruded and Laminated Dielectric Shielded Cable Jointed Rated 2500 V to 500,000 V
IEEE 592	-	-	Exposed Semiconducting Shields on High-Voltage Cable Joints and Separable Insulated Connectors
UL 486A	-	-	Wire Connectors

#### 1.4 Nameplates

1.4.1 All electrical equipment and appurtenant devices shall be equipped with nameplates having designations corresponding to those on the Drawings or as otherwise directed by the Engineer. This identification requirement shall include items such as motor control centers, starters, circuit breakers, automatic transfer switches, contactors, safety switches, control stations remote from starters, panelboards and all such similar equipment.

1.4.2 Nameplates shall be a laminated composition material, engraved to produce a two color nameplate. Embossed tape labels will not be acceptable. Unless otherwise indicated, nameplates shall be black with white letters.

1.4.3 Nameplates shall not be less than 3/32-inch thick and shall have polished surfaces on both sides and a bevel all around on the front edges. Nameplates for panels and similar equipment shall be not less than 1-1/4 by 5 inches with 1/2-inch high inscriptions. Unless otherwise indicated, other nameplates shall be not less than 3/4 by 2 inches with 3/16-inch high inscriptions.

1.4.4 Nameplates shall be attached with brass or stainless steel screws, or, where screws cannot be used, as otherwise specifically approved by the Engineer. Tapes or other pressure adhesives will not be acceptable.

1.4.5 Nameplates shall be attached to their respective equipment or device whenever space is available. Whenever space is not available, they shall be attached nearby at a location approved by the Engineer.

1.4.6 A list of all nameplates shall be submitted to the Engineer for review and approval before installation.

#### 1.5 Wiring Identification

1.5.1 All wiring shall be identified by means of color coding and wire markers as specified herein. Circuit identification shall include all color coding requirements of the NEC, with particular attention directed to Article 210-5.

1.5.2 All wires, including but not limited to shielded cable for instrumentation and control wiring, shall be identified by a wrap-around type transparent thermoplastic heat bonding film with a pressure sensitive adhesive that provides a self laminating, protective shield over the text or slip-on type heat shrinkable tube, as manufactured by 3M, Raychem, Brady or equal. All types of makers shall be mechanically printed with permanent ink, and heated according to manufacturer's specification for bonding or shrinking the maker in place.

1.5.3 Unless specifically approved by the Engineer, color coding of neutral and ground wires shall be by means of colored insulation, except where bare ground wires are indicated.

1.5.4 Branch circuit wiring smaller than No. 6, from panelboards, for lighting, receptacles and similar loads shall be color coded by means of colored wire insulation. Colors shall be as selected by the Contractor but a sufficient number of colors shall be used such that wiring in common enclosures is clearly differentiated and color combinations of wiring runs are generally not repeated. Care shall be taken in the phasing of combined-neutral circuit runs. Switched legs shall be differentiated from unswitched legs of a circuit.

1.5.5 Control circuit wiring shall be color coded by means of colored wire insulation as follows:

"line": black  
neutral: white  
ground: green  
others: red, or as otherwise indicated on the drawings

1.5.6 Except as otherwise specified herein, wire color coding may be by means of colored insulation or colored tape, applied at each termination, splice and pull box.

1.6 Submittals

1.6.1 Provide shop drawings and product data under provisions of Section 1A.

1.7 Guarantee

1.7.1 Provide guarantee under provisions of Section 1A.

1.8 Basis of Payment

1.8.1 The work shall be paid at the contract lump sum price for PUMP STATION ELECTRICAL WORK which shall be payment in full for the work described herein.

2. PRODUCTS:

2.1 Raceways

2.1.1 General

(a) Unless otherwise indicated, all wiring shall be installed in raceways in an integrated system comprised of raceways, couplings, fittings, hubs, supports and the like and boxes and covers as specified elsewhere herein.

(b) Unless otherwise indicated, raceways shall be rigid steel conduit with threaded fittings and terminations as specified herein.

2.1.2 Rigid Steel Conduit

Rigid steel conduit shall be manufactured to conform to Federal Specification WWC=581, NEC Article 344, ANSI C80.1, and UL labeled.

All surfaces, including factory-made threads shall be hot-dip galvanized after threading. The galvanized surface shall be protected by a coat of zinc chromate. Factory threads shall be protected by plastic and caps. Field cut threads shall be coated with galvanizing compound.

2.1.3 Flexible Metal Conduit

(a) Flexible metal conduit shall be liquid-tight flexible metal conduit as defined by NEC Article 348 and shall be UL listed for wet location use.

(b) Flexible metal conduit shall have nylon insulated throats.

(c) Sizes through 1-1/4 inch shall have a built-in copper grounding conductor, UL listed as such.

2.1.4 Rigid Nonmetallic Conduit

(a) Rigid nonmetallic conduit shall be manufactured to conform to Federal Specification WC-1094A, NEMA TC-2 and NEC Article 352 and shall be UL listed for exposed encased and underground applications.

(b) The conduit shall be "Schedule 40".

### 2.1.5 Conduit Fittings

(a) Conduit couplings, elbows and nipples shall conform to the fittings specifications corresponding to their respective conduit specifications.

(b) Locknuts, bushings, reducers, conduit plugs and similar fittings shall be galvanized or cadmium plated and shall conform to Federal Specification W-F-408.

(c) Conduit bodies, such as used for pulling fittings or for avoiding sharp bends shall be hot dip galvanized and shall be complete with covers having self-retaining screws. Unless otherwise indicated, conduit bodies shall be cast iron alloy or malleable iron, with gaskets and matching cast metal or malleable iron covers.

(d) Insulating bushings shall be malleable iron or steel complete with plastic inserts or shall be high impact resistance plastic. They shall be UL listed with a rating not less than 150 degrees C. and they shall be equipped with ground lugs where required.

(e) Conduit hubs which are not integral to a box or fitting shall be malleable iron or stainless steel and shall have nylon-insulated throats, neoprene o-rings, and shall be positively grounded and watertight.

Seal fittings and drain seal fittings shall be used in the hazardous locations as required by NEC.

### 2.1.6 Junction and Pull Boxes

#### (a) General

1) Boxes shall be cast boxes or sheet steel boxes as indicated or specified. Each box shall be complete with a cover of the same type and material as the box except that flush-mounted sheet.

steel boxes for switches and receptacles shall have Type 302 satin finish stainless steel plates. Boxes shall be hot-dip galvanized. Sizes of boxes shall be not less than shown on the Drawings, and shall otherwise conform to NEC requirements as a minimum except that boxes shall not be less than 4-inches square by 2 inches deep. Proper explosion -proof boxes shall be used in hazardous locations.

#### (b) Cast Boxes

1) Cast metal boxes shall be gray-iron alloy free from defects such as voids and shrinkage cracks, complete with covers having neoprene gaskets. Cast aluminum boxes shall not be used.

#### (c) Sheet Steel Boxes

1) Sheet steel boxes 29500 cubic cm (1800 cubic inches) or less shall be code gauge and boxes larger than 29500 cubic cm (1800 cubic inches) shall not be less than 12-gauge for the box and cover.

2) Where permitted below grade elevation or where otherwise indicated on the Contract Drawings, sheet steel boxes shall be fabricated of stainless steel with gasketed stainless steel covers and stainless steel hardware.

3) Sheet steel boxes which are 3-feet by 3-feet by 1-1/2 feet or larger in any dimension shall be reinforced via structural steel support members integral to the box. Covers for boxes of this size or larger shall be equipped with handles for ease of removal and a support lip to hold the weight of the cover during attachment and removal.

4) Sheet steel boxes and covers, where permitted below grade for large pull boxes, shall be hot-dip galvanized after complete fabrication.

#### 2.1.7 Expansion Fittings

(a) Expansion fittings for exposed conduit shall be compatible with the respective conduit run, and, unless otherwise indicated shall permit not less than 4 inches of movement. Each fitting shall be equipped with an external grounding bonding jumper and appropriate clamps. Fitting assemblies shall be asbestos free.

(b) Expansion fittings for conduit embedded in concrete or other masonry shall be of the expansion/deflection type, shall be watertight and corrosion-resistant and shall permit not less than a 3/4-inch movement in any direction. Each fitting shall be equipped with an internal grounding bonding strap.

(c) Expansion fittings for other raceways shall be as indicated or where not indicated shall be suitable for the application as approved by the Engineer.

#### 2.1.8 Conduit Wall Seals

(a) Conduit wall seals shall be used for all conduits entering concrete structure walls.

(b) Conduit wall seals used in new concrete walls shall consist of oversize polyvinyl chloride (PVC) coated steel sleeves with sealing assemblies at both sides of the wall. The sealing assemblies shall be cast iron alloy or malleable iron with pressure rings and neoprene sealing grommets, membrane clamp and they shall be tightened by means of hex head screws. Each wall seal shall accept multiple conduit sizes. The sealing assemblies' castings shall be hot-dip galvanized. The pressure disc shall be PVC coated stainless steel and the bolts shall be stainless steel.

Existing concrete walls shall be core-drilled for conduits to pass through. Conduit wall seals used in cored holes in existing concrete shall consists of an assembly of an oversize outside pressure disc with membrane clamp, a neoprene sealing ring and an interior pressure disc, with discs tightened by means of not less than three stainless steel socket head cup tighten screws with stainless steel washers. Pressure discs shall be PVC-coated steel.

#### 2.2 Wire and Cable

### 2.2.1 General

(a) The terms wire and cable as used herein and on the Drawings shall be interchangeable and shall refer to electric wire and cable conductors in conformance with the NEC.

(b) Unless otherwise indicated, all wire and cable shall be insulated conductors as defined by the NEC.

(c) Wire and cable shall be UL listed, new, and delivered to the site in full reels or boxes. The reels or boxes shall have tags or imprint showing the UL listing.

(d) No wire size smaller than No. 12 AWG shall be used unless specifically shown.

(e) Fixture wire, for branch circuit taps to lighting fixtures, shall be in conformance with NEC requirements. Temperature ratings shall be carefully coordinated with the respective lighting fixtures.

(f) Unless otherwise indicated, wire and cable shall be single conductor.

### 2.2.2 Conductors

(a) Unless otherwise specifically indicated all wire and cable shall have copper conductors conforming to ASTM B-3 or ASTM B-8 with Class B stranding.

(b) Conductors which are No. 8 AWG and larger shall be stranded.

Conductors smaller than No. 8 AWG may be solid or stranded.

(c) Conductors sized No. 8 AWG and larger shall be coated in accordance with ASTM B-33 or B-189.

### 2.2.3 Insulation

(a) Wire and cable insulation shall be suitable for the conditions of the installation and the voltage of the respective system and, unless otherwise specifically specified, all wire and cable for system operating at 480 volts or less shall be insulated for 600 volts AC and shall be rated at not less than 90 degrees C dry and 75 degrees wet.

(b) All 600-volt wire and cable sized No. 8 AWG and larger shall be UL listed as Type USE and RHH and RHW, VW-1, with insulation of heat and moisture ethylene-propylene rubber (EPR) resistant compound.

(c) All 600-volt wire and cable smaller than No. 8 AWG shall be UL listed as Type THW or THWN, with insulation of heat and moisture resistant polyvinyl chloride (PVC) thermoplastic and a nylon jacket or Type XHHW with insulation of cross-linked polyethylene compound, except that all such wiring on the project shall be of the same type.



#### 2.2.4 Signal Cables

(a) Signal cable (SC) shall be 2-conductor, 3-conductor or multiple assemblies of pairs or triads as indicated, and shall be UL listed Type TC cable rated not less than 600 volts AC and 90 degrees C.

(b) Conductors shall be soft annealed copper, 18 AWG minimum, with 7-strand Class B stranding in conformance with ASTM B-8.

(c) Pairs (2/C) or triad (3/C) cables shall be an assembly of left hand lay twisted insulated conductors, tinned copper drain wire, an overlapped conductive tape shield and a jacket overall. Conductor insulation and jacket shall be flame-retardant ethylene tetrafluoroethylene compound. The cable shall meet the requirements of IEEE Standard 383 and shall be rated non-burning under ASTM D635. Conductor

(d) Multiple-pair or multiple triad cable shall be an assembly of individual conductor groups consisting of insulated pairs or triads plus a copper drain wire covered with an overlapped conductive tape shield bound together with an overlapped conductive shield, a drain wire and rip cord and a jacket overall. Conductor insulation shall be heat and moisture-resistant thermoplastic not less than 15 mils thick with a minimum 4-mil nylon jacket, having a UL listed temperature rating not less than 90 degrees C. Conductor insulation shall be color coded to differentiate individual conductors as well as conductor groups.

#### 2.2.5 Telephone Cable

(a) Telephone cable shall be standard multi-conductor, single line telephone cable meeting or exceeding the requirements of the local telephone utility.

#### 2.3 Electrical Tape

2.3.1 Electrical tape shall be UL listed all weather vinyl plastic tape which is resistant to abrasion, puncture, flame, oil, acids, alkalis and weathering. It shall conform to Federal Specification HH-I-595. Thickness shall not be less than 8.5 mils and width shall not be less than 3/4-inch.

#### 2.4 Grounding

2.4.1 All electrical systems, equipment and appurtenances shall be properly grounded in strict conformance with the NEC, even though every detail of the requirements is not specified or shown. Good ground continuity throughout the electrical raceway system shall be assured. Where connections are made to painted surfaces, the paint shall be scraped to fully expose metal at the connection point and serrated connectors or washers shall be used.

2.4.2 Unless otherwise indicated, grounding conductors shall be copper and shall be insulated for 600 volts.

2.4.3 Unless otherwise indicated, ground rods shall be copper-clad steel rods not less than 1-inch in diameter and 10 feet long, driven so that tops of the rods are 24 inch below finished grade.

Where indicated, ground wells shall be included to permit access to the rod connections.

2.4.4 Unless otherwise indicated, all connections to ground rods, structural steel or fencing shall be made with exothermic welds. Where such connections are made to insulated conductors, the connection shall be wrapped with at least 4 layers of electrical tape extended 6-inches onto the conductor insulation.

2.4.5 Where a ground field of "made" electrodes is provided, the exact locations of the rods shall be documented by dimensioned drawings as part of the Record Drawings.

2.4.6 The grounding system shall be fully tested. This testing shall include continuity tests of all equipment grounding and a test of the system ground via measurements using a suitable bridge or by other means approved by the Engineer.

## 2.5 Receptacles

2.5.1 Duplex convenience receptacles shall be premium specification grade with wide heavy wrap-around support bridge, large deep-slot terminal screws which permit back or side wiring, heavy-walled area body and ground terminal lug. They shall conform to Federal Specification W-C-596 Style X2 and NEMA Standard WD-1-1965. Unless otherwise indicated they shall be brown, 2-pole, 3-wire, NEMA configuration 5-20R, 20-ampere, 125 volt.

2.5.2 Provide factory sealed explosion-proof convenience receptacles UL listed as suitable for Class I, Division 1, Group D installations, conforming to UL 1010 and UL 884, with malleable iron single gang box, 3/4-inch hubs and copper free aluminum housing and cover, 125 Volt, 20-ampere, 2-pole, 3-wire, in hazardous locations.

2.5.3 Other receptacles shall be as shown on the Drawings.

2.5.4 Receptacles installed outdoors or otherwise exposed to the weather shall be installed with weatherproof while in use covers and shall be of the Ground Fault Circuit Interrupter (GFCI) type, unless otherwise indicated.

2.5.5 Unless otherwise indicated, receptacles shall be installed with their centers 48 inches above the finished floor.

2.5.6 Clock receptacle shall be 3-wire, 15-ampere, 125-volt with hanger and flush stainless steel plate for each clock.

## 2.6 Toggle Switches

2.6.1 Toggle switches shall be premium specification grade with large deep-slot terminal screws, silver cadmium oxide contacts and a rugged molded plastic body. The switches shall conform to Federal Specification W-S-896, Specification Sheet W-S-896/3. Unless otherwise indicated, the switches shall be single pole single throw (SPST), 20-ampere, with brown handles, rated for 120-277 volts AC only.

2.6.2 Toggle switches in locations classified as hazardous shall be factory sealed explosion-proof, dead front type suitable for Class I, Division 1, Group D installation.

2.6.3 Switches installed outdoors or otherwise exposed to the weather shall have NEMA 4 covers. Switches in hazardous locations shall meet the NEC Class I, Division 1, Group D requirements.

2.6.4 Other switches shall be as shown on the Drawings.

2.6.5 Unless otherwise indicated, toggle switches shall be installed with their centers 48 inches above the finished floor.

## 2.7 Lighting Fixtures

2.7.1 Lighting fixtures shall be as indicated on the Drawings and they shall be provided complete with lamps and all necessary fixture wire for connection.

### 2.7.2 Fluorescent Fixtures

(a) Fluorescent fixtures shall have spring-loaded, high quality sockets which will hold lamps in place securely, even under conditions of vibration.

(b) Lenses, shall be virgin acrylic.

(c) Fixtures shall be complete with the frames, flanges, fittings, etc., required for the indicated installation. The fixtures shall be carefully examined for coordination with architectural and structural work.

(d) Fluorescent ballasts shall be Standard Type ballasts as specified herein. Standard Type ballasts shall be UL listed, high power factor Certified Ballast Manufacturers (CBM) certified Class P ballasts with integral thermal protection.

(e) Energy-saving (high efficiency) fluorescent ballasts shall be used. These ballasts shall be of the standard core and coil type (non-electronic) and shall be UL listed, high power factor, Certified Ballast Manufacturers (CBM) Certified Class P Ballasts with integral thermal protection. Ballasts shall be of the manufacturer's series for which the two-lamp F40 size, when tested in accordance with ANSI C82.2, will have listed input watts of not more than 72 watts.

(f) Fluorescent fixtures shall be for operation on a 120 volt supply.

### 2.7.3 High Intensity Discharge (HID) Fixtures

(a) High intensity discharge fixtures shall have porcelain sockets with lamp retaining mechanisms to resist loosening of the lamps from vibration or thermal effects.

(b) HID ballasts shall be of the high power factor type whenever such type is available. The indication of manufacturer's fixture catalog number for a fixture does not supersede this requirement.

Ballasts shall be integral with the respective fixture and shall be suitable for starting at -29 degrees C (-20 degrees F).

Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when fixture is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60% light output.

#### 2.7.4 Installation

(a) Lighting fixtures shall be installed as indicated on the drawings and in accordance with the manufacturer's recommendations.

(b) Pendant (stem mounted) fixtures in non-hazardous locations shall be suspended by rigid stems such as threaded conduit or rods and ball-and-socket type hangers which are rated for the weight to be supported and which will allow the fixtures to hang plumb. Pendant fixtures shall be grounded via a green-insulated grounding conductor extended and connected to the fixed, grounded raceway system. The stem and hanger assembly shall not be assumed to be an adequate ground.

(c) Care shall be exercised in assuring that wiring entering the fixture housing is suitably rated for the fixture temperature. Fixtures shall not be used for through-wiring unless the wiring compartment is UL listed for such use.

#### 2.8 Panelboards

2.8.1 Panelboards shall be in conformance with the NEC shall be UL listed and shall conform to Federal Specification W-P-115b. Panelboards used for service entrance shall be UL listed for use as service entrance equipment.

2.8.2 Panelboards shall be of dead-front construction, providing access to the wiring compartment without exposing bus.

2.8.3 Boxes (tubs) shall be code gauge galvanized steel with ample wiring space and knock-outs all in conformance with UL 50. Fronts shall be code-gauge steel with a hinged door and a cylinder lock. The front shall have a grey finish over a rust inhibitor. The interior of the door shall have a circuit directory in a frame with a clear plastic cover. Boxes and fronts shall be suitable for surface or flush mounting as indicated and where no other indication is made, panels shall be surface mounted.

2.8.4 Unless otherwise indicated, phase bus bars may be copper or aluminum, sized as shown or as required by UL standards, whichever is larger. Neutral shall have a solid bar with a separate connector for each pole of panelboard branch circuit space. Phase bus shall be for bolt-on branch circuit breakers. A ground bar shall be provided for all panels.

2.8.5 Unless otherwise specifically indicated, each panelboard shall be provided with a main breaker sized at the panel bus rating.

2.8.6 Unless otherwise indicated, branch circuits shall be arranged in parallel vertical rows with alternate phasing. Branch circuit protective devices shall be bolted-on circuit breakers unless otherwise indicated and these devices shall be interchangeable and removable without disturbing adjacent devices.

2.8.7 Panelboards operating at 240 volts phase-to-phase or less shall be rated at 240 volts AC with circuit breakers rated at 240 volts AC and, unless otherwise indicated, these circuit breakers shall have UL listed interrupting rating of not less than 22,000 RMS symmetrical amperes at 240 volts.

2.8.8 Unless otherwise indicated, panelboards operating at 480 volts shall be rated at 600 volts and with circuit breakers rated at 480 volts and, unless otherwise indicated, these circuit breakers shall have a UL listed interrupting rating of not less than 25,000 RMS symmetrical amperes.

2.8.9 Circuit breakers shall be molded case type, bolt-on, with trip-free handles and visual trip indicators.

## 2.9 Safety Switches

2.9.1 Safety switches shall be heavy duty type, UL listed as suitable for use as service entrance equipment and shall be in conformance with NEMA Standard KS1-1983 for type HD switches and Federal Specification WS-865c for heavy duty switches. Switches used as service entrance equipment shall have a factory-installed solid neutral and other switches shall have a factory-installed grounding kit unless otherwise indicated.

2.9.2 The switches shall have a quick-make, quick-break mechanism, a full cover interlock to prevent opening the cover with the switch in the closed position and a position-indicating operating handle. The operating handle shall be well insulated from the current carrying parts of the switch.

2.9.3 Unless otherwise indicated, switches shall be rated 600 volts, and when used with UL listed Class R fuses, shall have a UL listed short circuit withstand rating of 200,000 RMS symmetrical amperes.

2.9.4 Unless otherwise indicated, safety switches shall be 3-pole.

2.9.5 Unless otherwise indicated, safety switches shall be 30 ampere.

2.9.6 Unless otherwise indicated, safety switches shall be un-fused. Where fused switches are indicated, they shall be provided complete with UL Class K-5 current limiting fuses.

2.9.7 Unless otherwise indicated, safety switches installed below grade or exposed to the weather shall have NEMA 4 stainless steel enclosures; safety switches installed indoors above grade shall have NEMA 12 enclosures. Safety switches in hazardous locations shall meet the NEC Class I, Division 1, Group D requirements.

## 2.10 Transformers

2.10.1 Unless otherwise indicated, transformers shall be general purpose dry type, 2-winding, of the capacities and voltage indicated.

2.10.2 Transformers 15KVA and below shall be indoor/outdoor type and those above 15KVA shall be indoor type unless otherwise indicated.

2.10.3 Unless otherwise indicated, transformers 3KVA and above shall have not less than four 2-1/2% taps in the high voltage winding, two above and two below rated primary volts.

2.10.4 Transformers shall be UL listed and shall meet all applicable NEMA, ANSI, UL, and IEEE standards.

2.10.5 Unless otherwise indicated, transformers shall have 220 degrees C Class insulation but shall be designed for a maximum temperature rise of 115 degrees C, over an ambient temperature of 40 degrees C.

## 2.11 Manual Motor Starter Switches

2.11.1 Manual motor starter switches shall be complete with melting alloy type thermal overload protection which shall be trip-free and resettable. The exact size of the overload element shall be coordinated for the specific respective motor.

2.11.2 The switches shall be rated not less than 1 horsepower at 115 and 230 volts single phase. The switches shall be single pole unless otherwise indicated.

2.11.3 Where indicated, the switches shall be equipped with a pilot light and/or a hand-off-automatic selector switch.

2.11.4 Unless otherwise indicated, manual motor starting switches located in non-hazardous area shall be equipped with NEMA 4 cast enclosure. Flush mounted switches shall be mounted in the flush box and shall have a suitable flush plate. Switches in hazardous locations shall meet the NEC Class I, Division 1, Group D requirements.

## 2.12 Circuit Breakers

2.12.1 This specification shall apply to all circuit breakers furnished under this Division which are not integral to panelboards or motor control center equipment.

2.12.2 Circuit breakers shall be UL listed, molded case, thermal-magnetic, manually operated circuit breakers of the trip ratings shown or indicated.

2.12.3 Unless otherwise indicated, circuit breakers shall be 3-pole.

2.12.4 Unless otherwise indicated, circuit breakers shall be rated for use on 480 volt circuits.

2.12.5 Multi-pole circuit breakers shall have a common trip and single operating handles. Handles shall be trip free. Circuit breakers in 250 ampere frames and above shall have an adjustable magnetic trip setting.

2.12.6 The circuit breakers shall indicate "ON", "OFF", and "TRIPPED" conditions.

2.12.7 Unless otherwise indicated, circuit breakers shall have a UL listed interrupting rating of not less than 25,000 RMS symmetrical amperes at 480 volts.

2.12.8 Unless otherwise indicated, circuit breakers installed below grade or exposed to the weather shall have NEMA 4 stainless steel enclosures and circuit breakers installed indoors above grade shall have NEMA 12 enclosures. Circuit breakers in hazardous locations shall be in enclosures suitable for Class I, division 1, group D installation. All circuit breakers shall have external position-indicating operating lever handles with padlock provisions.

2.12.9 Where indicated or where required for indicated functions, circuit breakers shall be equipped with accessories such as shunt trips, auxiliary switches, and under voltage release.

## 2.13 Motor Starters

2.13.1 This specification shall apply to all motor starters which are provided under this Division which are not integral to motor control center equipment.

2.13.2 Unless otherwise indicated, motor starters shall be of the combination type with integral motor circuit short circuit protection mounted in a common enclosure with the starter and control components for control of circuit as indicated. Unless otherwise indicated, motor circuit short circuit protection shall be motor circuit protectors. Motor circuit protectors shall be manually operated and shall have a magnetic trip level adjustment. Trip ratings shown on the Drawings are approximate and the trip rating provided shall be as recommended by the device manufacturer for the characteristics of each respective motor. The Contractor shall coordinate device selection with motors provided under other Divisions.

2.13.3 Motor starters shall not be smaller than NEMA Size 1.

2.13.4 As a minimum, each starter shall be equipped with two normally open (N.O.) auxiliary contacts in addition to a starter seal-in (holding) contact. Un-used contacts shall be spare.

2.13.5 Unless otherwise indicated, control circuit shall operate at 120 volts derived from a control transformer integral to the combination starter. The control transformer shall have fused primary and secondary, and shall have sufficient capacity to operate the loads on the control circuit plus no less than 50 volt-amperes extra for future load.

2.13.6 Control Devices shall be as specified elsewhere herein or as indicated on the Drawings.

2.13.7 Unless otherwise indicated, motor starters installed below grade or exposed to the weather shall have NEMA 4 stainless steel enclosures, motor starters installed indoors above grade shall have NEMA 12 enclosures, and motor starters in hazardous locations shall be in enclosures suitable for Class I, Division 1, Group D installation. The starter shall be complete with a position-indicating operating handle, for the short circuit protective device, with handle padlock provisions.

## 2.14 Control Devices

2.14.1 Control devices shall be provided as part of motor starters, and also for control stations remote from motor starters and as otherwise indicated.

2.14.2 Unless otherwise specifically indicated, pushbuttons, selector switches, indicating lights and other control devices shall be of the heavy duty oil tight type.

2.14.3 Contact blocks for pushbuttons and selector switches shall have not less than one double pole double throw (DPDT) contact.

2.14.4 Indicating lights shall have built-in transformers, 6-volt miniature bayonet base incandescent lamps and lenses of the colors indicated. Unless otherwise indicated, indicating lights shall be push-to-test type.

2.14.5 Legend plates shall be provided on all oil tight control devices. Unless otherwise indicated, green indicating lights shall have "RUNNING" legend plates and legend plates for other indicating lights shall be as indicated or as selected by the Engineer.

2.14.6 Unless otherwise indicated, enclosures for control stations (control devices which are remote from motor starters or other equipment) which are located below grade or exposed to the weather shall be NEMA 4 stainless steel, enclosures for control stations located indoors above grade shall be NEMA 12. The enclosures for control stations located in hazardous locations shall be suitable for Class I, Division 1, Group D installation.

#### 2.14.7 Thermostats

(a) Supply air fans and exhaust air fans shall be controlled by 2-position type electric thermostats. When the thermostat senses a temperature 24 degrees C (85 °F) (adjustable) or higher, the thermostat shall energize fan control circuits located in the Motor Control Center. Upon a drop in temperature below 24 degrees C (85 °F), the fans shall stop.

Electric thermostats shall have bimetallic sensing elements and concealed adjustable set point. Electric thermostats shall have field adjustable sensitivity and be furnished with thermometers in stainless steel covers. Electric thermostats located in hazardous area shall be suitable for Class I, Division 1, Group D locations. Electric thermostats located in the Electrical Room shall have NEMA 12 enclosures.

#### 2.14.8 Pressure Switch – Negative Differential (Vacuum) DPS1

Provide a compound range pressure/vacuum switch for activation of Pump Room damper motor DM9. Switch shall be capable of sensing negative pressure in inches of mercury ("Hg) between the pump room and outside ambient conditions.

Unit shall activate a SPDT, snap-action switch.

Set point shall be fully adjustable with external calibration. Set point range shall be such that the noted set point falls between 20 and 80 percent of the adjustable range.

Units shall be diaphragm actuated, ranged for 1.0"WC to 6.0"Hg and shall be subject to over-range protection in either direction up to 150%.

Unit shall be Buna-N diaphragm actuated with zinc alloy connections.



Unit shall have contacts rated at a minimum of 15 amperes, continuous, at 120V ac. Enclosure shall be rated for Class I, Division 1, Group D hazardous classified locations.

Unit shall be; Dwyer, Series A1VS; Whitman Controls, Type P88C-2-C15TB; or equal.

## 2.15 Electric Unit Heaters

### 2.15.1 General

(a) Electric unit heaters with their corresponding thermostats control and mounting brackets shall be provided and installed at the locations shown on the drawing.

Heaters shall be provided with heavy duty magnetic control contactor except shown otherwise on the Plans.

(c) Electric unit heaters shall be the type and have the capacity and electric characteristics indicated. If current other than that indicated is required, transforming devices shall be provided with the unit heaters. Fan motors shall be wired internally to the heater power supply.

(d) Units shall be horizontal type as shown and be UL approved and bear the UL label. Units shall meet all requirements of the NEC.

(e) Heaters shall have automatic reset thermal cutout overheat protection control with bulbs or capillary tubes located in the air stream. Overheat protection controls shall interrupt the heater load supply directly or by independent contactors connected to the thermal cutout only. Integral delay type thermostats or relays shall allow the fans to continue to run after the heating elements are off until the heat is dissipated. Where designated or required, delay thermostats shall prevent the fans from starting until the elements have warmed up.

(f) Heating elements shall be non-glow, metal sheath finned tube type. They are shockproof. Heat radiation fins are corrosion resistant copper clad steel, furnace brazed to the tubular heating elements for good heat transfer.

(g) Unit heaters shall be controlled by wall mounted, snap action thermostats. Thermostats shall have internal sensing elements and thermometers on cover and manually adjustable set points and differentials with a set point range of approximately 4 degrees C (40 degrees F) - 27 degrees C (80 degrees F) and a differential of 2 degrees C (3 degrees F).

(h) Horizontal unit heaters shall be provided with factory made brackets for wall mounting as indicated. Brackets shall be complete with necessary fasteners, bolts, lock washers, cutter pins, and supports.

(i) Adjustable louvers shall be provided on the discharge side to direct air flow. Resistance coils shall be located on the discharge side of fans on horizontal units. Fan motors shall be located out of the air stream and separated from it by separator plates.

(j) Fans shall be broad bladed, non sparking, all aluminum propeller type, with high efficiency and quiet operation, directly connected to motors and dynamically balanced with the motors.

Motors shall be continuous heavy duty, totally enclosed, with sleeves, roller or ball bearings, built-in automatic reset, thermal overload protection, and designed for use with unit heaters. Fans and motors shall be resiliently mounted to prevent vibration and be provided with welded wire, or equal, removable fan guards.

(k) Heating elements and entire units shall be enclosed in steel housing, bonderized and furnished with baked on enamel.

(l) Unit heater shall be installed in accordance with the manufacturer's recommendations.

#### 2.15.2 Unit Heaters in Non-Hazardous Locations (Corrosion Resistant Electric Unit Heaters)

- (a) Manufacturers:
1. Qmark
  2. Ruffneck
  3. Or equal.

Type: Propeller type, washdown corrosion resistant electric unit heater.

Construction: unit casting shall be constructed of stainless steel with stainless steel universal type swivel mounting bracket. Provide with stainless steel louvered air outlet and inlet grille to act as fan guard.

Heating Elements: elements shall be constructed of type 304 stainless steel finned tubular elements with stainless steel fittings forming a water tight seal between elements and junction box. Provide units of voltage and capacities as scheduled.

Fans: fan shall be constructed of epoxy coated aluminum. Provide with motors in accordance with Division 16.

Controls: provide the following control devices prewired to unit:

Power contractor

Fan delay relay: provide fan delay relay to keep unit fan running until all heat is dissipated from the heating elements.

Automatic overtemperature cutout.

NEMA 4X junction box to house built-in controls and elements terminals.

Transformer for 24 volt control circuit.

NEMA 4X wall mounted thermostat.

Factor installed three position switch (On-Off-Fan only)

Pilot light to indicate when heating elements are running (ON).

Accessories: provide unit heaters with the following accessories:

Factory wired disconnect switch provided in accordance with Division 16.

Mounting kit.

#### Unit Heaters In Hazardous Locations (Explosion Proof Electric Unit Heaters)

Manufacturers:

Qmark  
Ruffneck  
Or equal.

Unit Heaters in hazardous area shall meet UL requirements for Class I, Division 1, Group D classification for hazardous locations.

Construction: unit casing shall be constructed of heavy gauge stainless steel epoxy coated steel frame. Provide adjustable louvers allow directional control of air.

Heating Element: Element shall be heavy walled, liquid filled, with three watt density, immersion type copper sheath elements hermetically sealed into the core along with the high limit thermal cut-out. Provide units of voltages and capacities as scheduled.

Heat transfer fluid shall be nontoxic, inhibited, propylene glycol heat transfer fluid and shall provide freeze protection down to -49°F.

Motors: Shall be explosion proof, permanently lubricated, ball bearing type. Provide motors in accordance with Division 16.

Controls: Provide the following control devices prewired to unit.

Power contactor.

Fan Delay Relay: Provide fan delay relay to keep unit fan running until all heat is dissipated from the heating elements.

Automatic overtemperature cutout.

Transformer for 24-volt control circuit.

Wall mounted explosion proof thermostat.

Stainless Steel and aluminum pressure relief valve for over pressure condition.

Factory installed three position switch (On-Off-Fan only)

Pilot light to indicate when heating elements are running (ON).

Accessories: Provide unit heaters with the following accessories as scheduled:

Manufacturer Hanging Mounting Kit, suitable for roof or overhead structure.

Factory wired Explosion proof disconnect switch provided in accordance with Division 16.

## 2.16 Fire Alarm System

2.16.1 Provide a complete fire alarm system for the station. The system shall include a wall mounted control panel, with annunciator back-up. The system shall be supervised and shall generate two isolated SPDT contact outputs for remote connection. One of these outputs shall be wired to the SCADA system and the other to the Pump Station Control Panel.

2.16.2 The system shall be complete with three zones - the control room, the pump room, and the lower levels. Smoke or heat detectors shall be provided as indicated on the Contract Drawings. The smoke detectors shall be of the ionization type.

2.16.3 The system shall have provisions for receiving a non-latching normally open non-function contact (Combustible gas monitor horn relay). The contact closure shall activate the horn/strobes only, the other fire alarm system functions shall not be affected.

2.16.4 Submittal information shall include all necessary wiring diagrams and installation requirements.

2.16.5 The system shall be the product of a single manufacturer having local available service. The system shall be UL listed and Factory Mutual approved.

2.16.6 Horns: Electric-vibrating-polarized type, operating on 24 V dc, with provision for housing operating mechanism behind grille. Horns produce sound-pressure level of 90 dB, measures at 10 ft (3 m) from source.

2.16.7 Visual Alarm Devices: Xenon strobe lights with clear or nominal white polycarbonate lens. Mount lenses on aluminum faceplate. Word "FIRE" is engraved in minimum 1 in. (25 mm) high letters on lens.

Devices have candela reading as stated in NFPA 72.

## 2.17 Intrusion Alarm System

2.17.1 An intrusion alarm system shall be provided as shown on the drawings and specified herein for the purposes of detecting unauthorized entry into the pump station, Control Room and Stairway. An alarm condition shall be sent to the SCADA panel and the pump station control panel.

2.17.2 The system shall consist of magnetic reed switches at the entry doors, a key operated alarm override switch at the main entry door; and a control relay, 120V - 12V transformer, DC power supply with battery and battery charger, alarm buzzer and other appurtenances in the Aegis/Intrusion Alarm Panel specified here-in-after.

2.17.3 The magnetic reed switches shall consist of two elements: the magnet which mounts to the interior face of the door and the magnetically operated reed switch which mounts to the door frame. The switch contacts shall be open when the door is opened and closed when the door is closed.

2.17.4 The override switch shall be weatherproof, shall be suitable for recessed mounting in a masonry wall and shall be secured against unauthorized removal. The switch shall have two contacts; one contact for shutting the door switches, and one contact for connection to the SCADA panel. The switch shall be operated by a special key. The key shall be removable in both positions. The key shall match the Department's existing keying system. Submit sample for approval by the Engineer.

2.17.5 A submittal for the Intrusion Alarm Panel showing the layout of the intrusion alarm system devices and the AEGIS system devices; and wiring shall be provided.

## 2.18 Aegis/Intrusion Alarm Panel

2.18.1 An Aegis/Intrusion Alarm Panel shall be furnished and installed in the pump station as a part of IDOT's system wide Aegis alarm system. The system shall report alarms via telephone lines. The panel shall include the Intrusion Alarm System devices as specified under Section 2.17, an automatic alarm dialer salvaged and relocated from an existing Aegis panel, a low voltage control transformer, surge suppressor and appurtenances in a wall mounting enclosure. The panel components shall match the existing IDOT's Aegis system devices.

2.18.2 The existing Aegis Alarm Panel has an automatic alarm dialer which shall be relocated to the new Aegis/Intrusion Alarm Panel. The existing panel enclosure shall be removed.

2.18.3 The panel shall operate on 120V, 60 Hz input.

## 2.19 Time Switches

2.19.1 Time switches, for the control of lighting or other functions shall be equipped with astronomical dials based on the latitude of the site. The switches may be digital solid state or heavy-duty motor driven. Each switch shall have a reserve power feature to provide continuous operation during loss of power, with not less than 16 hour capacity. The reserve power feature shall not require periodic battery replacement. Output contacts shall be double pole single throw normally open (DPST-NO), unless otherwise indicated and shall be rated not less than 40 amperes per pole at 277 volts. Unless otherwise indicated, switches shall be for operation on 120 volts. Provide a flush NEMA 1 enclosure with a gray finish similar to panelboards.

## 2.20 Electric Motors

2.20.1 This section outlines the requirements for electric motors as specified with equipment furnished under other Divisions.

2.20.2 Provide all submittals, including the following, and as specified in Division 1.

- (a) Provide manufacturer's catalog data for each motor.
- (b) Provide shop drawings for each motor detailing arrangement, wiring, conduit boxes, and motor application.
- (c) Provide certified standard commercial test reports for all motors.

### 2.20.3 Motor Requirements

- (a) Design all polyphase motors for high energy efficiency and high power factor operation.
- (b) Provide motor nameplate horsepower as specified for the driven equipment.

(c) Provide motors to operate continuously over the entire load range of the driven equipment without loading motor in excess of nameplate rating and its specified temperature limit.

(d) Provide squirrel cage induction motors for 1/2 hp and larger operating at 460 volts, 3-phase, 60-hertz (4160 volt, 3-phase, 60-hertz for Main Pumps).

(e) Provide 115-volt, single phase, 60-hertz motors less than 1/2 hp.

(f) Design motors to be suitable for continuous operation with a line voltage variation within  $\pm 10$ -percent of rated voltage.

(g) Rate motors for continuous operation in 40 degrees C ambient.

2.20.4 Provide motors with the following mechanical protection.

(a) Dry, clean and well ventilated areas: Provide totally enclosed, fan-cooled motors.

(b) Wet, damp or dusty areas: Provide totally enclosed, fan-cooled motors with removable drain plug.

(c) Class 1, Division 1 Area: Provide totally enclosed fan-cooled explosion-proof motor.

(d) Submersible Locations: Provide a completely sealed submersible motor suitable for operation in a hazardous location.

2.20.5 Make conduit box NEMA enclosure ratings compatible with motor enclosures.

2.20.6 Provide NEMA Design B, unless otherwise specified with NEMA Class F moisture resistant insulation and NEMA Class B, 80 degrees C temperature rise at rated nameplate load.

2.20.7 Use antifriction ball or roller type bearings at manufacturer's option, unless otherwise specified.

2.20.8 Provide 1.15 service factor unless otherwise specified. Where motors with a 1.0 service factor are furnished, provide motors rated at least 15 percent greater than required brake kilowatts (horsepower).

2.20.9 Provide steady state shaft loading not to exceed 100 percent of full load rating under maximum load, excluding the service factor, unless otherwise specified.

2.20.10 Provide breakdown torque of 200 percent or more of motor full load torque. Provide locked rotor torque of 80 percent or more of motor full load torque.

2.20.11 Provide slide rails and sole plates as required for proper installation.

2.20.12 Provide capacitor or open split phase start, for smaller than 373 watts (1/2 hp) motors unless otherwise specified.

2.20.13 Provide horizontal or vertical squirrel cage induction motors for continuous duty with full voltage starting except as otherwise specified.

2.20.14 Provide high efficiency motors meeting the requirements of NEMA MG1-12.55.

2.20.15 Provide motor winding temperature switches or thermal devices as specified.

## 2.21 Medium Voltage Cable

### 2.21.1 Manufacturers

(a) Cable:

- 1) Kerite Co.
- 2) Okonite Co.
- 3) Cablec Continental Cables Co.

(b) Cable Splicing and Terminating Products and Accessories:

- 1) Electrical Products Division 3M.
- 2) Raychem Corp.

### 2.21.2 Medium Voltage Cable

(a) General: Cable shall be MV-105 single conductor types, with types and sizes as indicated.

(b) Cable: Ethylene propylene rubber (EPR) insulated.

(c) Conductors: Class B stranded, coated or uncoated annealed copper.

(d) Strand Screen: Energy suppression layer concentrically extruded over stranded conductor.

(e) Insulation: Type ethylene propylene rubber (EPR) with insulation thickness corresponding to 133% insulation level in accordance with referenced standard.

(f) Insulation Screen: Outer energy suppression layer concentrically extruded directly over insulation.

(g) Metallic Shielding: Copper shielding tape, helically applied over semiconducting insulation shield or evenly spaced solid copper wires applied concentrically over semiconducting conductor shielding.

- (h) Jacket: Black polyvinyl chloride (PVC) outer jacket.
- (i) Phase Identification: Color coded black, red, and blue field applied colored vinyl tape on outer jacket.
- (j) Cable Voltage Rating: 5 kV phase to phase.
- (k) Cable Temperature Rating:
  - 1) 90°C normal operation.
  - 2) 130°C emergency operation.
  - 3) 250°C short circuit conditions.

### 2.21.3 Splicing and Terminating Products

- (a) Types: Compatible with cable materials.
- (b) Connectors: Compression type as recommended by cable splicing kit manufacturer for application.
- (c) Splicing and Terminating Kits: As recommended by manufacturer in writing for specific sizes, ratings, and configurations of cable conductor, splices, and terminations specified. Kits shall contain components required for complete splice or termination including detailed instructions and shall be product of single manufacturer. Completed splices and terminations shall provide insulation equivalent to insulation class of cable it connects.
- (d) Make splices with standard splicing kits and 1 of following types:
  - 1) Heat shrink splice kit of uniform cross section polymeric construction with outer heat shrink jacket.
  - 2) Premolded, cold shrink rubber, inline splice kit.
- (e) Conductor Terminations, General:
  - 1) Insulation class shall be equivalent to that of cable upon which they are installed. Terminations for shielded cables shall include shield grounding strap. Cable terminations shall include effective moisture seal for end of insulation whether or not this item is included in termination kits. Seal shall be cold shrink rubber sleeve, or heat shrink plastic sleeve as recommended by kit manufacturer. Termination kits shall be performance tested and shall be of following types:
    - 2) Class 1 Termination for Indoor Shielded Cable: Heat shrinkable type with heat shrinkable or cold over roll inner stress control and outer nontracking tubes, multiple molded nontracking skirt modules, and compression type connector.
    - 3) Class 1 Termination for Outdoor Shielded Cable: Modular type, furnished as kit, with stress relieving shield terminator; multiple wet process porcelain, slip on type, prefilled with insulating dielectric; shield ground strap and compression type connector.



#### 2.21.4 Arc Proofing Materials

(a) Tape for first course on metal objects shall be 10 mil thick, corrosion protective, moisture resistant PVC pipe wrapping tape.

(b) Arc proofing tape shall consist of UL listed fireproofing tape. Tape shall be flexible, conformable, intumescent to 0.3 in. thick, and compatible with cable jacket on which used. Tape shall be self extinguishing and shall not support combustion.

(c) Glass cloth tape shall be pressure sensitive adhesive type, 1/2 in. wide.

#### 2.21.5 Fault Indicators

(a) Indicators: Manual reset, fault indicator, arranged to clamp to cable sheath and provide display after cable has faulted. Instrument shall be immune to heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions. Indicators shall have current trip ratings coordinated with circuit requirements.

(b) Resetting Tool: Designed for use with fault indicators. Furnish moisture resistant storage carrying case.

### 2.21 Lighting Contactors

2.21.1 Manufacturer: Square-D Model 8903LXG20V02CR6 or equal.

2.21.2 Description: NEMA ICS 2, magnetic lighting contactor, 100% rated.

2.21.3 Configuration: Mechanically held.

2.21.4 Coil Voltage: 120 volts, 60 Hertz.

2.21.5 Poles: Two.

2.21.6 Contact Rating: 30 amperes.

2.21.7 Enclosure: ANSI/NEMA ICS 6, Type 1.

2.21.8 Accessories:

Selector Switch: ON/OFF/AUTOMATIC

Pushbuttons and Selector Switches: NEMA ICS 2, general duty type.

### 3. EXECUTION:

#### 3.1 Raceway Installation

##### 3.1.1 General

- (a) Except where otherwise indicated or specified, raceways shall be rigid steel conduit.
- (b) No conduit smaller than 3/4-inch diameter trade size shall be used unless specifically indicated. Wherever no conduit size is shown on the Drawings, the conduit size shall be taken to be 3/4-inch diameter.
- (c) Conduit runs shall have no more than 270 degrees of bends (the equivalent of three 90 degree bends) between pull points. Bends shall be long radius type unless specifically approved by the Engineer. Bends may be either factory-made bends or field bends using suitable bending apparatus.
- (d) Wherever possible, conduits shall be installed with a slight pitch to drain to the nearest box or fitting.
- (e) Threaded raceway joints shall be made with a conductive compound applied to the male threads. Threads shall be made to avoid butting and to avoid exposed threads. In no case will running threads be allowed.
- (f) Conduit reducers shall be provided as required for conduit terminations at equipment.
- (g) Unless otherwise indicated, conduits terminating at cast or malleable iron boxes, or in sheet steel boxes below grade shall be terminated in conduit hubs. Hubs may be integral to the box or may be installed separately. Non-integral hubs or integral hubs which do not provide a flared, smooth entry shall not be used where conductors are No. 4 AWG or larger, in compliance with NEC Article 300-4(g), and in these cases two locknuts and an insulating bushing shall be used.
- (h) Threaded conduits terminating at sheet metal boxes or enclosures above grade, or where bushings cannot be brought into firm contact with the box or enclosure or where insulating bushings are required by the NEC, shall terminate with two locknuts and an insulating bushing. Conduit bushings constructed wholly of an insulating material shall not be used to secure a raceway.
- (i) Expansion fittings, as specified herein, shall be installed in all raceway runs crossing structural expansion joints. The structural, architectural and electrical drawings shall be examined to determine complete extent of expansion joints.

### 3.1.2 Exposed Raceways

- (a) Unless otherwise indicated, exposed raceways shall be run straight, parallel to walls and floors except that conduits shall be pitched slightly to drain to the nearest box or fitting wherever possible. Exposed runs shall be grouped together as much as possible.

### 3.1.3 Embedded Raceways

- (a) Raceway runs installed embedded in concrete or masonry shall be installed in a way that will not detract from the structural integrity or watertightness of the structure. The raceways shall be placed in the approximate center of walls, floors, etc. The location of raceways within poured concrete shall be maintained by the use of spacers designed for the purpose. Raceways in poured concrete shall not be in contact with reinforcing steel.

(b) Concrete-tight split couplings may be used in lieu of union type couplings for conduit embedded in poured concrete. The couplings shall be installed tight to assure good metal-to-metal continuity.

(c) Raceways installed below slabs on grade shall be encased in not less than 3-inches of concrete all around. The concrete shall be monolithic with the floor slab and shall be tied to the floor slab with reinforcing steel as per floor slab construction.

### 3.1.4 Underground Raceway Installation

(a) Unless otherwise indicated, conduit runs installed underground shall be rigid non-metallic conduit as specified, encased in concrete. This shall not be taken to include conduit pushed or installed in trench to facilitate wiring of roadway lighting, which shall be as otherwise indicated or specified.

(b) Underground conduit runs for electric utility service entrance cables shall be rigid steel conduit as specified unless specifically required otherwise by the utility.

(c) Underground raceways, encased in concrete, shall have steel reinforcing where installed below roadway or other paved vehicle areas and the reinforcement shall extend not less than 5 feet additional from the edge of pavement unless otherwise indicated. Steel reinforcing shall also be provided where otherwise indicated.

(d) Underground concrete-encased raceways shall be supported on plastic spacers specifically designed for the purpose spaced along the length of the run as recommended by the manufacturer. Spacing between raceways within a common duct bank shall be not less than 2 inches and concrete cover overall shall be not less than 3 inches on all outside faces of the encased run. Care shall be exercised during concrete placement to assure that these are no voids and that spacers are undisturbed so that conduit spacing is maintained.

(e) Unless otherwise indicated, underground raceways shall be installed not less than 36 inches below grade and they shall be pitched to drain to the nearest manhole or handhole as applicable and shall generally be pitched away from structures. Underground raceway runs shall be placed to avoid interference with underground piping and utilities.

(f) Underground raceways entering structures shall be sealed with duct seal or other similar material approved by the Engineer.

(g) Raceways shall be protected from mechanical and corrosion damage during construction. Open ends shall be capped or fitted with plugs. Before cables are installed, raceways shall be cleared of all obstruction, moisture and burrs or rough edges. Conduits which have had mud, dirt or water inside shall be cleaned with a dry swab.

### 3.1.5 Wall Seals

(a) Unless otherwise indicated, conduit wall seals as specified herein shall be provided in all conduit runs penetrating exterior walls below grade. Handholes and manholes shall not have wall seals.

### 3.1.6 Flexible Conduit

- (a) Unless otherwise indicated all flexible conduit shall be liquid-tight flexible metal conduit as specified herein.
- (b) Flexible conduit shall be used for raceway terminations where vibration will be present, such as at motors, limit switches, electric damper motors, solenoid valves and the like and the length of these flexible conduit terminations shall not exceed 3 feet.
- (c) All fittings used with flexible conduit shall be suitable for the conduit in conformance with the conduit manufacturer's requirements.
- (d) Flexible conduits larger than 1-1/4-inch trade size shall be installed complete with an external bare copper grounding conductor complete with suitable terminating fittings at each end.

### 3.1.7 Support of Raceways

- (a) The raceway installation shall include all raceway supports and anchors as required and as specified herein.
- (b) Inserts in poured concrete used for the support of raceways shall be provided under this Division.
- (c) Unless otherwise indicated or specified, surface-mounted conduits shall be held in place by one-hole clamps and clamp backs. Conduits which are mounted to steel beams or columns shall be held in place by suitable beam clamps. Clamps, clamp backs and beam clamps shall be of electroplated malleable iron.
- (d) Other raceways shall be supported by trapeze or other hangers approved by the Engineer. Trapeze hangers shall be hot-dip galvanized steel channels or angle irons with conduits held in place by heavy-duty U-bolts, nuts and lock washers. Trapeze hangers shall be hung using threaded galvanized or stainless steel rods not less than 3/8-inch diameter and appropriate anchors or by other means approved by the Engineer.

Raceways shall be supported from the structure and shall not be supported from piping, ductwork or equipment. The use of wire, chain, perforated straps and hangers designed for the support of piping will not be permitted.

- (f) Fasteners for the support of raceways, for the attachment to the structure shall be as specified herein.
- (g) Spacing of raceway supports shall be in conformance with NEC requirements for the respective type of raceway.

### 3.1.8 Junction and Pull Boxes

- (a) Raceway runs shall include junction boxes and pull boxes indicated on the Drawings and shall also include all junction boxes, pull boxes and conduit fittings required to facilitate the installation.

(b) Unless otherwise indicated, all boxes which are less than 29500 cubic cm (1800 cubic inches) shall be cast boxes.

(c) Boxes installed concealed in masonry walls (not poured concrete) above grade may be sheet steel, square-corner type with suitable matching covers.

(d) Boxes which are exposed to the weather shall be NEMA 4.

(e) Boxes in which multiple devices are installed shall be multi-gang boxes sized such that one gang of box space is allocated for each device.

(f) Boxes which are surface mounted below grade and other boxes, where indicated, shall be mounted on spacers to provide not less than 3/8-inch of space between the box and the wall.

### Submersible Motor Cable Junction Boxes

The power cable for each submersible main pump motor shall be terminated in a purged NEMA 12 steel junction box with Raychem MCK-5 High Voltage Motor connection Kit. The junction box shall be purged by a BEBCO EPS purge panel as specified under Section 16C of the Specifications.

The control cable for each submersible main pump motor shall be terminated in a NEMA 12 steel junction box with terminal blocks. Purging is not required for the box since the control wiring will be terminated on an intrinsically safe device.

The motor cable for each submersible low flow pump shall be terminated in a purged NEMA 12 steel junction box with terminal blocks. A steel plate shall be install in the box to segregate power and control wiring. The junction box shall be purged by a BEBCO EPS purge panel as specified under Section 16C of the Specifications.

## 3.2 Fasteners

3.2.1 Fasteners used to mount conduit supports, panels and other items attached to the structure shall be suitable for the weight supported and shall be compatible with the structure material, i.e. wood screws shall be used for wood, toggle bolts shall be used for hollow masonry, expansion bolts or power-set studs shall be used for solid masonry or concrete and clamps shall be used for structural steel.

3.2.2 Expansion anchors shall not be less than 1/4-inch trade size and shall extend at least 2 inches into the masonry or concrete.

3.2.3 Power-set anchors shall not be less than 1/4-inch trade size and they shall extend at least 1-1/4 inches into masonry or concrete.

## 3.3 Wire and Cable Installation

3.3.1 Wires and cables shall be carefully installed to avoid damage to insulation and cable jackets.

3.3.2 Wire lubricant shall be used when pulling wires into conduits. The lubricant shall be non-injurious to conduits, conductors, insulations or jackets and the lubricant shall be UL listed. Documentation shall be submitted to confirm suitability of the lubricant for the cables used on the project.

3.3.3 Each run of cable shall have sufficient slack.

3.3.4 Where a number of wires are trained through a box, manhole or handhole, they shall be grouped by circuit where applicable and bundled using appropriate cable ties and supported to minimize pressure or strain on cable insulation.

3.3.5 Wire and cable shall not be bent to a radius less than the manufacturer's recommended bending radius, either in permanent placement or during installation.

3.3.6 Cable pulling apparatus shall have no sharp edges or protrusions which could damage cables or raceways.

### 3.4 Splicing Electrical Cables

3.4.1 Splices in electrical cables shall be made with materials which are compatible with conductors, insulations and any jackets of the associated cables.

3.4.2 Unless otherwise indicated, splices shall be made using compression type copper sleeves of the size and configuration required for the splice involved. The sleeves shall be made of tin plated copper and shall be UL listed. The sleeves shall be installed with tools and methods recommended by the sleeve manufacturer.

3.4.3 Splices in branch circuits for interior lighting and receptacles operating at 240 volts or less may be made with screw-on spring pressure connectors (solderless). The connectors shall be suitable for the wire sizes involved. Springs shall be zinc-coated steel and shall be contained in a plastic insulated housing such that the ends of the conductors will not cut through the spring and housing. Splices shall be well made pigtail splices which are mechanically secure before the connector is installed and conductors shall not be exposed beyond the connector skirt.

3.4.4 No splices shall be made in manholes, handholes or other similar locations.

3.4.5 All non-waterproof splices, including screw-on pressure connectors, shall be wrapped with not less than 3 wraps of half-lapped electrical tape.

3.4.6 The power cable for each medium voltage (4.16 KV) submersible pump shall be spliced with Raychem MCK-5 High Voltage Motor connection Kit.

### 3.5 Excavation and Backfill

3.5.1 Excavation and backfill for work under this Division shall be provided under this Division in conformance with Division 2.

### 3.6 Concrete

3.6.1 Concrete for equipment pads, conduit encasement, handholes, manholes and other work under this Division shall be provided under this Division in conformance with Division 3.

### 3.7 Cutting and Patching

3.7.1 All cutting and patching of building materials required for work under this Division shall be provided under this Division.

3.7.2 No structural members shall be removed, cut or otherwise modified without approval of the Engineer and any such work shall be done in a manner as directed by the Engineer.

3.7.3 Cutting and patching shall be performed in a neat and workmanlike manner, consistent with the best practices of the appropriate trade. All patching shall be done in a manner consistent with the building material being patched.

3.7.4 Holes made in concrete shall be made using a suitable core drill. The use of a star drill or air hammer will not be permitted.

3.7.5 In new construction, sleeves, chases, inserts and the like required for work under this Division shall be provided under this Division and the furnishing and placement of these items shall be fully coordinated with the other trades involved so as not to delay the new construction.

### 3.8 Hazardous Areas

3.8.1 The following areas are designed as Class I, Group D, Division 1 hazardous areas as defined by the NEC.

- (a) Wet Well.
- (b) Stair well and all other indoor areas in the Pump Station except the Control Room.

### 3.9 Medium Voltage Cable

#### 3.9.1 Examination

(a) Examine raceways, cable trays, pull boxes, manholes, handholes, junction boxes, and other cable installation locations for cleanliness of raceways, minimum bending radii of cables, and conditions affecting performance of cable. Pull mandrel through raceways to check for suitable conditions. Do not proceed with cable installation until unsatisfactory conditions have been corrected.

#### 3.9.2 Installation, General

(a) Install cable accessory items in accordance with manufacturer's written instructions and as indicated.

### 3.9.3 Installation of Cables

(a) Pull conductors simultaneously where more than 1 cable is indicated in same raceway. Use UL listed and manufacturer approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

(b) Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceways. Do not use rope hitches for pulling attachment to cable.

(c) In manholes, handholes, pull boxes, junction boxes and cable vaults, train cables around walls by longest route from entry to exit and support cables at intervals adequate to prevent sag.

### 3.9.4 Installation of Splices

(a) Provide continuous lengths of cable without splices unless otherwise noted.

### 3.9.5 Installation of Terminations

(a) Install terminations at ends of conductors and seal multiconductor cable ends with standard kits. Conform to manufacturer's written instructions. Comply with classes of terminations indicated.

(b) Tighten electrical connectors and terminals in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

### 3.9.6 Installation of Cable Accessories

(a) Arc Proofing: Arc proof medium voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials except where indicated otherwise. Apply as recommended by manufacturer of arc proofing tape and following:

- 1) Clean cable sheath.
- 2) Wrap metallic cable components with 10 mil pipe wrapping tape.
- 3) Smooth surface contours with electrical insulation putty.
- 4) Apply arc proofing tape in 1/2 lapped layer with coated side toward cable.
- 5) Band arc proofing tape with 1 in. wide bands of half lapped adhesive glass cloth tape 2 in. oc.

(b) Fault Indicators: Install fault indicators on each medium voltage cable.



### 3.9.7 Grounding

(a) Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated connector fittings, and hardware in accordance with manufacturer's written instructions.

### 3.9.8 Field Quality Control

#### (a) Manufacturer's Field Services:

1) Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by OWNER for mandays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of OWNER'S personnel for plant operation. See Section 1A. Include:

i. 1 manday for Instructional Services.

#### 2) Training:

i. Arrange and pay for services of factory authorized service representative to provide demonstration and training of Owner's maintenance personnel in use of fault indicators and separable insulated connectors.

ii. Conduct training in fault analysis, testing, troubleshooting, servicing, and preventive maintenance.

iii. Include both classroom training in system orientation and hands on problem solving and equipment operation.

#### (b) Testing:

1) Test and inspect in accordance with Section 16A.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

## **SECTION 16C - MAJOR ELECTRICAL EQUIPMENT**

### 1. GENERAL:

#### 1.1 Description

1.1.1 Major electrical equipment shall be the items of equipment specified herein.

1.1.2 The manufacturer of each specified item shall provide not less than four (4) hard-cover operation and maintenance manuals for the respective equipment item furnished. The manuals shall contain final, approved shop drawings and product data sheets (including any field additions or modifications), as well as recommended installation, testing, operation and maintenance procedures.

1.1.3 The manufacturer shall provide one set of any special tools, as applicable, required for the maintenance of the equipment, housed in a metal tool box.

1.1.4 Equipment furnished under this section shall be complete with anchor bolts and associated hardware required to anchor equipment to concrete. Anchor bolts and all hardware shall be galvanized steel.

1.1.5 For each specified item, a representative of the manufacturer shall check the installation and submit, to the Engineer, three (3) certified, signed statements, addressed to the Department, that the equipment has been properly installed and is in good working order.

## 1.2 Related Sections

- 1.2.1 Section 3A - Cast-In-Place Concrete.
- 1.2.2 Section 16A - General Electrical Provisions.
- 1.2.3 Section 16B - Basic Electrical Materials and Methods.
- 1.2.4 Section 16D - Supervisory Control and Data Acquisition (SCADA) Equipment.

## 1.3 References

### 1.3.1 Codes and Standards referred to in this Section are:

- (a) NEMA ICS-1 General Standards for Industrial Control and Systems.
- (b) UL 845 Motor Control Centers.
- (c) ISA Standards and Recommended Practices for Instrumentation and Control.
- (d) IEEE C37.04 Rating Structure for AC High Voltage Circuit Breakers
- (e) ANSI C37.06 AC High-Voltage Circuit Breakers
- (f) IEEE C37.20.1 Metal Enclosed Low –Voltage Power Switchgear
- (g) IEEE C57.13 Instrument Transformers
- (h) IEEE C37.90 Relays Associated with Electric Power Apparatus
- (i) NEMA ICS2 Industrial Control and System Controllers, Contractors, and Overload Relays Rated over 600 Volts
- (j) OSHA Regulation 1910.7 Requirements for a National Testing Laboratory

	(k)	NEC/NFPA 70	National Electric Code 2008	
	(l)	NEMA ICS 2-324/325	Medium Voltage Controllers	
Controllers, and Centers	(m)	UL 347	Medium-Voltage AC	Contractors, Control
Cooled, Phase Distribution Transformers	(n)	IEEE C57.12.26	Pad-Mounted	Compartmental-Type, Self- Three-
Integrity	(o)	ANSI C57.12.28	Pad-Mounted	Equipment-Enclosure

#### 1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A.

1.4.2 Submittals of shop drawings and product data shall be particularly detailed and complete. Submittals shall be complete with the manufacturer's guarantee. Piecemeal submittals will be returned without review.

1.4.3 Submittal information shall include schematic diagrams, point-to-point internal wiring diagrams, point-to-point field wiring diagrams, and other necessary diagrams and installation requirements for the motor starters, motor control center, automatic transfer switch, control panel, combustible gas monitor, float control system, fire alarm panel, alarm annunciator panel, intrusion alarm system, SCADA system, medium voltage switchgear, medium voltage transformers, and medium voltage solid state motor controllers, and other components and systems that are interfaced to these systems.

#### 1.5 Guarantee

1.5.1 All electrical equipment shall be guaranteed from all defects of material and workmanship for the manufacturer's standard length of guarantee or for 1 year from the date of final acceptance, which is longer.

#### 1.6 Delivery, Storage and Handling

1.6.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

#### 1.7 Basis of Payment

1.7.1 The major electrical equipment work shall be paid for at the contract lump sum price for PUMP STATION ELECTRICAL WORK which shall be payment in full for the work described herein.

2. PRODUCTS:

2.1 Motor Control Centers

2.1.1 General

(a) Motor control centers shall be free standing assemblies of standardized, components arranged in multi-compartment vertical sections for control of circuits as indicated.

(b) The equipment shall comply with all applicable requirements of ANSI for industrial control apparatus, IEEE Publication No. 15, and NEMA standards for industrial control, Publication No. ICS-1.

(c) Motor control centers shall be designed manufactured and tested in accordance with the provisions of UL procedure 845. The UL label shall be displayed on each vertical section and on individual compartments wherever possible.

(d) Motor control centers shall be NEMA Class I-S, Type B. Enclosures shall be as otherwise specified herein.

(e) Motor control centers shall be the finished product of one manufacturer who shall be the manufacturer of the starters installed within.

(f) Motor control centers shall be complete, including all main and auxiliary bus work, door interlocks, internal wiring and other equipment required for the control and protection of associated circuits.

(g) Motor control centers shall be completely tested at the factory, in accordance with ANSI and NEMA standards, including operating and high potential tests. A record of the tests shall be furnished to the Department prior to delivery of the equipment.

2.1.2 Enclosures

(a) Enclosures shall be dust-tight and drip-proof, with gasketed doors, NEMA 12.

(b) Each vertical section shall be nominally 20 inches wide by 20 inches deep by 90 inches high, except where larger structures are required to accommodate specific equipment.

(c) The equipment shall be dead-front construction, and unless otherwise specifically indicated, all section fronts shall be in line.

(d) Enclosures shall incorporate individual unit compartments as generally indicated on the drawings, separated from each other by means of metal pans, structure walls and baffles, designed and tested to dissipate and limit communication of fault currents. Unless otherwise specifically indicated, structures shall have individual compartments arranged in a manner to accommodate not more than six NEMA size 1 starters in a vertical section.

(e) Each utilized compartment and each usable space unit shall have an individual flush door, a concealed hinge, and captive, spring-loaded quarter-turn fasteners. Each unusable space shall have a matching flush plate attached with machine screws or as otherwise approved by the Engineer. Doors on combination motor starter or overcurrent device units shall have mechanical interlocks, with hidden override, to prevent the doors from being opened unless the respective circuit protective device is in the off position.

(f) Usable space units shall not be less in number and size than indicated on the drawings and each space unit shall be equipped with bus work and rails, sized for the maximum possible future load possible for that space, ready for the future installation of a combination starter or overcurrent device.

(g) Motor control center structures shall have a top horizontal wireway, isolated from the horizontal bus, accessible via removable covers. Adequate top and bottom conduit and cable entry without structural interference shall be part of the motor control center design. Wiring shall be safely accessible without disrupting service.

(h) Each vertical section shall have an individual vertical wireway with a hinged door or doors held closed with captive spring-loaded quarter-turn fasteners. Vertical wireways shall be isolated from the unit compartments.

(i) Unit disconnects (unit overcurrent devices which are for feeders or which are part of combination starters) shall be operable via a separate mechanical operating mechanism which is not part of the device and which is operable with the unit door closed. The operator shall have a position indicating handle and it shall be possible to pad lock the handle in the "on" or "off" position. When the unit door is open, an interlock shall be provided to prevent closing the disconnect. An interlock shall prevent reinsertion of a draw-out unit while its disconnect is in the "on" position.

(j) The manufacturer shall make particular note of the requirements of N.E.C. Article 404-8. Where indicated on the drawings, motor control centers shall be installed on 4-inch high concrete pads. The arrangement of unit compartments and overcurrent device operators within compartments shall keep all operating handles, when in their highest position, no higher than 6.5 feet above the finished floor and this limitation shall take into account concrete pads as applicable.

(k) Unless otherwise specifically indicated, motor control centers shall be fabricated, including bus work, such that future vertical section may be added at either end of each line up.

(l) Each motor control center shall have a steel channel base and shall be complete with end plates to cover base openings at the ends.

(m) Each motor control center shall have shipping splits, coordinated as required to assure ease of building entry and ease of installation. The manufacturer shall assemble the complete line-up at the factory to assure matching of sections and shall appropriately mark and ship all parts and hardware required for re-assembly at the project site.

(n) Motor control centers shall be chemically cleaned and treated to remove all dirt and grease and shall be prepared to assure a good paint finish. Enclosures shall be factory painted inside and outside. The type of paint finish shall be the manufacturer's standard. The colors of the motor control center enclosure shall be the manufacturer's standard internal color and the manufacturer's standard light gray external color.

(o) Each motor control center section, including all auxiliary sections, shall be equipped with 120 volt space heater to minimize condensation. The heaters shall be thermostatically controlled. The heaters shall be energized upon delivery to the site.

### 2.1.3 Busses

(a) Busses shall be bar or tube type. Cables are unacceptable. Unless otherwise indicated all busses shall be tin-plated copper.

(b) Unless otherwise indicated, main horizontal bus shall not be less than 600 amperes.

(c) Vertical bus shall be sized appropriately for the arrangement of circuits but shall not be less than 300 amperes.

(d) A copper ground bus having a cross-sectional area of not less than 0.375 square inches shall extend for the full length of each motor control center. It shall have adequate lugs for the connection of grounding conductors and it shall be bonded to each vertical section. The motor control center shall be grounded to the ground field and the existing building ground cable as shown on Drawings.

(e) All bus work shall be mechanically secure. Buses, insulators and supports shall be rated to withstand a short circuit of not less than 65,000 RMS symmetrical amperes without damage. All bus joints shall be front accessible for ease of maintenance.

(f) For line-ups to be mounted with backs against walls, all bus bolts, etc. shall be completely accessible from the front.

(g) Buses (horizontal and vertical) shall be isolated from unit compartments and wireways and from each other, including phase-to-phase isolation. Locations for stabs for starter units and the like shall be equipped with removable plugs.

### 2.1.4 Motor Starter Units

(a) Unless otherwise indicated motor starters shall be full-voltage non-reversing starters.

(b) Unless otherwise indicated motor starters shall be combination type, complete with motor circuit protector type short circuit overcurrent protective devices as specified herein.

(c) Starters shall be sized for the motor to be connected, but shall not be smaller than NEMA size 1. Starter size shall be carefully coordinated based on the motor characteristics of the motor actually to be connected and the manufacturer's starter ratings.

Where special pumps are involved, horsepower alone may not be sufficient to fully coordinate starter sizing. Horsepower ratings shown on the drawings are approximate.

(d) All full-voltage non-reversing starter units through NEMA size 4 shall be of the draw-out type, complete with guide rails and stab alignment means.

(e) All starter units shall be equipped with pull-apart terminal blocks for control wiring and, for starter units through NEMA size 4, pull-apart terminal blocks shall be provided for power wiring.

(f) Starters shall be electrically operated, electrically held, 3-pole, with arc-extinguishing characteristics and renewable silver-to-silver contacts. Each starter shall have an overload relay assembly with a thermal bimetallic overload element for each phase which shall be sized to the specific motor nameplate load data. Unless otherwise indicated, overload relay shall be resettable via an insulated button on the unit compartment door.

(g) As a minimum, each starter shall be equipped with two normally open (N.O.) auxiliary contacts in addition to a starter seal-in (holding) contact. Additional contacts shall be provided as indicated or required for the control circuits indicated. An auxiliary relay shall be provided where the number of contacts required exceeds the number which can be mounted on the starter. Unused contacts shall be spare.

(h) Unless otherwise indicated, control circuits shall operate at 120 volts derived from a control transformer integral to the combination starter. The control transformer shall have a fused secondary and shall be sized adequately for the starter and all connected control devices but in no case shall the transformer be sized less than 50 volt-amperes over the capacity required to operate the starter. Control transformers shall be NEMA ST-1, dry type, with a temperature rise not exceeding 55 degrees C. above a 40 degrees C. ambient temperature at continuous rated load. Data submitted for approval shall include starter coil load data and total VA rating of control transformers.

(i) Starters shall be complete with control devices as required for the control of circuits as indicated. Control devices shall be as specified herein. Control devices, where indicated, shall be mounted on the unit compartment door and all control devices shall be arranged such that they do not interfere with access to starter wiring. Control device contact blocks shall not separate from the device operator when the compartment door is opened.

(j) Buckets shall be sized to have adequate space for the installation of the moisture/temperature monitoring relay provided by the pump manufacturer where indicated on drawings.

#### 2.1.5 Circuit Protective Devices

(a) Unless otherwise indicated, protective devices for incoming supply and downstream feeder circuits shall be circuit breakers as specified herein.

##### (b) Circuit Breakers

1) Circuit breakers shall be UL listed, molded case, thermal-magnetic, manually operated circuit breakers of the trip ratings shown or indicated.

- 2) Unless otherwise indicated, circuit breakers shall be 3-pole.
- 3) Unless otherwise indicated, circuit breakers shall be rated for use on 480 volt circuits.
- 4) Multi-pole circuit breakers shall have a common trip and single operating handles. Handles shall be trip free. Circuit breakers in 250 ampere frames and above shall have an adjustable magnetic trip setting.
- 5) The circuit breakers shall indicate "ON", "OFF", and "TRIPPED" conditions.
- 6) Circuit breakers rated 600A and larger shall be equipped with electronic trip with adjustable long time, short time and instantaneous trip.
- 7) Incoming line circuit breakers shall be 100% rated, with microprocessor based adjustable LSI trip. No ground fault trip shall be provided.

Unless otherwise indicated, circuit breakers shall have a UL listed interrupting rating of not less than 65,000 RMS symmetrical amperes at 480 volts.

Where indicated or where required for indicated functions, circuit breakers shall be equipped with accessories such as shunt trips, alarm switches, auxiliary switches, and under voltage release.

(c) Unless otherwise indicated, protective devices for use in combination starter units shall be motor circuit protectors as specified herein.

(d) Motor Circuit Protectors

- 1) Motor Circuit protectors shall be manually operated and shall have a magnetic trip level adjustment. Trip ratings shown on the Drawings are approximate and the trip rating provided shall be as recommended by the device manufacturer for the characteristics of each respective motor. The Contractor shall coordinate device selection with motors provided under other Divisions.
- 2) Motor circuit protectors shall be 3-pole, for use on 480 volt circuits, with common trip and with position-indicating handles.
- 3) Motor circuit protectors shall be rated for use within a motor control center having an available fault current of 65,000 RMS symmetrical amperes. In order to meet this requirement, the devices may be equipped with bolt-on fuse type current limiting devices if required.
- 4) Unless otherwise indicated, each motor circuit protector shall be equipped with both an alarm switch to close a contact whenever the breaker is tripped and an auxiliary switch to close a contact whenever the breaker is open. (The auxiliary switch may also close upon trip, but even when so operating, the separate alarm for trip shall also be provided.) Contacts shall be rated not less than 7 amperes.



#### 2.1.6 Control Devices

(a) Unless otherwise specifically indicated, pushbuttons, selector switches, indicating lights and other control devices shall be heavy duty oil tight type.

(b) Contact blocks for pushbuttons and selector switches shall have not less than one double pole double throw (DPDT) contact. Pushbuttons shall be color coded and shall be black for "start" and red for "stop" and as indicated or selected by the Engineer for other functions.

(c) Indicating lights shall have built-in transformers, 6-volt miniature bayonet base incandescent lamps and lenses of the colors indicated. Unless otherwise indicated, indicating lights shall be push-to-test type.

(d) Legend plates shall be provided on all oil tight control devices. Unless otherwise indicated, green indicating lights shall have "RUNNING" legend plates and legend plates for other indicating lights shall be as indicated or as selected by the Engineer.

(e) Where indicated, or where control functions are not possible with oil-tight units, instrument-grade multi-position control switches having pistol-grip handles.

#### (f) Control Relays

Control relays shall be hermetically sealed, with 4 pole Form C, high reliability contacts rated not less than 5 amperes resistive. Provide relaying clips to hold relay in place.

#### (g) Solid State Time Delay Relays

Solid state time delay relays shall be "on-delay" or "off-delay" as indicated or may be of the convertible operation type. The relays shall have the dial range indicated and shall be complete with a permanently wired plug-in base. Where indicated, they shall be suitable for flush panel mounting, and shall then be complete with cycle progress pointer. When not indicated as for flush panel mounting, the relays shall be suitable for internal mounting and they shall then be equipped with retaining clips to keep them secure in their plug-in sockets. They shall have contacts as required for the functions indicated. Unless otherwise indicated, the relays shall be for 120-volt operation.

#### 2.1.7 Meters and Instruments

(a) Unless otherwise indicated, meters and instruments, such as ammeters and voltmeters shall be switchboard type, black on white, approximately 4.5 inches square with 1% accuracy zero adjustment and 250-degree scales. Where scale ranges are not indicated, scales shall be selected such that full scale is adequate for the range of readings possible and nominal expected readings will be at roughly half of full scale.

(b) Ammeters for individual compartments shall be nominally 2.5 inches square or round, analog meters with accuracy of 1% or better, with scale ranges matched to the starter current. Damping shall be appropriate for current. Where indicated, ammeters shall be of the meter relay type with at least one adjustable set point.

Meter cases shall be compatible with motor control center construction specified.

(c) Meter and instrument transfer switches shall be instrument-grade multi-position control switches having pistol-grip handles. Voltmeter selector switches shall be 7-position. Ammeter selector switches shall be 4-position. All switches shall have an off position.

(d) Elapsed time meters shall be approximately 2-1/2 inches square or round, with suitable flush mounting flange, reading in hours and tenths of hours. The meters shall be non-reset type.

(e) Potential transformers and current transformers for meters and instruments shall be fully compatible with associated instrument scales and accuracy. When no other indication is given, 3 potential transformers shall apply for voltage metering and 3 current transformers shall apply for current metering. A single phase current transformer may be used for individual starter compartment ammeters, with the output also suitable for a connection as a single input to the SCADA system. Single phase current transformers shall have 100:5 transformer ratios.

(f) A separate ground fault relay and ground current sensor shall be provided for each incoming line. The relay shall actuate an alarm light and close a dry contact for remote monitoring. The relay shall not be used to trip the incoming breaker.

#### 2.1.8 Automatic Transfer Switches

(a) Automatic transfer switches incorporated in motor control centers shall be as specified elsewhere herein.

#### 2.1.9 Micro Processor Based Metering System (Square-D PM820 or CH DP4000)

The motor control center main line metering system as shown shall be solid-state with LED indicating readout. Metering system shall monitor phase amperes, phase-to-phase voltages, and phase-to-neutral voltages with one percent accuracy. Metering system shall also monitor and indicate megawatts, megavars, power factor, megawatt demand and frequency. In addition, overvoltage/undervoltage, phase loss/ unbalance/reversal protective functions shall also be available and user programmable. Furnish two NO/NC alarms and two NO/NC trip contacts. Fused potential transformers shall be included. Current transformers shall be as shown. Metering system shall be provided with a communications interface. Interface shall implement an integral Ethernet data port with ModBus TCP/IP protocol. System shall have Metering system shall be door mounted.

### 2.2 Automatic Transfer Switches

2.2.1 Automatic transfer switches shall be air break, double throw interrupter type, electrically operated and mechanically held in both the normal and emergency positions. The switch operators shall be single solenoid or single motor operated and shall be momentarily energized by the sources to which the load is transferred. Switches shall be capable of transfer in either direction on 70% of rated voltage.

2.2.2 Transfer time in either direction shall not exceed 0.5 second.

2.2.3 Unless otherwise indicated, the switch shall be rated for 480 volts. The current rating shall be as indicated, as a minimum. Main contacts and main current carrying parts shall be insulated for 600 volts. The rating of the switch shall be a 24-hour continuous rating in a non-ventilated enclosure for all classes of loads including resistance inductive, tungsten lamp and ballast loads. Temperature rise shall conform to NEMA standards.

2.2.4 Main contacts shall be mechanically held in position by the operating linkage without the use of hooks, latches, magnets or springs and the contacts shall be of a silver-tungsten alloy.

2.2.5 Separate arcing contacts, with magnetic blowouts shall be provided. Interlocked molded case circuit breakers or interlocked contactors will not be acceptable.

2.2.6 The number of poles shall be as indicated. Four pole switches shall be equipped with four fully-rated poles, all operating on a common shaft and the short circuit rating of the fourth pole shall be identical to the rating of the main poles.

2.2.7 Not less than two auxiliary contacts, one closed on normal and one closed on emergency, rated not less than 10 amperes at 120 volts, shall be mounted on and actuated by the same shaft as the main contacts. Additional relay contacts, timers, control relays and associated wiring required for the functions indicated shall be front accessible. All wiring shall be tagged with self-sticking or tubular wire markers.

2.2.8 Except for the normal functioning of a programmed neutral position, failure of any component shall not result in a neutral position where both normal and emergency contacts remain open. Also, the failure of any component shall not result in a condition where both normal and emergency contacts are closed, or attempt to close at the same time.

2.2.9 Unless otherwise indicated, transfer switches shall be without integral and overcurrent or short circuit protection.

2.2.10 Switch components shall be easily maintainable from the front without removal of the switch from its enclosure and without disconnecting the main power cable. Adequate safety baffles and barriers shall be provided and all components shall be clearly identified.

#### 2.2.11 Manual Operator

(a) Each transfer switch shall be equipped with a manual operator. The manual operator shall operate the switch in the same transfer time as normal electric operator transfer. Interlocking shall be provided to prevent electric operation of the switch when the manual operator is used. The manual operator shall be arranged to provide adequate shielding and protection from live electrical parts for operating personnel.

#### 2.2.12 Withstand Rating, Tests and Certifications

(a) Transfer switches for 480 volt circuits shall have a withstand rating of not less than 50,000 RMS symmetrical amperes at 20% power factor for a duration of 3 cycles at 480 volts without contact separation or damage.

(b) In addition, they shall have a UL Standard 1008 listed withstand and closing rating, at 480 volts, when coordinated with molded case circuit breakers, of not less than 85,000 RMS symmetrical amperes.

(c) Product data submitted for approval shall include copies of a report from an independent testing laboratory which documents that identical switches have met the requirements of UL Standard 1008 for the specified ratings. In addition, the data shall include certified copies of test documentation of the 3-cycle withstand requirements specified herein.

(d) Also, the manufacturer shall document and certify that the switch has sufficient arc interrupting capabilities for 50 cycles of operation when operating between a normal and emergency source for the following load:

- 1) 600% of rated current at 0.4 power factor.
- 2) 20% of rated current at 0.4 power factor.

#### 2.2.13 Basic Operation

(a) Operation shall be controlled by voltage sensing relays in each phase of both the normal and emergency sources.

(b) Upon a decrease in voltage on one or more phases of the normal source to roughly 70% of rated voltage, the load shall be transferred to the emergency source, after an emergency transfer, time delay as specified. Upon restoration of voltage to all phases of the normal source to roughly 90% of rated voltage, the load shall be re-transferred to the normal source, after a normal retransfer time delay as specified. If the emergency source fails at any time while connected to the load, the switch shall immediately retransfer to the normal source upon restoration of voltage to the normal source on all phases.

#### 2.2.14 Control Features

Each transfer switch shall include, as a minimum, the following features of control:

- (a) Emergency Transfer Time Delay

This time delay relay shall delay the transfer to the emergency source for a time to allow for momentary outages. This time delay shall be adjustable with a range of roughly 0 to 5 minutes.

- (b) Test Switch

A test switch shall be mounted on the enclosure door to simulate failure of the normal power source.

- (c) Indicating Lights

The switch shall have indicating lights mounted on the enclosure to indicate which position, normal or emergency, the switch is on.

- (d) Normal Source Selector

The transfer switch shall be mounted on the enclosure door to allow either source to be selected as the normal source.

(e) Programmed Neutral Position

The switch operation shall have a programmed, adjustable time neutral position in which neither the normal or emergency sources are connected to the load. The time period shall be adjustable from roughly 0 to 20 seconds to prevent mechanical damage to motors which are running at the time of transfer.

(f) Override Switch

The transfer switch shall have an override switch, mounted on the enclosure door to hold transferred switch in the emergency position regardless of the status of the normal source.

(g) Auxiliary Contacts

An auxiliary contact for each of the following functions:

- 1) A contact closed when source 1 connected (Normal Position).
- 2) A contact closed when source 2 connected (Emergency Position).
- 3) A contact closed when transferred to emergency.
- 4) A contact closed on utility source 1 undervoltage.
- 5) A contact closed on utility source 2 undervoltage.

(h) Normal Retransfer Time Delay

This time delay relay shall delay the retransfer to normal and it shall be adjustable from 0 to 30 minutes.

### 2.2.15 Enclosure

(a) Where indicated, transfer switches shall be installed within motor control centers. Such switches shall be installed at the motor control center manufacturer's factory and shall be an integral part of the motor control center equipment. The depth of the enclosure shall be the same as that of the motor control center and shall not exceed 21 inches.

(b) Where transfer switches in separate enclosures are indicated, those enclosures shall be NEMA 12 unless otherwise indicated.

### 2.2.16 Instructional Data/Material

(a) Not less than 4 full sets of hardbound installation and maintenance manuals, complete with any appropriate descriptive literature and any special tools required to service transfer switches shall be provided. Where more than one size is provided, the material shall address each size and shall be clearly delineated.

The material so furnished shall include complete wiring diagrams.

(b) Plastic-laminated step-by-step operating and test procedures, complete with schematic wiring diagrams shall be permanently attached to automatic transfer switch enclosures.

## 2.3 Control Panel (027-CP-1)

### 2.3.1 General

A control panel shall be provided for pump system control, monitoring and local alarming.

The panel shall be equipped with a complete float type water level control system integrated as depicted on the drawings and as specified.

The panel shall be equipped with a complete combustible gas detection system integrated as depicted on the drawings and as specified.

The panel shall serve as an enclosure for all hard-wired pump control and duty cycle selection circuitry. The panel shall select duty cycle status for the eight Main Pumps and two Low Flow Pumps. In the event of a SCADA Panel (027-SP-1) failure or bubbler level system failure, panel 027-CP-1 shall act as a hard-wired backup level controller by virtue of the float level control system.

The panel shall be hardwired to 027-SP-1 and shall pass monitoring parameters as depicted on the drawings.

The panel shall match the general construction of the motor control center and shall be of the same height.

The panel shall conform to all applicable standards of NEMA and ANSI and shall consist of a formed steel panel containing equipment and devices as indicated.

The panel shall be equipped with a space heater as specified for motor control centers.

### 2.3.2 Enclosure

(a) The enclosure shall be NEMA 12, of a height and depth to match the motor control center and of a width sufficient for the equipment to be housed.

(b) The panel shall have a full piano hinge door and a 3-point latch with a locking handle. The handle shall have a cylinder type lock keyed to match the Department's system. The door for the Control Panel shall have a hinged gasketed door with clear polycarbonate window to cover the flush mounted combustible gas monitor.

(c) The enclosure shall be finished inside and out. The finish shall be as specified for the motor control center. Exterior color shall match that for the motor control center, and the interior color shall be white or as otherwise approved by the Engineer.

### 2.3.3 Devices and appurtenances

(a) Unless otherwise indicated, pushbuttons, selector switches, indicating lights, relays, and other devices shall be provided as part of the control panel and shall be as specified for motor control centers. Devices similar to those in the motor control center panel shall be of the same manufacturer.

(b) Where indicated, certain devices shall be furnished under other Sections of the Specifications for installation under this Section. The control panel manufacturer shall coordinate the arrangement and wiring of these devices for a complete finished assembly. Such devices shall be factory installed by the panel manufacturer.

(c) The alarm panel shall be as specified under "Alarm Annunciators".

The float control system circuitry shall be as specified under "Float Control System". The float relays shall be intrinsically safe.

The Combustible Gas Detectors shall be as specified under "Combustible Gas Detection System".

(f) Nameplates shall be as specified in Section 16A. Relays and other devices located inside the panel shall be identified with nameplates.

### 2.3.4 Wiring

(a) Wiring shall be brought to terminal strips near the bottom of enclosures and 10 percent spare terminals shall be provided in each. The identification of terminals shall conform to the schematic diagrams and shall consist of adhesive labels as manufactured by Brady, Thomas, or equal.

## 2.4 Float Control System

2.4.1 The float control system shall include floats, interconnecting integral cable of a length required, and control logic for the functions indicated.

2.4.2 Floats shall consist of sealed mercury switches sealed in stainless steel spherical floats, with integral neoprene jacketed cable.

2.4.3 The system shall be intrinsically safe for installation in the wet well.

2.4.4 The system shall be complete with control logic to provide the contacts for controls and alarm functions indicated.

2.4.5 The system shall be complete with all required mounting hardware and accessories.

2.4.6 The float system shall be complete with mounting arrangement with a stilling well of adequate size, or by other means approved by the Engineer, to forestall the attachment of large sections of ice to the floats during cold weather which could then disturb the system mounting.

The mounting arrangement shall permit easy removal of the floats and easy realignment when replaced. Submit details for approval by the Engineer prior to installation.

## 2.5 Alarm Annunciator

2.5.1 Unless otherwise indicated, alarm annunciator shall be of the Solid State type and shall be configured of dual-alarm modules in an arrangement as indicated on the Drawings or as otherwise directed by the Engineer.

2.5.2 Each module shall be engraved as indicated on the Drawings or as otherwise directed by the Engineer.

2.5.3 The annunciator shall operate in a "Sequence A" flashing mode as follows:

(a) The control logic selectable to incorporate lock-in or non-lock-in alarm activation. Lock-in selection shall maintain alarm status until the alarm has been acknowledged by depressing the acknowledge pushbutton at the annunciator. Non-lock-in selection shall permit alarm status to return to the normal off condition as soon as the alarm input is cleared.

(b)	<u>Condition</u>	<u>Nameplate Status</u>
	Normal	Off
	Alarm	Flashing
	Acknowledge	Steady On
	Normal (clear)	Off
	Lamp Test	Steady On

2.5.4 Each alarm window shall be illuminated with not less than two long-life lamps which shall be easily accessible for replacement.

2.5.5 Each annunciator shall be complete with an integral flasher unit. Alarm logic, such as for the flasher, shall be solid state. The flasher shall not occupy a designated alarm module, i.e., if twelve alarm positions are shown, all shall be useable for alarms.

2.5.6 Unless otherwise indicated, annunciators shall have provisions for an audible alarm and silence upon alarm "acknowledge" condition for possible future addition of an audible alarm.

2.5.7 Unless otherwise indicated, annunciators shall operate from a 120 volt, 60 Hz supply.

2.5.8 Unless otherwise indicated, annunciators shall be flush panel mounted.

2.5.9 Blank alarm module units shall be fully equipped for alarms.

2.5.10 After power failure all alarm output contacts shall remain in the original positions just before the power failure.



2.5.11 For uniformity among stations, alarm annunciators shall be Panalarm Series 90A or approved equal.

## 2.6 Combustible Gas Detection System (Gasoline)

2.6.1 The combustible gas detection system shall be a centralized gas monitoring system capable of continuously monitoring ambient air for gasoline at locations as shown on the drawings, using remote gas sensor/transmitters ('detectors') designed to measure the concentrations of gasoline.

2.6.2 The gas detection system shall measure and display gas concentration. The system shall provide identifiable audible and visual alarms when preset limits are exceeded. Relays for different alarm setpoint levels shall be provided for alarms and ventilation control.

2.6.3 The combustible gas detection system shall be comprised of six (6) field located gas detectors and one (1) centralized monitoring unit. The monitoring unit shall consist of three (3) dual-channel controllers as described below. The detectors shall be the Ultima 'X' Series and the monitoring unit controllers shall be Model 9120. Both detectors and controllers shall be as manufactured by Mine Safety Appliances Company, or approved equal.

2.6.4 The controllers shall be dual-channel, programmable monitoring/readout units. Each shall accept one (1) 4-20mA dc detector input and be equipped with four (4) alarm relay outputs: Warning, Alarm, Failure and Horn. Each controller channel shall be assigned to a detector, allowing for independent monitoring. The detectors shall be capable of being located up to 3000 feet from the controller. Detectors shall receive power from, and send corresponding gas value signals to, the controllers. Each detector shall be mounted in an enclosure suitable for NEC Class I, Division 1, Group C & D hazardous locations. The detectors shall have provisions for mounting to a wall or similar structure.

2.6.5 The combustible gas monitoring unit shall be of the panel mounted type suitable for flush mounting in the door of the Control Panel as shown on drawings. All wiring connections shall be marked with functional designations such that connections can be made without the use of diagrams or tables. All connections must be easily accessible from the rear of the controller. An external pushbutton shall be mounted on the door of the Control Panel for alarm resetting and silencing. All unused channel spaces shall be neatly blanked off.

2.6.6 Alarms and relays at the monitoring unit shall be set for the following levels of gas concentration:

- (a) Gasoline "WARNING" alarm - 20% LEL
- (b) Gasoline "ALARM" - 50% LEL

2.6.7 The combustible gas detectors shall be of the catalytic bead type with 3-wire LDL signal transmitting electronic circuitry designed to monitor the presence of petroleum in ambient air. The transmitter circuit shall produce a 4-9 kHz frequency output signal proportional to 0-100% LDL and shall be equipped with a 3-1/2 digit LCD display. The transmitter circuit shall have real time clock and internal memory for day stamping and logging minimum and maximum gas concentrations.

The sensing element of the detector shall have a 1-year minimum operating life and shall be replaceable without opening the enclosure. A non-intrusive hand-held wireless remote infrared controller unit shall be provided for sensor calibration, clocking setting, Min/Max gas value and date of last calibration display. Installation, set-up, calibration and start-up of the sensor unit shall not require opening of the sensor/transmitter enclosure. The detectors shall be mounted in explosion proof cast aluminum enclosures.

2.6.8 Explosion-proof horns, suitable for Class 1 Division 1 areas, in the Pump Station shall be energized in response to a WARNING or ALARM signal due to high concentrations of gasoline in the monitored space. The ventilation system for the monitored space shall be activated. The horns shall be provided as part of the Combustible Gas Detection System. Horns shall produce a minimum of 95 dB at a distance of 10'.

2.6.9 A calibration test kit for field checking the calibration of the detection system shall be furnished. The kit shall be complete, including a light weight carrying case, dispensing valve, regulator assembly and hose, test coils and necessary cylinder for type of calibrating gas. The test kit shall be stored in an approved cabinet adjacent to and match the air monitor panel.

2.6.10 Spare parts shall be provided for the air monitoring equipment as follows:

One set of fuses, one sensor head assembly and one sensor.

2.6.11 The services of a qualified representative of the manufacturer shall be provided to inspect the installation, make any adjustments, test the equipment, field calibrate the air monitoring equipment upon completion of the installation; after 24 hours of operation and again after one week; and instruct the operating personnel in the operation, calibration and maintenance of the equipment.

## 5KV SWITCHGEAR

### 2.7.1 Submittals

(a) Product Data: For each component, including following:

- 1) Features, characteristics, and ratings of individual circuit breakers.
- 2) Features, characteristics, and ratings of individual interrupter switches.
- 3) Time current characteristic curves for overcurrent protective devices, including circuit breaker trip devices and fusible devices.

(b) Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Include following:

- 1) Nameplate legends.
- 2) Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.

assembly.

- 3) Current ratings of buses.
- 4) Short time and short circuit ratings of switchgear
- 5) Utility company metering provisions.
- 6) Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer installed and field installed wiring.

(c) Test Results:

- 1) Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- 2) Product Test Reports: Indicate compliance of switchgear with requirements.

(d) Miscellaneous:

- 1) Manufacturer field service report.
- 2) Certificates for field testing agency, signed by CONTRACTOR, certifying that agency complies with requirements specified in "Quality Assurance" Article below.

- 3) Report of Field tests and Observations: Certified by testing agency.

- 4) Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where pipe and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

- 5) Product Certificates: Signed by manufacturers of switchgear certifying that products furnished comply with requirements.

(e) Operation and Maintenance Data:

- 1) Submit in accordance with Section 1A.

(f) Submit in accordance with Section 1A.

(g) Approval of equipment specified in this section is contingent upon approval of coordination study specified in Section 16A.

### 2.7.2 Delivery, Storage, and Handling

(a) Deliver in shipping splits that can be moved past obstructions in delivery path.

(b) Store so condensation will not form on or in switchgear.

(c) Apply temporary heat where required to obtain suitable service conditions.

(d) Handle switchgear using factory installed lifting provisions.

(e) Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchgear, including clearances between switchgear and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' switchgear with equal performance characteristics and complying with indicated maximum dimensions may be considered. Dimensions shall be no greater than 27'-0" long x 8'-0" deep x 92" high.

### 2.7.3 Coordination

(a) Coordinate layout and installation of switchgear with other construction.

(b) Coordinate size and location of concrete or mounting bases. Concrete, reinforcement, and formwork requirements are specified in Section 3A.

### 2.7.4 Extra Materials

(a) Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1) Spare Fuses: 3, of each type and rating of fuse used. Include spares for power fuses, potential transformer fuses, control power fuses, and fuses and fusible devices for fused circuit breakers.

2) Spare Indicating Lights: 6, of each type installed.

3) Touchup Paint: 3 containers of paint matching enclosure finish, each 0.5 pint (250 mL).

### 2.7.5 Manufactured Units

(a) Factory assembled and tested.

### 2.7.6 Ratings

(a) System Configuration: Switchgear suitable for application in three phase, 60 Hz, grounded neutral system.

1) System Voltage: 4.16 kV nominal; 4.76 kV maximum.

### 2.7.7 Metal-Clad Circuit Breaker Switchgear

(a) Manufacturers:

1) Square-D Co.

2) Cutler-Hammer/ Westinghouse Electric Corp.

(b) Nominal Interrupting Capacity Class: 250 MVA.

(c) Ratings:

1) Main Bus Continuous: As indicated on drawings.

(d) Vacuum Circuit Breakers: Drawout mounted units using three individual, vacuum sealed contact modules and including following features:

1) Circuit-Breaker Design: Operates at rated voltage to interrupt fault current within its rating within three cycles of trip initiation. For systems with X/R ratio of 17 or less, transient voltage during interruption does not exceed twice rated line-to-ground voltage of system.

2) Contact Wear Indicator: Readily accessible to field maintenance personnel.

3) Spare Auxiliary Contacts: Six minimum. Final number determined by switchgear manufacturer.

4) Operating Mechanism: Electrically charged, mechanically and electrically trip free, stored energy operated.

i. Closing Speed of Moving Contacts: Independent of both control and operator.

ii. Design of Mechanism: Permits manual charging of mechanism and slow closing of contacts for inspection or adjustment.

1) Control Power: 120 V, AC for closing and tripping. The charging time of the motor shall not exceed 6 seconds.

iii. Circuit Breaker Tripping Provisions: Shunt tripping available independent of overcurrent trip.

5) Circuit breaker status annunciator lights:

i. Circuit breaker open.

ii. Circuit breaker closed.

iii. Circuit breaker not available.

(f) Main Breaker Trip Units: The trip unit for main breaker 1 and main breaker 2, shall be capable of communication via Multi-drop serial communication system with a Ethernet interface module to a remote master PLC. The communication shall include display of monitored values, trip/alarm events, remote open/close controls, and waveform capture and display.

(g) Accessory Set: Tools and miscellaneous items required for circuit breaker and switchgear test, inspection, maintenance, and operation. Include extension rails, lifting device, and transport or dockable dolly or mobile lift, and all other items necessary to remove circuit breaker from housing and transport to remote location. Include racking handle to move circuit breaker manually between connected and disconnected positions and secondary test coupler to permit testing of circuit breaker without removal from switchgear. Include relay and meter test plugs.

1) Provide portable mobile circuit breaker lift and necessary accessories for circuit breaker removal and testing at switchgear lineup.

(h) Circuit Breaker Test Cabinet: Separately mounted and containing push buttons for circuit breaker closing and tripping, control relay, fuses, and secondary coupler with cable approximately 9 ft (3 m) long. Include set of secondary devices for operating circuit breaker if removed from switchgear and moved near test cabinet. Include provision for storage of test and maintenance accessories in cabinet.

#### 2.7.8 Fabrication

- (a) Indoor Enclosure: Steel.
- (b) Finish: Manufacturer's standard gray finish over rust inhibiting primer on phosphatizing treated metal surfaces.
- (c) Bus Transition Unit: Arranged to suit bus and adjacent units.
- (d) Incoming Line Unit: Arranged to suit incoming line.
- (e) Outgoing Feeder Units: As indicated.
- (f) Auxiliary Compartments: Arranged to house meters, relays, controls, and auxiliary equipment; isolated from medium voltage components.
- (g) Key Interlocks: Arranged to effect interlocking schemes indicated.
- h) Provisions for Future Key Interlocks: Mountings and hardware required for future installation of locks, where indicated.

#### 2.7.9 Components

- (a) Main Bus: Copper, tin plated.
- (b) Ground Bus: Copper, tin plated; minimum size 1/4 by 2 in. (6 by 50 mm); full length of switchgear.
- (c) Bus Insulation: Covered with flame retardant insulation.
- (d) Instrument Transformers:
  - 1) Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
  - 2) Current Transformers: Ratios; burden and accuracy class suitable for connected relays, meters, and instruments.
- (e) Multifunction Digital Metering Monitor (Square-D CM4250 or CH Power Expert 4000): UL listed or recognized, microprocessor based unit suitable for three or four wire systems and with following features:

1) Inputs from sensors or 5 A current transformer secondaries, and potential terminals rated to 600 V.

2) Switch selectable digital display of following:

a. Phase Currents, Each Phase: Plus or minus 1%.

b. Phase to Phase Voltages, Three Phase: Plus or minus 1%.

c. Phase to Neutral Voltages, Three Phase: Plus or minus 1%.

d. Three Phase Real Power: Plus or minus 2%.

e. Three Phase Reactive Power: Plus or minus 2%.

f. Power Factor: Plus or minus 2%.

g. Frequency: Plus or minus 0.5%.

h. Integrated Demand, with Demand Interval

Selectable from 5 to 60 min: Plus or minus 2%.

i. Accumulated energy, in megawatt hours (joules), plus or minus 2%; stored values unaffected by power outages for up to 72 hrs.

j. Oversample circuits at a minimum of 512 samples per cycle.

3) Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

4) Communications interface: Interface shall implement an integral Ethernet data port using ModBus TCP/IP protocol.

(f) Surge Arresters: Distribution class, metal oxide varistor type. Comply with NEMA LA 1.

1) Install in cable termination compartments and connect in each phase of circuit.

2) Coordinate rating with circuit voltage.

(g) Provision for Future Devices: Equip compartments with rails, mounting brackets, supports, necessary appurtenances, and bus connections.

(h) Control Wiring: Factory installed, complete with bundling, lacing, and protection; and complying with following:

1) Flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2) Size conductors according to NFPA 70 for duty required.

## SPECIAL SWITCHGEAR CONFIGURATIONS

Automatic Transfer Control – Three Breaker Automatic Transfer Control with Two Mains and Normally Open Tie and Normally Open Generator.

Switchgear assembly shall be furnished with an automatic transfer control system for two (2) normally closed mains and one (1) normally open tie and one (1) normally opened generator. The automatic transfer control system shall be located integral to switchgear and shall consist of sensing devices, redundant PLC based transfer controller and auxiliary equipment necessary for automatic transfer operations. Operation shall be such that upon loss of voltage to the line side of a main, that main shall open and then the tie shall close.

The switchgear shall have an equipped generator line breaker for connection to a future generator. The two main breakers, the bus tie breaker and generator breaker shall be interlocked in such a way that each main bus can be fed by any main or generator breaker and that each bus can only be fed by only one main or generator breaker at a time.

The basic sequence of operation based upon two normally energized sources shall be as follows. Normal operation shall be with the main breakers closed and the tie-breaker and generator breaker open. Upon detection of an undervoltage to the line side of a main breaker and after a field adjustable time delay, that main breaker shall open and after an additional field adjustable time delay, the tie breaker shall close restoring power to the affected portion of the facility. Upon restoration of voltage to the line side of the preferred main breaker and after a field adjustable time delay the tie breaker shall open and after a field adjustable time delay the open main breaker shall close. Electrical Interlocking shall prevent paralleling of two sources in manual or automatic mode.

### Transfer Controller Hardware and Functions

The controller shall be a redundant PLC with two controllers, redundant power supplies, analog and digital I/O and a 10" color graphic HMI panel. The PLC shall communicate via Modbus TCP/IP protocol with the Pump Station SCADA system PLC.

The set points shall be field adjustable without the use of special tools. LED lights shall be provided to show: Utility 1 Source Available, Utility 2 Source Available, Utility 1 Source Connected, Utility 2 Source Connected, Generator Source Available, Generator Source Connected, Bus 1 Energized, and Bus 2 Energized.

The HMI shall be configured to resemble the switchgear one-line diagram and display each option as it is functioning. The display shall include actual line-to-line voltage, line frequency and timers. When timers are functioning, the HMI shall display the timer counting down. All set points shall be programmable from the HMI when it is in the program mode. In addition, the HMI shall display date, time and reason of last 16 transfers, set points of timers, voltage pickup and dropout set points. It shall be able to communicate to the SCADA PLC all values and historical data that are displayed locally, and have the capability to change settings.

The Controller shall be programmed to provide the following:

A time delay transfer for the tie breaker to close to ensure the load voltage has decayed before reconnecting to the source from which the load is to be fed (0 seconds to 30 minutes).



A time delay to override a momentary power outage or voltage fluctuation (0 seconds to 300 seconds).

A time delay for transferring from the Utility 1 source to the Utility 2 source (0 seconds to 30 minutes).

A time delay for transferring from the Utility 2 source to the Utility 1 source (0 seconds to 30 minutes).

A Form C relay contact that changes state when the power is available on the Utility 1 source

A Form C relay contact that changes state when the power is available on the Utility 2 source

A Form C relay contact that changes state when the power is available on the standby source.

A preferred source selection (Source 1 or Source 2, or auto). Tie breaker shall be open when both source 1 and source 2 are energized.

Electrical Interlocking shall prevent paralleling of two sources in manual and automatic mode.

Generator programming is not required and will be done in the future. Controller shall have the ability to operate a standby generator.

Two (2) sets of three-phase "line side" voltage transformers (open delta for 5 kV) with primary fuses and secondary supplementary protectors to provide both sensing and control power.

The automatic transfer system shall contain:

Ability to switch between automatic and manual positions.

Ability to have open-close control for manual electrical operation of each controlled breaker. Interlocks shall prevent paralleling two sources in manual mode.

Ability to initiate manual retransfer to source 1 or source 2 when the Transfer Controller is functioning in automatic mode and programmed for manual retransfer.

5 KV Motor Starter Line-up

Summary

(a) Section Includes:

1) Motor controllers for control and protection of 4,200 v, 3 ph, 60 Hz motors.

#### 2.8.2 System Description

(a) Performance Requirements:

1) Nominal Operating Ambient Temperature: 0 – 40°C (32°F to 104°F) with relative humidity of up to 95% (non-condensing).

2) Power: Operate with three-phase AC power at nominal voltage of 4200 VAC, +/- 10%.

3) Starters are designed for operation at 60 Hz (+/- 3Hz) at ambient temperature of 40°C.

(b) Design Criteria:

ITEM	CRITERIA
Horse Power	HP: 550
Power Ratings	500% FLA for 30 sec. 125% continuous
PIV Ratings	4,200 VAC: 12,000V
Starting Torque	0 to 100%
Ramp Time	0 to 60 seconds
Maximum Voltage-Rating	4,620 VAC
Nominal Ratings	4,160 VAC
Standard Insulation Test	4,200 VAC: 13.25 KV
Rated Short Circuit Amps	45 KV BIL
SCR Voltage Drop or Voltage Drop "L" to "T"	3.5 V without bypass/<1 V with bypass
Overall Efficiency	99.7% without bypass/99.94 with bypass
SCR Firing Technique	Hard drive with "picket fence"
Transient Protection	DV/DT circuits/phase
Diagnostic LEDs	Power On CPU Heartbeat Fiber Optic Firing Communication Phase Condition LCD Display
Undervoltage Protection	Adjustable 1% to 40%
Control Input	120 VAC or Dry Contact, 2 or 3 wire
Fault Level as a Fused (E2) Controller (4.6 KV)	NEMA/EEMAC 400 MCA SYM

### 2.8.3 Submittals

(a) Product Data:

- 1) Manufacturer's Product Data sheets.

(b) Shop Drawings:

- 1) Submit opening size and layout in slab for equipment prior to slab pour.
- 2) Elementary schematic diagrams.
- 3) Wiring and interconnection diagrams.
- 4) Frontal elevation and dimension drawings.
- 5) Bill of material listing components.

(c) Test Results:

- 1) Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

switchgear with requirements.

2) Product Test Reports: Indicate compliance of  
3) Each structure shall be suitable for future  
expansion on each end.

4) Each structure shall also have  
non-removable base channel and removable lifting angles for each installation.

(d) Miscellaneous:

1) Manufacturer field service report.

2) Certificates for field testing agency, signed  
by CONTRACTOR, certifying that agency complies with requirements specified in "Quality  
Assurance" Article below.

3) Report of Field tests and Observations:  
Certified by testing agency.

4) Coordination Drawings: Floor plans  
showing dimensioned layout, required working clearances, and required area above and around  
enclosure where pipe and ducts are prohibited. Show enclosure layout and relationships  
between components and adjacent structural and mechanical elements. Show support  
locations, type of support, and weight on each support. Indicate and certify field measurements.

5) Product Certificates: Signed by  
manufacturers of switchgear certifying that products furnished comply with requirements.

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

1) Submit in accordance with Section 1A.

(f) Submit in accordance with Section 1A.

(g) Approval of equipment specified in this section is  
contingent upon approval of coordination study specified in Section 16A.

#### 2.8.4 Quality Assurance

(a) Manufacturer Qualification: Firm experienced in  
manufacturing medium voltage solid state motor control centers similar to that indicated for this  
project and that has a record of successful in-service performance.

(b) Testing Agency Qualifications: In addition to  
requirements specified in Section 16A independent testing agency shall meet OSHA criteria for  
accreditation of testing laboratories, Title 29, Part 1907, or shall be Full-member Company of  
International Electrical Testing Association.

1) Testing Agency's Field Supervisor: Person  
currently certified by International Electrical Testing Association or National Institute for  
Certification in Engineering Technologies, to supervise on-site testing.

(c) Source Limitations: Obtain medium voltage motor  
control center through one source from single manufacturer.

(d) Controllers shall be designed, manufactured, assembled and tested in accordance with NEMA ICS2.

(e) Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL) to extent possible.

1) Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2) Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

(f) Regulatory Requirements:

1) National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

#### 2.8.5 Delivery, Storage, and Handling

(a) Deliver in shipping splits that can be moved past obstructions in delivery path.

(b) Handle equipment to prevent internal components damage, breakage, and denting and scoring enclosure finish, using factory-installed lifting provisions. Do not install damaged equipment.

(c) Store equipment in clean, dry space and protect from dirt, fumes, water, construction debris, and physical damage. Store so condensation will not form on or in switchgear.

(d) Apply temporary heat where required to obtain suitable service conditions.

(e) After installation, protect from damage by Work of other trades.

Product Selection for Restricted Space: Drawings indicate maximum dimensions for solid state starters, including clearances between solid state starters and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' solid state starters with equal performance characteristics and complying with indicated maximum dimensions may be considered. Overall enclosure dimensions shall be no greater than 36" wide x 30" deep x 92" high.

#### 2.8.6 Coordination

(a) Coordinate layout and installation with other construction.

(b) Coordinate size and location of concrete or mounting bases. Concrete, reinforcement, and formwork requirements are specified in Section 3A.

### 2.8.7 Extra Materials

(a) Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1) Spare Fuses: 3, of each type and rating of fuse used. Include spares for power fused, potential transformer fuses, control power fuses, and fuses and fusible devices for fused circuit breakers.

2) Spare Indicating Lights: 6, or each type installed.

3) Touchup Paint: 3 containers of paint matching enclosure finish each 0.5 pint (250 mL).

### 2.8.8 General

(a) Provide Medium Voltage Solid State Motor Controllers where shown on Drawings and as described by frontal elevation drawings, one-line diagrams, and equipment schedules.

### 2.8.9 Enclosure Construction

(a) Enclosure shall be sized to have adequate space for the installation of the moisture/temperature monitoring relay provided by the pump manufacturer.

(b) Construct as Class I controller. Disconnect section shall conform to Class E2 controller.

(c) Basic structure shall consist of formed and bolted back and side plates, minimum 11 ga sheet metal.

1) Doors shall be minimum 11 ga sheet metal, pan type with flanges formed to provide sturdy, rigid structure.

2) Door latches and hinges capable of holding door closed during maximum fault condition.

3) Ventilation openings where required with protective barrier behind them.

4) Provide door interlocks to keep doors from being opened with power applied.

5) Doors shall be hinged to allow 120° swing.

(d) Free standing NEMA-1A gasketed NEMA-1A ventilated with filter elements.

1) Nominally 92 in. high, 36 in. wide, and 30 in. deep.

2) Provide removal lifting provisions.

(e) Finish:

1) Metal parts to be given rust resistant treatment.

- enamel.
- 2) Paint with one coat of ANSI 49 medium grey baked  
plate/bronze chromate process.
- 3) Finish components not painted with zinc
- (f) Enclosure Layout:
- 1) Medium voltage or power section: Locate in  
main body.
- 2) Low voltage section: Locate behind door,  
contains control logic.
- 3) Optically isolate control signals from  
medium voltage signals.
- 4) Load terminals at bottom.
- (g) Provide front accessibility to electrical components.
- (h) Mechanically interlock door of solid state starter  
section to prevent entry until power is removed and isolating means is grounded.

#### 2.8.10 Power and Ground Bus

- (a) Main Bus:
- 1) Locate in back at top of enclosure. Mount in  
common horizontal plane to provide maximum short circuit capability and better heat  
distribution.
- 2) Tin plated copper with ampacities as  
indicated on Drawings.
- 3) Minimum continuous current carrying  
capacity as indicated on Drawings.
- 4) Support on 5 KV fiberglass polyester  
insulators.
- (b) Ground Bus:
- 1) Continuous 1/4 in. by 1 in. bare copper  
along entire length of control line-up.
- 2) Locate in bottom of each vertical section.
- 3) Provide mechanical lugs for ground cables  
shown on Drawings.
- (c) Bus Bracing:
- 1) Brace and test bus bars and cables to  
withstand, without damage or deformation.
- 2) Short circuit ratings are 400 MVA  
symmetrical at 5000 volts defined by NEMA/EEMAC and UL. Conduct tests with short circuit at  
load site of controller and maximum current is limited by current limiting fuse.

(d) Bolted bus joints shall have minimum of 2 bolts. Provide suitable bolt holes to facilitate future extension on either side.

#### 2.8.11 Wiring

(a) Complete with internal power and control wires including terminations for external connections. Phase sequencing shall have proper identification and wires shall have suitable markings at terminations.

(b) Incoming Line: Incoming line section provided with bus connections to horizontal bus.

(c) Connect motor cables requiring stress cones to current transformers or stand off insulators. Provide space for terminating incoming conductors.

(d) Provide space for stress cones.

#### 2.8.12 Medium-Voltage Combination Controller

(a) Main Isolation Switch:

1) Externally operable 3-pole, ganged, load break unit, and provides following features:

a. Isolates power bus compartment from power cell by means of shutter mechanism.

b. Interrupt no-load current of control circuit transformer supplied in controller.

c. In off position, it shall ground normally energized medium voltage power components, bleeding off hazardous stored energy, thus providing safer operation and maintenance.

d. 400 amp rating size.

e. 1 N.O. and 1 N.C. auxiliary contact will be available. EEMAC/NEMA contact rating: AC-A600, DC-P300.

f. It shall remain connected to external operating handle at all times and be fully interlocked with contactor.

g. It shall have provision to be padlocked with up to 3 locks in open position.

(b) Power Fuse Holder:

1) Provide Controller with fixed power fuse holders that are part of power cell.

2) Fuse holders shall be clip-in style with option for bolt-on style.

3) Bolt-on fuse holder design shall allow for multiple fuses per pole (up to 4 per pole) for large hp applications.

(c) Main and Bypass Contactor:

- 1) Vacuum break type, fixed mounted style.
- 2) Current Ratings: 400 ampere.
- 3) Voltage Rating: Up to 4,600 VAC.
- 4) Interlock with main isolating switch, both

electrically and mechanically, providing following safety features:

- a. Prevents opening of medium voltage door when isolating switch is in closed position.
- b. Prevents closing of isolating switch when medium voltage door of controller is open.
- c. Removes power to control circuit when isolating switch is in open position.

(d) Low Voltage Control Panel:

1) Each Controller shall have separate low voltage control compartment, totally isolated from power cell and power bus compartment for increased safety.

2) Panel shall include following features:

- a. Low voltage control devices and metering.
- b. Terminal blocks.
- c. Front accessibility without shutting controller down when opening low voltage panel door.
- d. Allows remote low voltage cable to enter from top or bottom in protective metal, fiberglass or plastic wireways.
- e. 120 VAC test plug with selector switch.

### 2.8.13 Power Fuses

(a). Mount inside enclosure:

- 1) Vertically mount in front for ease of inspection and removal without special tools.
- 2) Current limiting type with 3-ph symmetrical interrupting ratings of 200 MVA at maximum of 2,500 v, and 350 MVA at maximum of 5,000 v.
- 3) Blown-fuse indication.
- 4) Size in accordance with Section 16A coordination study recommendations.

### 2.8.14 Control Power Transformer

(a) Mounted separately in vertical section.

- 1) 120 v secondary with primary and secondary current limiting fuses.



2) Rated at minimum of 500 VA providing 350 VA capacity for loads above requirement of controller.

#### 2.8.15 Interlocking

(a) Mechanical interlocking shall prevent:

- 1) Opening medium voltage compartment door with isolating switch handle in up position and isolating switch closed.
- 2) Closing isolating switch with door open.
- 3) Closing isolating switch with contactor placed in its normal operating position and closed.

#### 2.8.16 Control

(a) Control Power:

- 1) 120 vac from control transformer mounted separately in vertical section.

(b) Fuse control transformer on primary and secondary for proper coordination.

- 1) Supply 2 fuses on primary and 1 fuse on secondary side with 1 leg grounded.
- 2) Disconnect primary of control transformer from power supply with isolating switch in open position.

(c) Control Wires:

- 1) Minimum 14 ga stranded, rated for 600 v.
- 2) Imprint wire number on full length of wire every 4" for easy identification.

(d) Terminal Strips:

- 1) Rated for 600 v and suitable for terminating maximum 10 ga wire.
- 2) Mark both ends of control wires for identification.

(e) Push buttons, pilot lights, and control relays.

- 1) Heavy duty, rated to 600 v.
- 2) Buttons and operators shall be 30 mm type.
- 3) Indicators shall be push to test type and LED type.

(f) Controller shall include circuit to test contactor and control circuit when isolating switch is in open position.

1) Test circuit shall consist of receptacle and plug mounted in medium voltage compartment and accessible only when medium voltage compartment door is open.

2) In test position, plug may be removed from receptacle and connected to external 120 v source of power.

3) Isolating switch shall isolate control transformer and prevent energizing control transformer secondary from test voltage source.

(g) Identify devices mounted in low voltage compartment in accordance with Section 16A.

#### 2.8.17 Logic Control Configuration

(a) Description:

1) Control configuration provides basic 2 and 3-wire control and starting current and ramp time adjustments.

2) Standard electrical control logic is located on single microprocessor- based PC card in low voltage section which provides sequential logic as well as gate signals to trigger cards used to drive SCRs.

3) Design control system to implement required sequential logic to start and stop motor as well as operate bypass contactor and in-line isolation contactor (if present).

4) Design control logic to perform timing required for operation while continuously monitoring motor and starter operation for faults. If fault is detected, control logic provides fault indication via an LCD display. In event of fault condition, control logic safely shuts down starter to disable motor.

5) Control logic PC card shall be interchangeable with other control logic PC cards of similar design.

(b) Low Voltage Compartment:

1) Locate low voltage section behind separate door and physically separated from medium voltage section by 11 gauge mild steel for added protection.

2) Door to permit access to control logic without exposure to medium voltages.

3) Remote interlocking and control are interfaced in this section as well as metering, relays, and pilot devices.

4) Operate each medium voltage phase or power pole by individual pulse generator card located on power pole in medium voltage section. Optically-isolate main control PC card located in low voltage section from medium voltage pulse generator cards on power poles.

(c) Electrical:

1) Logic control incorporates micro computer which consists of circuitry required to drive power semiconductors located in power section.

2) Logic provides following standard features:

- a. Adjustable Ramp Time (0-60 seconds).
- b. Adjustable Initial Current (100%-400%).
- c. Adjustable Maximum Current (200%-600%).
- d. Adjustable Voltage Decel Profile.
- e. Selectable Current Limit During Motor Start.
- f. Line Phase Loss Detection.
- g. Line Current Imbalance Detection 10-40%.
- h. Low Line Detection (25-50% below nominal).
- i. Up to Speed Indication.
- j. Line Phase Sequence Sensitivity or Insensitivity.
- k. Selectable Solid State Overload Class 10, 20 or 30.
- l. Selectable Motor Service Factor 1.0, 1.15 or 1.25.
- m. Adjustable Motor Full Load Amperes.
- n. Adjustable Current Transformer Ratio.
- o. Battery "Backup" of Starter Parameters.
- p. Line Voltage Independent Operation.
- q. Instantaneous Overcurrent Detection.
- ri. Shorted SCR Detection.
- s. Software Selectable Relay Outputs.
- t. "Revolving" Event Recorder (25 most recent events).
- u. Line Frequency Tracking.
- v. LCD Status Display.

3) Standard features shall operate concurrently.

(d) Software Selectable Relay Outputs:

1) Auxiliary relay outputs are selectable as starter parameters and shall not require hardware jumper modification.

2) Provide following relay outputs for standard starter:

- a. Run.
- b. Motor Thermal Overload Trip.

3) Provide outputs in addition to general fault relay output. General fault relay shall indicate following errors:

- a. Line Phase Loss.
- b. Line Phase Imbalance.
- c. Low Three Phase Line.
- d. Line Phase Sequence Change.
- e. Motor Thermal Overload Trip.
- f. Battery Backup Failure.
- g. Instantaneous Overcurrent.
- h. Shorted SCR Fault.
- i. Three Phase Line Frequency Deviation.
- j. Control Power Failure.
- k. Computer Error.

- (e) LCD Status Display:
- assembly designed to:
- parameters.
- as date, time, current, voltage,  
etc.
- the solid state starter, if enabled.
- and provide alphanumeric information on 2 lines of 16 characters.
- 1) Each starter shall have keyboard/display
    - a. Set or examine operating
    - b. Provide status information.
    - c. Provide real - time information such
    - d. Provide a means to start and stop
  - 2) Display shall utilize liquid crystal technology

- (f) LED Indicators:
- and fault annunciation.
- 1) Provide LED indicators for advisory status
    - a. Power On.
    - b. CPU Heartbeat.
    - c. Fiber Optic Firing.
    - d. Communication.
    - e. Phase Condition.
    - f. LCD Display.

#### 2.8.18 Protection and Metering Equipment

- (a) Overload Protection:
- relay, operated through current transformers.
- reset on compartment door.
- open control circuit nor stop motor if it is running.
- (b) Current transformers used for overload protection:
- motor current and shall have adequate burden capacity for devices they supply.
- accuracy classification.
- (c) Mount control, protection and metering equipment  
in separate isolated low voltage compartment.
- 1) 3-ph thermal adjustable electronic overload
  - 2) Mount on low voltage panel with external
  - 3) Pressing overload reset button shall not
- 1) Linear response through 6 times full load
  - 2) Linear response in accordance with ANSI

(d) Multifunction motor protective relay (MP):

1) Contractor is responsible for providing necessary wiring, equipment and devices to establish fully functioning motor protection as herein specified and shown on Drawings.

2) Functional Specification:

a. Protective Functions Include: Phase overload standard curves, overload by custom programmable curve (51), I<sup>2</sup>t modeling (51), Stator Overtemperature/Bearing Overtemperature with 10 independent RTD inputs (49), negative sequence unbalance/single phase (46), phase reversal (46), start per hour and time between starts (48), short circuit (50), ground fault (50g/50n/51g/51n), undercurrent (37), and mechanical jam/stall.

b. Management functions include:

1) Statistical Data.  
2) Pre-trip Data.  
3) Ability to learn, display, and integrate critical parameter to maximize motor protection.  
4) Data communications interface. Interface shall implement an integral Ethernet data port using ModBus TCP/IP protocol.

3) Operation:

- a. Keypad programming.
- b. Tamperproof setpoints.
- c. 48 character alphanumeric display, backlit.
- d. Question and answer messages.
- e. Request for HELP messages.
- f. Recall of setpoints.
- g. Actual values upon demand.
- h. Output relay status indication.

4) Monitoring Display:

- a. 3 phase average current.
- b. Individual phase currents.
- c. Hottest stator RTD temperature.
- d. Individual stator RTD temperatures.
- e. Maximum stator RTD temperature since last access.
- f. Unbalance ratio (% In/Ip).
- g. Ground leakage current.
- h. Individual motor bearing RTD temperatures.
- i. Individual drive bearing RTD temperatures.
- j. Individual maximum bearing temperatures since last access.
- k. Thermal capacity remaining/Estimated time to trip at present overload level.

- l. Motor load as % per load.
- m. Phase to Phase Voltage.
- n. KW, KVAR, MWHR, PF, Frequency.

5) Prior Alarms:

- a. Immediate Overload/Stall Warning.
- b. Ground Fault.
- c. Undercurrent.
- d. Stator RTD Overtemperature.
- e. Bearing RTD Overtemperature.
- f. Broken Sensor (RTD).
- g. Self Test - Service.

6) Fault Diagnosis:

- a. Pre-trip Average Motor Current.
- b. Pre-trip Unbalance Ratio.
- c. Pre-trip Ground Fault Current.
- d. Pre-trip Maximum Stator RTD Temperature.
- e. Pre-trip Phase Voltage.
- f. Pre-trip KW.
- g. Pre-trip Power Factor.
- h. Pre-trip Frequency.

7) Statistical data:

- a. Running hours since last commissioning.
- b. Number of starts since last commissioning.
- c. Number of trips since last commissioning.
- d. Number of overload trips.
- e. Number of rapid trips.
- f. Number of unbalance trips.
- g. Number of ground fault trips.
- h. Number of RTD trips.
- i. Number of short circuit trips.
- j. Number of Start trips.
- k. Total Watt-hours.

8) Output relays which can be programmed

into the following modes:

- a. Main Trip Relay - Latched, Fail-safe/Non-fail-safe.
- b. Alarm Relay - Latches/Unlatched - Fail-safe, Non-fail-safe.
- c. Auxiliary Relay No. 1 - Latched/Unlatched -  
Fail-safe/None-fail-safe.
- d. Auxiliary Relay No. 2 - Latched and Fail-safe.
- e. Contact Rating - 10 amp, 120/240 vac - 20 amp Make and Carry -  
48-270 VDC Inductive.

9) Self Test:

- required) and programming remains intact upon power loss following lock-out trip, lock-out time is adhered to.
- a. Non-volatile memory (no batteries) and programming remains intact upon loss of control power. In event of control power loss following lock-out trip, lock-out time is adhered to.
  - b. Continues self-check is maintained with or without motor running and automatic alarm in event of relay internal malfunction.

10) Separate trip and alarm motor temperature set points (ten RTD inputs) to match equipment output.

- a. Six Stator Windings - Overtemperature: Device 49.
- b. Two Motor Bearings - Overtemperature: Device 38.
- c. Two Load Bearings - Overtemperature: Device 38.

2.8.19 Data Communications Port

The starters shall have an integral communications interface. Interface shall implement an Ethernet data port using ModBus TCP/IP protocol.

2.8.20 Identification

(a) Equipment Markers: Provide 2-ply, 1/8 in. thick laminated plastic, engraved equipment markers.

- 1) Color: Black letters on white background.
- 2) Nomenclature: Include following, matching terminology on schedules as closely as possible:

- a. Equipment name (i.e. medium voltage solid state motor controller).
- b. Equipment Tag No. (SSRV-1 thru SSRV-8).

3) Size: Provide approximate 3 in. by 6 in. (minimum) for equipment.

- a. 1 in. high letters for equipment tag number.
- b. 1/2 in. high letters for descriptive equipment name.

4) Size: Provide approximate 1-1/2 in. by 3 in. (minimum) for device or component.

- a. 1/4 in. high letters for equipment tag number.
- b. 1/4 in. high letters for descriptive equipment name.

5) Fasteners: Self-tapping stainless steel screws except contact type permanent adhesive where screws cannot or should not penetrate substrate.

#### Enclosure Purging System

An equipment purging system shall be provided to purge each of the power cable junction boxes for the eight main pumps and two low flow pumps. The system shall Type X Bebcos EPS Purge System for Class I, Division 1 to non-hazardous area applications. UL, CUL & FM classified.

The system shall include a Bebcos EPS Model 2001A-STD-C1-FM Type X purge panels with alarm relays, an enclosure protection vent, supply and reference fittings and mounting kit for each of the ten (10) junction boxes, and other accessories necessary for proper functioning of the system.

A tank mounted duplex oil-less air compressor with tank, air filter, low pressure alarm switch, and duplex motor starters with disconnect switch shall be provided. The compressor motor shall be 3-phase 460 volt, 1.5hp. The compressor shall be sized to deliver a minimum of 4 cfm continuously.

### 2.10 Medium Voltage Transformers

#### Summary

Section Includes:

Distribution and power transformers with medium- voltage primaries.

#### Submittals

(a) Product Data:

- 1) Include data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views.
- 2) Show minimum clearances and installed devices and features.

Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.

Field Test Reports: Indicate and interpret test results for tests specified in Part 3.

Maintenance Data: For transformers to include in maintenance manual.

Submit in accordance with Section 1A.

Submit Operation and Maintenance Data in accordance with Section 1A.

(g) Approval of equipment specified in this section is contingent upon approval of coordination study specified in Section 16A.



## Quality Assurance

Testing Agency Qualifications: In addition to requirements specified in Section 16A an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or shall be full-member company of International Electrical Testing Association.

1) Testing Agency's Field Supervisor: Person currently certified by International Electrical Testing Association or National Institute for Certification in Engineering Technologies, to supervise on-site testing.

Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

### Regulatory Requirements:

National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

Comply with IEEE C2.

### Delivery, Storage, and Handling

Temporary Heating: For indoor, dry-type transformers, apply temporary heat according to manufacturer's written instructions within enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in space that is continuously under normal control of temperature and humidity.

Product Selection for Restricted Space: Drawings indicate maximum dimensions for transformers, including clearances between transformers and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' transformers with equal performance characteristics and complying with indicated maximum dimensions may be considered.

### Manufacturers

Cooper Industries; Cooper Power Systems Division

ABB Power T & D Co., Inc.

Square D; Groupe Schneider.

Cutler-Hammer.

Transformers, General

Description: 2-winding type, designed for operation with high-voltage windings connected to 3-phase, 3-wire, 60 Hz, grounded-neutral distribution system.

#### Liquid-Filled/Pad-Mounted Transformers

Dielectric Liquid: Envirotemp FR3 Fluid, listed as less-flammable, non-toxic, non-bioaccumulating, biodegradable per EPA, 100% derived from seed oils and food grade performance enhancing additives. The fluid shall be Factory Mutual (FM) approved and UL classified.

Energy Efficient Transformers: Efficiency equal to or greater than that stated in NEMA TP 1, for that type and rating of transformer.

Full-Capacity Voltage Taps: Four 2.5% taps, 2 above and 2 below rated voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.

Surge Arrestors: Distribution class, one for each primary phase. Support from tank wall within high-voltage compartment.

High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for dead-front bushing-well inserts. Include following:

- 1) Bushing-well inserts: One piece, externally removable, one for each high-voltage bushing well.
- 2) Surge Arrestors: Dead-front, elbow-type, metal-oxide-varistor type.
- 3) Parking Stands: One for each high-voltage bushing well.
- 4) Portable Insulated Bushings: Arranged for parking insulated, high-voltage, elbow-type cable terminators; one for each primary feeder conductor terminating at transformer.

Include following accessories:

- 1) Drain Valve: 1 in. (25 mm), with sampling device.
- 2) Dial-type thermometer.
- 3) Liquid-level gauge.
- 4) Pressure-vacuum gage.
- 5) Pressure-Relief Device: Seal-sealing with an indicator.
- 6) Alarm contacts for above gages and thermometer.

#### Finishes

Enclosure Coating System for Outdoor Units: Comply with ANSI C57.12.28 regardless of transformer type.

#### Source Quality Control

Factory Tests: Design and routine tests comply with referenced standards.

Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project if specified sound levels are below standard ratings.

3. execution

## FACTORY TESTING

3.1.1 The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

### For 5KV Circuit Breakers

Electrically operated circuit breaker shall be operated over the range of minimum to maximum control voltage.

When circuit breakers are equipped with Digitrip 520V or 1150V integral trip units, functional operation of the trip units and breaker tripping through trip actuator shall be verified by secondary current injection into the secondary circuits of the applicable current sensors.

Factory setting of contact gap.

One (1) minute dielectric test per ANSI standards.

Final inspections and quality checks.

The following production test shall be performed on the circuit breaker housing:

One (1) minute dielectric test per ANSI standards on primary and secondary circuits.

Operation of wiring, relays and other devices verified by an operational sequence test.

Operation of the automatic throwover sequence.

Final inspection and quality check.

The following production test shall be performed on the equipment in the 5KV motor starter line-ups:

- 1) One Wiring check.
- 2) Sequence of control circuits.
- 3) Dielectric Test (Hi Pot) per NEMA ICS 3 Part 2 at 2000 volts plus 2.25 times nominal voltage, for 60 seconds, phase-to-phase and phase-to-ground (1) minute dielectric test per ANSI standards on primary and secondary circuits.

3.1.2 The manufacturer shall provide three (3) certified copies of factory test reports.

Factory tests as outlined above shall be witnessed by the owner's representative.

The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed.

The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility.

## EXAMINATION

VERIFY LOCATION AND LAYOUT OF 5KV SWITCHGEAR, 5 KV MOTOR STARTER LINE-UPS, MOTOR CONTROL CENTER, ENCLOSURE PURGING SYSTEM, AEGIS/INTRUSION ALARM EQUIPMENT, FIRE ALARM EQUIPMENT AND COMBUSTIBLE GAS DETECTION SYSTEM.

Verify that electrical power is available and of correct characteristics.

## FIELD QUALITY CONTROL

3.3.1 The Contractor shall provide the services of qualified factory-trained manufacturer's representatives to instruct on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, participate in the startup of the equipment, participate in the field testing of the equipment, place the equipment in trouble-free operation, and instruct operating personnel in its operation and maintenance of the equipment specified under this section for a period of not less than 5 working days. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein. This service shall include all equipment provided for this project specified under this Section.

The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:

- (a) Megger bus.
- (b) Ground test.
- (c) Verify that all mechanical interlocks are functioning properly.
- (d) Automatic throwover test for the switchgear breakers.

Test the operations of Pump control system, Combustible Gas Monitoring System, Enclosure Purging System, fire Alarm System, and Intrusion Alarm System.

3.3.3 The start-up services for the following equipment shall be coordinated with IDOT and IDOT shall be notified at least one week in advance:

5 KV Switchgear and Auto Throwover Controller.

5 KV Motor Starter Line-ups.

Medium Voltage Transformers

Motor Control Center including Automatic Transfer Switch.

SCADA Panel.

Equipment Purging system.

Combustible Gas Detector.

Intrusion Alarm Panel.

Fire Alarm Panel.

3.3.4 The Contractor shall provide three (3) copies of the manufacturer's field start-up report.

### 3.4 MANUFACTURER'S CERTIFICATION

The Contractor shall provide a qualified factory-trained manufacturer's representative to certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

#### TRAINING

The Contractor shall provide a training session for up to five (5) owner's representatives for 4 normal workdays at a jobsite location determined by the owner.

The training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly of switches, circuit breaker(s), protective devices, and other major components.

#### INSTALLATION

The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings. The installer shall provide all labor and perform all work to install and make operable all mechanical and electrical equipment necessary to assure safe and reliable operation.

All necessary hardware to secure the assembly in place shall be provided by the Contractor.

Check all bolted connections to assure that they are in accordance with the manufacturer's recommended torque requirements.

#### FIELD ADJUSTMENTS

The relays or trip units shall be set/programmed in the field by a qualified representative of the manufacturer, retained by the Contractor in accordance with settings designated in a coordination study of the system as required elsewhere in the contract documents.

#### FIELD TESTING

Sequence the control circuit to verify that the starter will start and run properly.

Simulate incoming line failure to test operation of the automatic throwover equipment.

### 3.9 5 kV Switchgear Installation

#### 3.9.1 Installation

(a) Locations and Layout: Exact locations and physical layout of equipment and components may be varied as required to suit manufacturer's design and as approved, provided required functions and operations are accomplished; follow identification of units indicated on Drawings exactly to ease checking and building maintenance procedures.

(b) Concrete Bases: 4 in. (100 mm) high, reinforced, with chamfered edges. Extend base no more than 2 in. (50 mm) in each direction beyond maximum dimensions of switchgear, unless otherwise indicated. Comply with Section 3A.

(c) Temporary Lifting Provisions: Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from switchgear units and components.

### 3.9.2 Identification

(a) Diagram and Instructions: Frame under clear acrylic plastic on front of switchgear.

1) Operating Instructions: Printed basic instructions for switchgear, including control and key interlock sequences and emergency procedures.

2) Storage for Manual: Include rack or holder, near operating instructions, for copy of maintenance manual.

3) System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.

### 3.9.3 Connections

(a) Connect switchgear ground bus to common building ground indicated on Drawings.

(b) Tighten bus joint, connector, and terminal bolts 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.

### 3.9.4 Coordination Study

(a) Where coordination study specified in Section 16A recommends changes in types, classes, features or ratings of equipment or devices from those indicated, make written request for instructions. Obtain instructions from ENGINEER before ordering equipment or devices recommended to be changed.

### 3.9.5 Field Quality Control

(a) Manufacturer's Field Services:

1) Representative for equipment specified herein shall be present at Project Site or classroom designed by OWNER for minimum workdays specified below, travel time excluded, for assistance during construction, startup, and post-startup Include minimum of:

- i. 5 workdays for Installation Services.
- ii. 3 workdays for Instructional Services.
- iii. 3 workdays for Post-Startup Services.

2) Supplier of manufacturer shall direct services specific to system and equipment operation, maintenance, and troubleshooting. See Section 1A.

3) In addition to services specified above, provide manufacturer's services as required to successfully complete system demonstration as specified in Section 1A.

4) Engage factory authorized service representative to demonstrate and train OWNER'S maintenance personnel as specified below:

- i. To identify each switchgear location.
- ii. To instruct in function, operation, and maintenance of each component.
- iii. To instruct in each distinct procedure and schedule related to servicing and preventive maintenance.

(b) Prepare for acceptance tests as follows:

- 1) Make insulation resistance tests of each switchboard bus, component, and connecting supply, feeder, and control circuits.
- 2) Make continuity tests of each circuit.

(c) Testing Agency: Engage qualified independent testing agency to perform field quality control testing in accordance with Section 16A.

(d) Remove and replace malfunctioning units with new units and retest.

#### 3.9.6 Adjusting

(a) Protective Relay Settings: Verify that settings are appropriate for final system configuration and parameters. Where discrepancies are found, recommend final relay settings for approval before making final adjustments.

1) Set field adjustable pick up and time sensitivity ranges in accordance with Section 16A.

(b) Fuse Characteristics: Verify that fuse size and types are appropriate for final system configuration and parameters. Where discrepancies are found, recommend fuse selection for approval before making final adjustments.

1) Provide fuse sizes and types in accordance with Section 16A.

#### 3.9.7 Cleaning

(a) Inspect interior and exterior of installed switchgear. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

#### 3.9.8 Protection

(a) Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written recommendations, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturers stipulated service conditions.

### 3.9.9 Demonstration

(a) Engage factory authorized service representative to train OWNER'S maintenance personnel in following:

- 1) Train OWNER'S maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- 2) Review data in maintenance manuals. Refer to Section 1A.

### 3.10 Medium Voltage Solid State Motor Controller Installation

#### 3.10.1 Examination

(a) Examine areas and conditions under which medium voltage solid state motor controller is to be installed and correct conditions detrimental to proper and timely completion of Work.

#### 3.10.2 Installation

(a) Install medium voltage solid state motor controller in accordance with NEMA ICS 2.3 "Instructions for Handling, Installation, Operation, and Maintenance of MCCs," and with manufacturer's written installation instructions.

(b) Anchor each motor control center assembly to concrete base in accordance with manufacturer's recommendations. Level and grout sills flush with motor control center mounting surface.

(c) Remove temporary lifting eyes, channels, brackets, and temporary blocking of moving parts from medium voltage solid state motor controller units and components.

(d) Tighten bus connections and mechanical fasteners.

#### 3.10.3 Concrete Bases

(a) Where concrete slab is indicated under medium voltage solid state motor controller location, provide 4 in. high concrete foundation pad.

(b) Construct in accordance with Section 3A.

#### 3.10.4 Field Quality Control

(a) Manufacturer's Field Services:

1) Representative for equipment specified herein shall be present at Project Site or classroom designed by OWNER for minimum workdays specified below, travel time excluded, for assistance during construction, startup, and post-startup Include minimum of:



- i. ½ workday for Installation Services.
- ii. 1 workday for Instructional Services.
- iii. 2 workdays for Post-Startup Services.

2) Supplier of manufacturer shall direct services specific to system and equipment operation, maintenance, and troubleshooting. See Section 1A.

3) In addition to services specified above, provide manufacturer's services as required to successfully complete system demonstration as specified in Section 1A.

4) Engage factory authorized service representative to demonstrate and train OWNER'S maintenance personnel as specified below:

- i. To identify each switchboard location.
- ii. To instruct in function, operation, and maintenance of each component.
- iii. To instruct in each distinct procedure and schedule related to servicing and preventive maintenance.

(b) Prepare for acceptance tests as follows:

- 1) Make insulation resistance tests of each switchboard bus, component, and connecting supply, feeder, and control circuits.
- 2) Make continuity tests of each circuit.

(c) Testing Agency: Engage qualified independent testing agency to perform field quality control testing in accordance with Section 16A.

(d) Manufacturer's representative shall perform quality inspection of final installation and, in presence of CONTRACTOR and ENGINEER, perform functional test of system.

### 3.10.5 Coordination Study

(a) Where coordination study is specified in Section 16A recommends changes in types, classes, features or ratings of equipment or devices from those indicated, make written request for instruction. Obtain instructions from ENGINEER before ordering equipment or devices recommended to be changed.

### 3.10.6 Adjustment

(a) Protective Relay Settings: Verify that settings are appropriate for final system configuration and parameters. Where discrepancies are found, recommend final relay settings for approval before making final adjustments.

1) Set field adjustable pick up and time sensitivity ranges in accordance with Section 16A.

(b) Fuse Characteristics: Verify that fuse size and types are appropriate for final systems configuration and parameters. Where discrepancies are found, recommend fuse selection for approval before making final adjustments.

- 1) Provide fuses sizes and types in accordance with Section 16A.
- (c) Adjust operating mechanisms for free mechanical movement.
- (d) Tighten bus connections and mechanical fasteners.
- (e) Touch up scratched or marred surfaces to match original finish.

#### 3.10.7 Cleaning

(a) Inspect interior and exterior of installed switchgear. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

#### 3.10.8 Protection

(a) Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written recommendations, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

#### 3.10.9 Demonstration

(a) Engage factory authorized service representative to train OWNER'S maintenance personnel in following:

- 1) Train OWNER'S maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.
- 2) Review data in maintenance manuals. Refer to Section 1A.

### 3.11 Medium Voltage Transformer Installation

#### 3.11.1 Installation

- (a) Comply with IEEE C2.
- (b) 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 UL 486B.

#### 3.11.2 Grounding

(a) Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping as indicated to comply with NFPA 70.

(b). Comply with Section 16B for materials and installation requirements.

#### 3.11.3 Field Quality Control

(a) Manufacturer's Field Services:

1) Supplier's or manufacturer's representative for equipment specified herein shall be present at jobsite or classroom designated by OWNER for mandays indicated, travel time excluded, for assistance during plant construction, plant startup, and training of OWNER'S personnel for plant operation. Include:

- i. 1 man-day for Installation Services.
- ii. 1/2 man-day for Instructional Services.
- iii. 1/2 man-day for Post-Startup Services.

2) Supplier or manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system related areas other than wastewater treatment process. See Section 1A.

3) In addition to the services specified above, provide manufacturer's services as required to successfully complete systems demonstration as specified in Section 1A.

(b) Instructional Services:

1) Factory authorized service representative shall explain transformers and accessories and to train Owner's maintenance personnel. Provide both classroom training and hands on equipment operation covering following:

- i. Safety precautions.
- ii. Features and construction of project transformers and accessories.
- iii. Routine inspection, test, and maintenance procedures.
- iv. Routine cleaning.
- v. Features, operation, and maintenance of integral disconnect switches and protective devices.
- vi. Interpretation of readings of indicating and alarm devices.
- vii. Tap changing procedures.
- viii. Features, operation, and maintenance of separable, insulated, connector system.

(c) Independent Testing Agency: Engage an independent electrical testing agency to test medium voltage transformer installations as specified in Section 16A.

(d) Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

### 3.11.4 Cleaning

(a) On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish.

Clean components internally using methods and materials recommended by manufacturer.

### 3.11.5 Adjusting

(a) After installing and cleaning, touch up scratches and mars on finish to match original finish.

(b) Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

## **SECTION 16D - SUPERVISORY, CONTROL AND DATA ACQUISITION (SCADA) EQUIPMENT**

### 1. GENERAL:

#### 1.1 Description

SCADA equipment shall be provided to act as supervisory control of the pumping station and the communication nexus with the District. SCADA equipment shall include: SCADA Panel 027-SP-1, PC workstation equipment, telemetry equipment for external communication and networking equipment for data communications within the pumping station. SCADA equipment programming and configuration shall be as specified below.

The SCADA system shall consist of, but not be limited to; programmable controllers, a personal computer, data communication equipment, printer, process instrumentation and control devices, uninterruptible power systems (UPS), and other devices as required and/or as indicated on Plans.

All materials, equipment, labor, programming, configuration and installation services, and incidentals required to achieve a fully integrated and operational system shall be furnished and installed complete by a qualified system integrator with a minimum of 10-years experience. The system integrator shall design and coordinate the instrumentation and control system for proper operation with related equipment and materials.

Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with equipment provided under this Contract shall be included whether shown on the drawings or not.

The system integrator shall provide all programming and configuration of equipment and software including development of graphic displays and reports. Displays and Report development shall be coordinated with existing Department standards.

The system integrator shall install the control system and shall perform all on-site testing, start-up, and training of IDOT's staff.

All necessary coordination required for interfacing the proposed pump station facility with the proposed SCADA system shall be provided by the system integrator.

The existing SCADA equipment excluding the radio equipment in the existing pumping station shall be removed and turned over to the Owner.

The existing SCADA mast and antenna shall be retained. The required cabling between the new SCADA Panel and the antenna shall be provided by the Contractor.

To ensure compatibility with the existing IDOT District-wide Pumping Station SCADA System, all new SCADA equipment, software and application programs provided shall conform to the IDOT requirements. For means of migrating to an open architecture system for better performance, the department is in the process of upgrading the existing pumping station SCADA system, the details of which will be provided by the Engineer.

Under the direction of the Engineer, the Contractor shall procure the equipment from the designated source and it will be paid under Article 109.05 of the Standard Specifications:

#### PUMP STATION SCADA EQUIPMENT

An itemized copy of the supplier's invoice shall be submitted for approval to IDOT District 1, Bureau of Electrical Operations, as part of the submittal process.

For bidding purposes, this item shall be estimated at \$75,000.00.

#### Related Sections

- 1.2.1 Section 16A - General Electrical Provisions.
- 1.2.2 Section 16B - Basic Electrical Materials and Methods.
- 1.2.3 Section 16C - Major Electrical Equipment.

#### 1.3 Reference

1.3.1 ISA Standards and Recommended Practices for Instrumentation and Control.

#### 1.4 Submittals

1.4.1 Provide shop drawings and product data under provisions of Section 1A.

1.4.2 Submittals of shop drawings and product data shall be particularly detailed and complete. Submittals shall be complete with the manufacturer's guarantee. Piecemeal submittals will be returned without review. Submittal information shall include the following.

#### 1.4.3 Product Data

- (a) Bill of Material: List all the materials and equipment to be furnished. Tag number, manufacturer's complete catalog number, service, location, and cross-reference numbers of instruction sheet, specification data sheet and wiring diagram shall be included under each item.
- (b) Specification Data and Drawings: Furnish instrument specification data sheet as per ISA standard instrument specification form, if applicable, wiring and/or connection diagram, outline dimensions, installation diagram and manufacturer's catalog for each instrument. A common set of drawings with setting and/or scale individually listed may be furnished for instruments with identical specification except setting and/or scale.
- (c) Panel Drawings: Furnish panel drawings for each instrument/control panel. List bill of materials, show panel or cabinet structure, outline dimension, general arrangement, devices, cutouts and mounting details of instruments and control devices, terminal blocks, wire ways and piping.

#### 1.4.4 System Diagrams

- (a) Instrument Loop Diagram: Show all analog and digital loops for all instrument sensors, secondary instruments, I/O functions, alarms, control and displays using ISA standard symbols per ISA Standard S5.4.
- (b) SCADA System Block Diagram: Show system hardware configuration and identify model numbers of each system component.
- (c) Schematic diagrams, point-to-point internal wiring diagrams, point-to-point field wiring diagrams, and other necessary diagrams and installation requirements for the SCADA system and other components and systems that are interfaced to these systems.
- (d) Interconnecting Wiring and/or Piping Diagrams: Show schematically the wiring and piping runs for each instrumentation and control system. The diagram shall show and identify, with location noted, all instruments, piping and appurtenances furnished under this section and related electrical equipment furnished under other Sections. All terminal blocks and pipe taps shall be identified.

#### 1.4.5 Software Documentation

Submit system software, application software, I/O point data base listing, programming ladder diagrams, graphic pages and report forms in prints. Software, application programs, ladder diagrams and control logics shall also be submitted in 740MB CD-R.

The system integrator shall furnish the station operational program. The CD ROM copy and printout of the PLC control program shall be furnished to DEPARTMENT at the time of start-up. Disk and printed copy of the operating program shall be maintained on the file with the system integrator.

#### 1.4.6 Instruction Manuals

Submit instruction manuals covering installation, operation, calibration, maintenance, diagnostic and repair for all hardware and software.

#### 1.4.7 Record Documents

Accurately record actual calibration setting and scales of instruments.

#### 1.5 Work for Hire

1.5.1 Any and all configuration, programming, setup or other software functions (SOFTWARE) performed on all intelligent devices provided as part of this Project is to be considered "Work for Hire" under the 1976 Copyright Act as amended (title 17 of the United States Code). The SOFTWARE shall be owned by IDOT and shall be turned over to IDOT fully documented as the work is completed.

1.5.2 IDOT intends only to obtain the SOFTWARE for its own use.

1.5.3 IDOT will not prevent the SOFTWARE supplier from reuse of the SOFTWARE concepts and ideas for other projects. Any reuse of the SOFTWARE concepts and ideas generated under this Project is solely the responsibility of the SOFTWARE supplier. The SOFTWARE supplier shall defend, indemnify and hold harmless IDOT from all claims, damages and expenses (including reasonable litigation costs), arising out of any use, misuse or misapplication of SOFTWARE concepts and ideas.

#### 1.6 Operational and Performance Requirements

1.6.1 The SCADA system includes a PC system as the main HMI device, a PLC for pumping system control, a reactive air bubbler level sensing system as the primary means of wet well level measurement and a multi-float/relay level monitoring system as the backup pump control system.

1.6.2 The PLC shall check the validity of analog level signals using float levels as reference, and select a valid signal for pump control (default to analog). If level signal is invalid, then the point level inputs signals from the multi-float system shall be used for pump control.

1.6.3 The SCADA System shall be designed for full automatic control of the pump station, and shall also be designed to allow manual operation. In the event of loss of signal(s) from water level sensing device(s), the SCADA system shall be capable of accepting data by manual entry of observed water levels via keypad/board or touch screen (or other acceptable means) from operating personnel at the pump station.

1.6.4 Pumping operation of the facility shall respond to water levels sensed in accordance with the pumping operation tables shown on the Drawings. The Programmable Logic Controller (PLC) and associated personal computer with SCADA software herein specified shall be capable of automatically controlling pumping operations.

1.6.5 The Control Panel shall be designed to establish an 8-pump duty cycle for the main pumps and a 2-pump duty cycle for the low flow pumps. This information shall be passed to the SCADA PLC. The PLC shall sequence the pumps in its respective group in a cyclic mode, alternation occurring when all pumps are off within a pumping cycle.

1.6.6 In the event of PLC failure, the Control Panel shall control pump output based upon the local duty cycle selectors but shall not alternate the pumps.

1.6.7 Normally closed float relay contacts representing water levels lower than the float switch actuation points will be fed into the SCADA DI board, the control processor shall be properly programmed to interpret the float relay contact status.

1.6.8 Conceptual SCADA input/output (I/O) points are defined in the SCADA Panel Terminal Schedule on the drawings. In addition to those points shown, provide all I/O points necessary to affect a complete and operable SCADA system. Also, provide a minimum of 20% prewired spare I/O points of all types used. Wire spare points to terminal blocks.

## 1.7 Guarantee

1.7.1 Provide guarantee from all defects of material and workmanship for the manufacturer's standard length of guarantee or for 1 year from the date final acceptance, whichever is longer.

## 1.8 Deliver, Storage and Handling

1.8.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

## 1.9 Basis of Payment

1.9.1 Supervisory, Control and Data Acquisition (SCADA) equipment shall be paid for at the contract lump sum price for:

### PUMP STATION SCADA EQUIPMENT

## 2. PRODUCTS:

### 2.1 SCADA System

2.1.1 The SCADA system specified herein shall perform the following generalized functions:

- (a) Perform real-time process control, including proportional integral derivative control action, sequencing, process calculations, etc.
- (b) Collect and store accurate, reliable operating information for present and future uses.
- (c) Assist plant operating personnel by noting and communicating off-normal operating conditions and equipment failures.
- (d) Accumulate and store equipment running times for use in preventative maintenance.
- (e) Provide color graphic displays and summary reports for use by the plant operating and supervisory personnel.
- (f) Provide trending for all analog values.
- (g) Provide control system diagnostics.



The system is based on the SCADA system block diagram shown on the drawings. The system shall include:

- (a) Redundant Allan-Bradley ControlLogix programmable logic controller (PLC) system with local input/output (I/O), graphical interface panels, network communications and other capabilities as specified herein and shown on the SCADA system block diagram.
- (b) Computer work station with associated peripherals.
- (c) Computer operating system, Human Machine Interface(HMI) control/graphic software, PLC programming software, and other application software as specified herein.
- (d) The computer shall be linked to the PLC over an Ethernet (IEEE 802.3) based local area network (LAN).

All process control functions including PID, calculations, sequencing, set points, timing, etc., shall be done in the PLCs. The real-time database, report generation, graphic screens, program development, set point modification, data archiving, etc., shall be done by the computers.

The system shall allow the operator to manually control (by keyboard entry and mouse type pointing device) the status of pumps, valves, etc. (i.e., on-off, open-close, set point value, etc.) when viewing the appropriate graphic screen on HMI.

Latest version of Intellution iFIX as the SCADA HMI software.

2.1.6 The mounting, installation and termination wiring shown on the Contract Drawings for the control processor shall be included in the basic PUMP STATION ELECTRICAL WORK. Any miscellaneous wiring, labor, etc., not included in the Contract Drawings, but necessary to provide a fully operational system shall be paid for under this item.

## 2.2 Station Interface

2.2.1 The station shall be equipped with all devices and accessories necessary to provide interfacing between the control processor and process/mechanical equipment at the station to accomplish the applicable control functions of the station.

2.2.2 The SCADA panel shall be equipped with data communications modules capable of communication with the pump station metering units using Ether/IP and Modbus TCP/IP protocols. Refer to the SCADA System Network Diagram to determine Ethernet protocol type.

2.2.4 Push buttons for MANUAL LOCK-OUT and MANUAL PURGE and an alarm pilot light shall be provided on the enclosure door.

2.2.5 Name plates and operating instructions shall be provided on the enclosure door.

Compression bells for the bubbler system shall be provided as shown on Plans and as specified in Section 15F.

## 2.3 SCADA Panel Enclosure

2.3.1 The enclosure shall be single door, floor mount, NEMA 12, 36" wide by 90" high by 20" deep and shall match the motor control center line-up and shall be as specified under Section 16C, Subsection 2.3. Enclosure shall be front accessible only, metal enclosed type, arranged for cable and/or conduit entry from the top, bottom or sides, as required. Panel design shall allow easy access to all internal wiring and appurtenances. Ventilation fan, air filter, thermostatically controlled space heater, light kit and 120V receptacle shall be provided.

2.3.2 The panel shall have a full piano hinge door and a 3-point latch with a locking handle. The handle shall have a cylinder type lock keyed to match the Owner's system.

2.3.3 The enclosure shall be finished inside and out. The finish shall match that for the motor control center specified under Section 16C. Interior color may be white or as otherwise approved by the Engineer.

## Computer Work Station

2.4.1 Provide fully configured desktop computer systems including computer hardware, peripherals, operating software, application software, and configuration as specified herein for data logging, alarm annunciation and report generation.

2.4.2 Manufacturers: Computers and peripherals shall be manufactured by Dell, Hewlett-Packard (HP), or IBM.

The computer shall be a Intel Xeon processor based PC in a tower case with the following features as a minimum requirement:

- Dual Intel Xeon 2.4 GHZ CPU's with 512 KB Cache
- 512 MB 333 MHz DDR SDRAM
- Two 16553 Serial ports minimum
- 2 ECC/EPP Parallel ports
- 4 Universal Serial Ports
- 7 expansion slots minimum
- Two 80 GB hot swappable Raid 1 SCSI hard drives
- CD
- 52x24x52x CD-RW
- 40GB DDS4 SCSI tape drive
- Graphic controller with 16 MB VRAM
- 10/100 Base-T Ethernet card
- 2 hot-pluggable redundant power supplies, 400W minimum each
- Keyboard and optical mouse
- Microsoft Office software
- Windows XP Professional operating system
- MultiTech Model MT5600BL V.90/56 Kbps Dialup/2-4wire lease line Modem
- 19" color LCD monitor
- Laser jet printer, Hewlett-Packard Model 1200N
- Dot matrix printer, 24 pin, narrow carriage, Epson LQ-870 or OKI ML-590.

## Software

Provide all software on original diskettes, software publishers license, and manual(s), including Intellution iFIX with iHistorian upgrade from existing Fix dynamic; Logix5000, PanelBuilder and other software as required.

The desktop computer, running the SCADA system software which will direct the PLC and remote terminal units (RTU) shall be capable of off line usage for purposes other than system control and supervision, without loss of statistical data. The computer shall be capable of off line services for periods of up to one year without loss of statistical data.

The computer shall be capable of multi-mode menu driven statistical analysis with hard copy capability. Communications between the system and the supervisory computer shall automatically re-establish in the event that communications are momentarily lost.

The computer shall be arranged for system monitoring and management. The primary function of the computer shall be to provide the control logic, monitoring and, operational records for the pump station facility. In addition, the computer shall be capable of generating reports and maintenance records.

Provide one (1) computer desk for the desktop computer and printer. Desk shall be 48" x 30" in dimension. Desk shall be steel industrial or heavy-duty commercial grade in construction. Locate desk in Electrical Room.

## System Software

### General Requirement

The System Integrator shall furnish and install all programming necessary to provide a fully debugged and operating system based on the system descriptions. The software required shall consist of those programs necessary for the System to perform the functions specified herein, plus enable convenient and efficient preparation of new programs. The System Integrator shall assume complete responsibility for the successful operation of all software and application programs provided as part of the System. All programs shall be completely debugged and operable prior to delivery of the System. IDOT shall not be required to expend any programming effort in order to achieve a fully operational system.

Software shall be modular, comprised of an integrated group of proven, standard software modules.

All of the programs are to be generalized in nature such that DEPARTMENT may later add new functions. Integration of future application programs and the servicing of their input and output requirements, including construction of new printing formats and other system interfaces, shall be accomplished without recompiling of application software.

Changes in process parameters, addition and deletion of process schemes or equipment, and addition or modification of graphic displays and printed report formats shall be via the use of process operator and control engineer oriented icons, graphics, and menus organized in a hierarchical fashion.

System parameters such as: date, time, set points, alarm limits, PID tuning constants, etc., shall be entered or modified via the LCD/keyboard. Any input which modifies the system shall be logged on the logging printer and a historical disk file with date, new value, and previous value.

The System Integrator shall develop and implement all specified LCD screens, logs, reports, etc. IDOT shall provide input to the System Integrator in the areas of presentation format, included information and other general operator interface considerations.

#### Operating System

The operating system software shall provide system resource allocation and management in a pseudo real-time environment. Both program development and on-line monitoring and control programs shall execute concurrently under predetermined priority assignments. The Operating System shall control storage allocation and program movement; program scheduling; monitoring of system security timers; and interrupt processing for internal and external events such as Input/Output transfer completion, real-time program initiation, and detection of abnormal system conditions.

The operating system shall provide automatic start-up of the system, including processor and network communication, and all application software functions, upon initial power up or restoration of power after a power failure without operator intervention.

Provide operating system to monitor and control the execution of all programs; handle job initiation and termination requests; monitor program requests for system service; accept job control, operator commands, and translate them into actions; respond to and report error conditions relating to program processing.

Process Input/Output Handler: Process Input/Output routines shall be main memory resident, and shall provide interface to programs, process measurements and control system, and perform "reads" and "writes" and monitor device status.

Security: Provide operating system with provisions for password protection and security access to files and programs. On log-off, access to all computer functions shall be inhibited including boot-access via floppy diskettes. Configure the system and develop file structure for three user types initially.

System Administrator: Full access to system.

Engineer/Supervisor: Full access to all HMI and control system variables, databases, and programs. Restricted access to system/network parameters.

Operator: Read access to all HMI and control system variables, databases, and programs. Full access to WTP operating functions including reports, control setpoints, manual overrides, alarm acknowledgment, etc.

Provide 32 bit operating system, Microsoft Windows XP Workstation, Version 4.0 or later as recommended by the HMI software manufacturer. Provide Microsoft Remote Access Service for remote access of the HMI.

## Support Software

The Support Software shall include a collection of programs, which simplify new program development and implementation, permit testing and verifying the functional operation of the equipment associated with the system, and provide tools to perform the tasks associated with the creation and maintenance of an efficient system environment. All support software shall be Microsoft Windows XP Version 4.0 or later compliant.

The support software shall provide an on-line facility through the operator's Flat Panel Display/keyboard which will allow an operator or programmer to access, print, and change contents of allowable memory locations, as well as enable the activation of new process inputs and control outputs.

The support software shall contain Utility Routines which shall allow operator or programmer to:

Load and verify CD's.

System status routines which output to the system terminal, printers, and disk files. Routines shall include memory allocations, dumps, interrupt definitions, disk status, processor performance, etc.

(d) The support software shall contain diagnostic routines which shall be provided to test the performance of the computer-based control and data acquisition system in at least the following areas:

Main memory.

Execution of all instructions.

Input/Output system.

Hard disk.

Failure to pass any of the above tests shall be reported with indication of the location and type of system error.

(e) The DATA tape software provided with the system shall perform the following functions:

Automatic scheduler for automatic (unattended) backup.

File by file and image backup (selectable).

File restoration.

Menu driven configuration guide.

(f) Modem Communication Software: Provide communication software for use of dial-up modems provided with the HMI computer and laptop computer.

Spreadsheet software: Provide spreadsheet software. Spreadsheet software shall be compatible with HMI application software and allow import of data using Dynamic Data Exchange (DDE) protocols. Provide Microsoft Excel, latest version.

#### Application Programs

General Requirements: The software package shall be supplied for data base generation; process monitoring and control; collection, analysis, storage, preparation and printing or display of operating information for historical reports; and for plant start-up, normal operating cycles, and shutdown. The application programs shall perform the following general tasks:

Scanning of PLC data table for transferring analog and discrete data to and from the PLC. Scan rates shall be selectable over a range of approximately 1 sec to 8 hr and individually assignable to any point. In general, scan periods will be initially set at 1 second but shall be field adjusted by the System Integrator to achieve the fastest possible time PC/PLC scan without negative impact on system performance.

Digital filtering via either an assignable filter constant or by difference equation method.

Perform alarm monitoring of discrete and analog inputs/outputs. The analog inputs shall also be checked for out of range (via high and low limit checks). Alarms shall be capable of being assigned to a minimum of three severity categories (critical, non-critical, advisory) with each category producing a distinct sound via the CPU speaker. Alarm acknowledgment shall be from the keyboard or mouse. Audible alarm enable/disable shall be selectable by the operator.

Permit the addition or deletion of system inputs or outputs and modification of the system database using pop-up graphics and fill-in-the-blanks configuration tables.

Supervise and control all routines necessary to respond to operator requests for control changes, displays, allowable operator modifications, printouts, and any other required operator requests. Operator actions shall be serviced on an interrupt basis, and shall be interweaved with normal operations.

Permit manual data entry through the keyboard. This data shall consist of laboratory inputs, and entering or changing such things as alarm limits, set points, or constants. Confirmation shall be required via the respective display and keyboard prior to actual entry into the process database. Security coding shall prevent unauthorized data entry. The system shall be structured so that personnel will not experience an excessive delay time when entering or modifying data.

Support all required graphic displays for LCD. The software will both format and display LCD images of fixed and dynamic data. The System Integrator shall develop the screens using object oriented, pixel graphics. Displays shall be consistent with a Microsoft Windows NT environment and a common user interface look and feel shall be provided for all graphic screens.

Support all required logging and reporting. All logs, reports, and print-outs will be free form, that is the headings and format will be programmed and printed at the time of generation. Pre-printed sheets are unacceptable. The basic logs, reports, printouts, are described herein, to give the system supplier a general description of the quantity, complexity and types.

The final format and variables to be printed shall be developed by the System Integrator after consulting with IDOT after award of Contract. Any calculations required shall be made at the time of printing and indicate the latest status of the variable. Each page of report shall have the name of the plant, type of report, time and date the report was prepared and the page number. All logs and summary reports, with the exception of the alarm and equipment status logs, shall be allowed to be manually initiated and canceled.

Provide the capability to manually OPEN/CLOSE, START/STOP or initiating auto sequences of selected plant equipment via the operator's LCD and keyboard.

Provide for output of current or historical trending values to either the LCD or report printer.

Provide an optional automatic reset sequence for all alarms.

Provide export and import of the system configuration database to/from an ASCII (comma delimited) or Excel format file for modification or printing.

Provide a library of standard graphics symbols in conformance with ISA standard S5.1.

Perform configuration and operator interface to implement the control strategies included in this Section.

Application program shall be Microsoft Windows XP compliant and allow launching of other Windows XP compliant programs, transfer of Dynamic Data Exchange (DDE) data points to other programs, and execution of Windows XP applications while the application program is on-line.

#### Real Variables Processing:

Real Variables shall represent process data for which there are analog signal inputs to the system. The system shall sample each of these input signals at the selected scan frequency, and perform the proper conversions and scaling to obtain the instantaneous engineering values. These values then shall be used to update real-time data on LCD displays, check for alarm conditions, and store for use in the historical files.

The instantaneous values of all variable data shall be displayed and added to the historical database whenever the present value exceeds a preprogrammed compression deadband. The compression deadband will be field adjusted by the System Integrator to provide for maximum storage utilization.

Provide for storage of historical data on an adjustable file period of daily, weekly, monthly, quarterly, or yearly period for the purpose of trends or data analysis.

Variables, such as rate of flow, weight, and kilowatt usage, shall have their instantaneous values integrated with respect to time and their quantities totaled. the storage of each of these totals shall be done on an hourly basis into the historical file.

Alarm conditions shall be stored in the historical file. In addition, the last 100 alarms shall be displayed on the alarm graphic screen. The alarm storage format shall be an alarm description, time of occurrence, and tag number.

(c) Calculated Variables Processing:

Calculated variables shall represent process parameters for which there are no direct analog inputs to the system. These variables shall utilize real variables, and manually entered constants or laboratory data to compute their value.

Calculated variables which utilize one or more real variables and/or manually entered constants. These variables shall be treated in the same manner as real variables and shall have the same attributes as real variables (including alarming and control), with the exception that the calculation shall be performed automatically over an adjustable cycle period.

Calculated variables which are used only for the Daily, Monthly, and Annual Operation Summary reports, and which utilize laboratory input data shall be computed once a day for inclusion in the Daily report and stored for use in the Monthly and Annual reports. The capability to display these variables shall be provided.

The system shall provide for a minimum of 200 calculated variables.

(d) Manual Input Data Handling:

Provide the capability to enter data manually from the keyboard. Data shall consist of additional values for the current data file (e.g., laboratory analyses), inserting alarm limits, set point changes, adjustments to process constants, control system set point changes and system tuning parameter adjustments.

All manually entered data shall be entered and stored in the appropriate engineering units. All data entered shall be displayed for confirmation on the data entry device prior to incorporation to the database.

(e) LCD Displays:

All displays shall contain and continuously update the displayed process variables, date and time of day. All process values shall be displayed in engineering units. All displays shall incorporate references to both instrumentation tag numbers and plant equipment numbers as shown on the Drawings. The following basic types of LCD displays are required:

- Index displays
- Graphic displays
- Trend displays
- Manual lab summary displays
- Alarm summary displays
- System status displays
- Single point configuration/status displays
- Pop-up displays
- Help displays
- Setpoint displays

The LCD displays shall make maximum use of the colors available. Colors for status such as open/close, start/stop shall be the same as the indicators on the local control panels. The use of color for status shall be unique and consistent for all graphic screens.



The LCD displays shall be interlinked for easy and direct access. Navigation shall be accomplished by mouse selection from Windows like pulldown menus or via hot links on displays. Display hot links shall allow navigation from the general to the specific and include a "PREVIOUS" select point for reversing the previous 10 navigation steps.

The system shall allow the operator to manually control the status of pumps, valves, etc., via either keyboard entry on the currently displayed graphic screen. The status change shall require a secondary acknowledgement (action confirmation) by the operator before the status is processed.

Index displays: Display shall be provided as a guide to the available display options. The index displays shall be a complete and logical listing of the names and number of all screens. Provide hot links on the index displays to allow immediate access to any screen listed.

Graphic displays: The display shall depict basic process schematic diagrams with representative symbols for pumps, tanks, etc., combined with real time process variables or conditions. The equipment represented on the display shall be suitably titled for identity. The displays shall be dynamic (i.e., symbols for a pump shall change color indicating run or stop or alarm, the volume of tanks shall be indicated by varying the height of the interior color of the tank symbol, etc.) The data shall be identified on the display by its name and tag number. All of the current data in the database shall be available for graphic displays. It shall be possible to easily modify an existing display or generate a new display. The graphic displays shall consist of a single master plant flow schematic and multiple subscreens detailing specific plant systems or elements. The process graphic displays shall be comprised of master, area and system displays. The master and area displays shall show general graphic representations of the facility covered with general equipment, alarm, analytical summaries and control capabilities. The system display shall detail all relevant aspects of the individual equipment or system (i.e., an individual pump). The intent is to provide the operator with an overview (Master) with the capability to "zoom in" on a process (Area) or a piece of equipment (System) as necessary. The System Integrator shall use the Process, Mechanical, and Instrumentation Drawings included as part of this Contract to generate the graphic displays.

Trend display: The trend display shall display the value of a process variable versus time. The intent of the display is to resemble the type of plot produced on an analog recorder, only displayed on the LCD. Each of the assigned points will have its point identification number, point name, current value, and instrument range displayed in the color used for its trend. Each point will be trended in a different color. The time period shall be selected and time and date of start, shall be displayed. The values displayed on an historical trend shall consist of the stored values for each variable trended. Provide both historical and real-time trending capability. Real-time trends shall be updated at the scan frequency of the variable. Provide historical and real-time trending for all analog inputs shown on the P&ID. Points shall be logically grouped on a trend screen as directed by IDOT or Engineer.

Alarm summary display: The display shall consist of all points current in alarm, and shall include the tag number, description, time of occurrence, present status (high, low, normal, etc.). The alarm summary shall identify alarm points by severity by utilizing distinct colors for each severity category. The severity classification shall be a configuration option.

**System status displays:** The displays shall summarize all error status of all devices in the system capable of reporting errors to the CPU (e.g., printers, communication devices, communication lines, remote PLCs, etc.). The display shall indicate if an error is detected or a failure occurs. These displays shall be used primarily for maintenance purposes.

**Single Point Configuration/Status displays:** The configuration/status displays shall be of the software vendors standard format.

**Pop-up displays:** Provide pop-up style displays for operator notification, help screens, or ancillary display functions. Pop-up display shall conform to Microsoft Windows look and feel including pop-up termination or action pushbuttons.

**Help displays:** Provide process help displays for all graphic screens developed for this project. Help displays shall be pop-up type and provide operator information about the process graphic currently displayed.

**Setpoint displays:** Provide standard display for all PID loops presenting all analog process variables, associated PID setpoints and loop tuning parameters stored in the PLC. Provide additional level of password protection prior to allowing any changes to loop tuning parameters.

Provide button link graphic icons that allow operator action by selection of the button with the mouse and mouse key. Button link shall be a standard graphic item and be modifiable for any process action or graphic call.

(f) Alarm/Equipment Status Reporting:

The alarm log shall print all alarms as they occur. The alarm message shall include the time of occurrence, tag name, tag number, and whether it's a low, high, or failure alarm. When the point in alarm returns to normal, the time, point identification number, and return to normal shall be printed. All reports shall include the plant equipment number of the associated device.

Equipment status shall be logged whenever a change in status occurs (i.e., start, stop). The status monitoring shall be capable of being disabled and/or suppressed from the operator's console. The equipment status log shall include the time, the equipment name, tag number, and the particular change in status.

The current alarm summary printout shall print all points currently in alarm with point identification number, point name, time of occurrence, and type of alarm.

(g) Daily Operation Summary Report:

The daily operation summary report shall summarize plant operation for the previous day. The report information shall be based on calculations using stored hourly averages of on-line monitored process variables as well as manually input laboratory data. In general, the report shall contain an item for each monitored process related parameter of the facility (i.e., flow, etc.).

The report format shall consist of: the correct date, plant name, report name, page number, group headings, sub-headings, point identifications, and engineering units. The daily minimum, average, maximum, and total where applicable shall also be calculated and printed for each point.

Values for which there are no data available shall be left blank or identified with a special character. Thus, only values which are actually zero shall be printed as such.

The daily operation summary report shall be available for printing or writing to a database file on demand or by schedule. The system shall be initially configured to automatically write the report data to a computer file (a separate file shall be created for each new report) at 1:00 a.m. of the following day. Immediately after the file is created, the system should automatically send the report to the report printer.

The laboratory report portion of the daily operation summary report shall be available for printing by itself, on demand without requiring printing of the entire report.

(h) Monthly Operation Summary Report:

The monthly operation report shall summarize plant operation for the previous calendar month. The information printed shall be based on calculations using stored daily values of on-line monitored process variables as well as manually entered laboratory data.

The report format shall be identical to the daily operation summary report, with the exception of the day being replaced by the month, and the hour column being replaced by the day column.

The monthly operation summary report shall be available for printing or writing to a file, on demand or by schedule during the entire following calendar month. The system shall initially be configured to automatically write the report data to a computer file (a separate file shall be created for each new report) at 1:00 a.m. on the first day of the new month. Immediately after the file is created, the system should automatically send the report to the report printer.

The monthly report shall conform in all other respects to the requirements for the daily report.

Process Reports:

Provide fifteen additional process reports incorporating real-time, historical, or manually entered data. Specifics of these reports shall be coordinated with IDOT during the submittal phase of this project.

PLC Program Development Software System

The System Integrator shall provide as part of the System a software package to allow off-line or on-line ladder logic program development, annotation and monitoring on an IBM or compatible personal computer operating under the computer operating system specified herein.

The software shall be utilized for development of the ladder logic programs and transfer to the PLC. Provide all PLC configuration required to implement the control strategies specified in this Section and shown on E19 SCADA System Diagrams.

The software package shall be completely menu driven and shall be distributed on standard CD's.

All required hardware (including cables, cable adapters, etc.) to allow the PLC's connection to a Standard RS-232-C or USB personal computer port shall be furnished.

The software package shall include a software license agreement allowing IDOT the rights to utilize the software as required for any current or future modification, documentation, or development of the PLC's furnished for this project.

The software shall provide as a minimum the following functions:

Annotation of all ladder elements with at least 3 lines of 6 characters each.

Annotation of all ladder rungs with at least 240 characters.

Provide visual "power flow" monitoring of circuit elements (when connected to the PLC).

Provide annotated ladder diagram printout on a standard IBM compatible dot matrix printer for documentation purposes.

On-line help facility.

Download or upload ladder program from the PLC to the PC.

Provide a ladder element and I/O cross reference table.

Provide all monitoring, forcing, programming error detection, searching, configuration, etc., functions as required to allow an operator/ programmer to completely program a PLC.

Programming software shall be Allen-Bradley RSLogix 5000 for Windows NT. Software shall be suitable for simultaneous operation with the computer based control system software specified herein. Provide means for development software operation without affecting on-line operation of the computer control system.

#### Graphical Interface Panels (GIP)

Provide graphical interface panels incorporated into each PLC as shown on the drawings. Graphical interface panels shall be configured to allow operator access to status and control of local processes being monitored by the PLC. Provide all software, hardware, cables, and appurtenances for a fully configured system.

Provide industrial grade NEMA 4 sealed panel with keypad. Keypad shall include a minimum of 15 user definable panel buttons and 5 user definable control buttons. Provide 12.1-inch, 800 x 600 pixel or 6.5 inch as specified, 640 x 480 pixel, VGA, color TFT display.

Provide PLC communications interface drivers to allow direct access of the graphical interface panel to the PLC and network. During configuration, the System Integrator shall assign specific addressing and input/output access to allow monitoring of the specific local process. Provide a minimum of two configurable serial communication ports.

Provide Windows based configuration software with the graphical interface panels. Configuration software shall utilize fill-in-the-blank style structure and support a minimum of 30 control display pages per panel. Control pages shall be stored in non-volatile EEPROM memory. Configuration shall be performed using the POWS device specified herein.

Provide screen templates for screen configuration including discrete indicator, analog numeric readout, message text display, graphical analog bar, register table, alarm windows, and control button. Panel software shall allow mixing of custom graphics and templates on any page configuration. Provide variable sizing of templates with no limitation on the number of elements on any alarm page.

Provide custom graphic capability for a schematic, graphical representation of the process. Resolution of graphics shall be to the screen pixel level. Custom graphics shall have the ability to be animated including proportional and status color based strategies. Provide a library of pre-developed symbols based on ISA graphical standards.

Provide alarm monitoring capabilities with audio output. Alarm buffer shall store a minimum of 100 alarms for scrolling, review, and acknowledgment by the operator using an alarm summary page. Provide alarm acknowledge and audio output silence logic. Alarm audio output shall be adjustable up to 2 watts maximum.

Provide capacity for a minimum of 500 text messages.

Provide all configuration, transfer, and graphics software as required.

Unit shall operate from 24V DC power source. Operating temperature range shall be 0-50°C with 20-80% humidity range, non-condensing. Provide a single Form C alarm fault contact rated a minimum of 1A at 120 VAC. Contact shall be wired into a discrete input of the PLC serving the GIP.

Graphical interface panel shall be Allen-Bradley Panel View Plus, Cutler-Hammer PanelMate Power Pro, or approved equal.

## 2.9 GIP Software Configuration

2.9.1 General: The GIP graphical presentation shall present graphic logic for the PanelView monitor. Specific details of the graphical presentation at the GIP are not necessarily shown on the Drawings or described in the Control Descriptions. When GIP requirements are not specifically shown, provide GIP panel graphics that match that of the HMI logic for the points as detailed on the Drawings or in the Control Descriptions.

2.9.2 The GIP shall provide the following general purpose screens:

Two system status screens that summarize the present operational status of the pump station and sluice gate structure.

Main menu and navigation screens for the GIP screens presented in a general to specific hierarchy.

System alarm screen that presents a list of critical system wide alarms. Alarms shall be for operator information only. Operator acknowledgment of all system alarms shall not be possible at the GIP level, only at the HMI level.

Local alarm screen that presents a list of local process alarms. Alarms shall be for operator information only. Operator acknowledgment of all system alarms shall not be possible at the GIP level, only at the HMI level.

GIP Help screen(s) that summarize operator interface formats, use of function keys, navigational standards, etc.

2.9.3 GIP Interface shall match to the greatest extent possible the formats used at the HMI level including status colors, alarm presentation, text fonts, screen formats, etc. The operator interface at the GIP shall match that used for the HMI whenever possible.

#### Data Outlet - Industrial

2.10.1 Data Outlets shall support Universal applications in a multivendor environment, accepting modular RJ-45 plugs, and shall be provided with the following features:

Bulkhead connector suitable for through-front of control panel installation.

Gasketed, screw-on closure cap with chain.

Data Jacks – 8 position/ 8 conductor, RJ-45, modular, insulation displacement type for 24 AWG copper cable.

Duplex jack outlet in process building electrical rooms. One process Control Network (PCN) jack, one telephone jack.

NEMA 4 rated.

Quantity of jacks as specified.

#### Uninterruptible Power Supply (UPS) System

Uninterruptible Power Supplies (UPS) System shall be provided for the SCADA and instrumentation systems as shown on the Drawings and specified herein. The UPS shall sustain operation during short-term power failures, and shall provide power for an orderly shutdown to prevent the loss of data during power failure and shall provide isolation between the control system and the plant power system.

The UPS shall be a single phase, true on-line, solid DEPARTMENT unit with microprocessor controlled static inverter, hot pluggable batteries, battery charger, LED display and keypad, and manual isolated make before break maintenance bypass switch.

Under normal operating conditions, the critical load shall be continuously supplied by the UPS inverter. The battery charger shall maintain a float-charge on the battery. When AC line power fails, or goes out of tolerance, the inverter shall obtain power from the batteries and supply AC power to the loads without interruption.

The UPS system shall be sized to sustain 1.5 times the connected full load for a minimum period of 30 minutes in an operating environment of 32°F to 104°F. Final UPS sizing is the responsibility of System Integrator.

The UPS system shall be lightning and surge tested per ANSI/IEEE C62.41 and shall be capable of reducing an input spike to less than 3 volts on the output for a 2000 to 1 spike attenuation. The UPS system shall have 120 dB common mode and 60 dB Transverse mode noise attenuation.

The UPS system shall provide a true separately derived power source as defined in the NEC article 250.30 with output neutral bonded to ground. There shall be no direct connection between input and output and less than 2 pf of effective input to output capacitance.

The UPS system output shall be regulated to 120/208 VAC  $\pm$  3%, single phase three wire, 60 HZ  $\pm$  0.5 HZ over the full dynamic range from no load to full load and low line VAC to high line VAC and low battery voltage to high battery voltage.

The UPS system shall provide computer grade sine wave power with 5 percent or less total harmonic distortion.

The UPS system capacity shall be rated in volt amperes (VA) while loaded with typical computer grade switch mode power supplies having a power factor of 0.6 to 0.7 and crest factor of 2.7 to 3.5.

The UPS system shall have an efficiency of at least 92% when operated from AC line.

The UPS system shall have built-in self-diagnostic monitoring capable of monitoring as a minimum AC volts in/out, AC current in/out, battery voltage, VA load, watts, power factor percent of full load, time of day, system hours, inverter hours and projected run time available. Unit shall have relay contacts that close on UPS alarm condition and normal (utility) power failure.

The UPS system shall have a dual track redundant configuration that utilizes either line or inverter output for power and shall be designed to meet or exceed a MTBF of 100,000 hours.

The system input voltage shall be 120/208 VAC, 60 Hz, single phase, 3 wire. Provide external break before make disconnect switch to allow transition to like power for testing or removal of the UPS.

Topaz P8 or equal 3KVA power conditioner shall be provided.

The system batteries shall be supplied with a battery cabinet of the same design and finish as the UPS. The batteries shall be sealed, no maintenance type rated to provide minimum continuous operation of connected equipment as specified herein.

The System Integrator shall provide sizing data on the UPS listing all loads and calculations required for sizing the UPS system. As a minimum a 3 KVA unit shall be provided. The UPS system shall be as manufactured by Liebert or MGE with maintenance bypass switch and extra battery module or approved equal.

## 2.12 Bubbler System:

2.12.1 Provide compressed air bubbler systems for monitoring pump station levels. Bubbler systems shall be provided for each compression bell location as shown on Plans. Each bubbler system shall include but not be limited to: compressor, pressure transmitter, pressure control valve, flow regulator and purge valve. See drawings for additional information and details.

3. EXECUTION:

3.1 Inspection

3.1.1 Verify that field conditions are acceptable and are ready to receive work.

3.2 Installation

3.2.1 Install Supervisory, Control and Data Acquisition (SCADA) equipment in accordance with manufacturer's instructions.

END OF THIS SECTION

**ALKALI-SILICA REACTION FOR CAST-IN-PLACE CONCRETE (BDE)**

Effective: August 1, 2007

Revised: January 1, 2009

Description. This special provision is intended to reduce the risk of a deleterious alkali-silica reaction in concrete exposed to humid or wet conditions. The special provision is not intended or adequate for concrete exposed to potassium acetate, potassium formate, sodium acetate or sodium formate. The special provision shall not apply to the dry environment (humidity less than 60 percent) found inside buildings for residential or commercial occupancy. The special provision shall also not apply to precast products or precast prestressed products.

Aggregate Expansion Values. Each coarse and fine aggregate will be tested by the Department for alkali reaction according to ASTM C 1260. The test will be performed with Type I or II cement having a total equivalent alkali content ( $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ ) of 0.90 percent or greater. The Engineer will determine the assigned expansion value for each aggregate, and these values will be made available on the Department's Alkali-Silica Potential Reactivity Rating List. The Engineer may differentiate aggregate based on ledge, production method, gradation number, or other factors. An expansion value of 0.05 percent will be assigned to limestone or dolomite coarse aggregates and 0.03 percent to limestone or dolomite fine aggregates (manufactured stone sand); however the Department reserves the right to perform the ASTM C 1260 test.

Aggregate Groups. Each combination of aggregates used in a mixture will be assigned to an aggregate group. The point at which the coarse aggregate and fine aggregate expansion values intersect in the following table will determine the group.

AGGREGATE GROUPS			
Coarse Aggregate or Coarse Aggregate Blend ASTM C 1260 Expansion	Fine Aggregate or Fine Aggregate Blend ASTM C 1260 Expansion		
	$\leq 0.16\%$	$> 0.16\% - 0.27\%$	$> 0.27\%$
$\leq 0.16\%$	Group I	Group II	Group III
$> 0.16\% - 0.27\%$	Group II	Group II	Group III
$> 0.27\%$	Group III	Group III	Group IV



Mixture Options. Based upon the aggregate group, the following mixture options shall be used; however, the Department may prohibit a mixture option if field performance shows a deleterious alkali-silica reaction or Department testing indicates the mixture may experience a deleterious alkali-silica reaction.

- Group I - Mixture options are not applicable. Use any cement or finely divided mineral.
- Group II - Mixture options 1, 2, 3, 4, or 5 shall be used.
- Group III - Mixture options 1, 2 and 3 combined, 4, or 5 shall be used.
- Group IV - Mixture options 1, 2 and 4 combined, or 5 shall be used.

For Class PP-3 concrete the mixture options are not applicable, and any cement may be used with the specified finely divided minerals.

- a) Mixture Option 1. The coarse or fine aggregates shall be blended to place the material in a group that will allow the selected cement or finely divided mineral to be used.

When a coarse or fine aggregate is blended, the weighted expansion value shall be calculated separately for the coarse and fine aggregate as follows:

$$\text{Weighted Expansion Value} = (a/100 \times A) + (b/100 \times B) + (c/100 \times C) + \dots$$

Where: a, b, c... = percentage of aggregate in the blend;  
A, B, C...= expansion value for that aggregate.

- b) Mixture Option 2. A finely divided mineral shall be used as described in 1), 2), 3), or 4) that follow. The replacement ratio is defined as "finely divided mineral:portland cement".

- 1) Class F Fly Ash. For Class PV, BS, MS, DS, SC, and SI concrete and cement aggregate mixture II (CAM II), Class F fly ash shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

- 2) Class C Fly Ash. For Class PV, MS, SC, and SI Concrete, Class C fly ash with 18 percent to less than 26.5 percent calcium oxide content, and less than 2.0 percent loss on ignition, shall replace 20 percent of the portland cement at a minimum replacement ratio of 1:1; or at a minimum replacement ratio of 1.25:1 if the loss on ignition is 2.0 percent or greater. Class C fly ash with less than 18 percent calcium oxide content shall replace 20 percent of the portland cement at a minimum replacement ratio of 1.25:1.

For Class PP-1, RR, BS, and DS concrete and CAM II, Class C fly ash with less than 26.5 percent calcium oxide content shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

- 3) Ground Granulated Blast-Furnace Slag. For Class PV, BS, MS, SI, DS, and SC concrete, ground granulated blast-furnace slag shall replace 25 percent of the portland cement at a minimum replacement ratio of 1:1.

For Class PP-1 and RR concrete, ground granulated blast-furnace slag shall replace 15 percent of the portland cement at a minimum replacement ratio of 1.5:1.

For Class PP-2, ground granulated blast-furnace slag shall replace 25 to 30 percent of the portland cement at a minimum replacement ratio of 1:1.

- 4) Microsilica or High Reactivity Metakaolin. Microsilica solids or high reactivity metakaolin shall be added to the mixture at a minimum 25 lb/cu yd (15 kg/cu m) or 27 lb/cu yd (16 kg/cu m) respectively.
- c) Mixture Option 3. The cement used shall have a maximum total equivalent alkali content ( $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ ) of 0.60 percent. When aggregate in Group II is involved, any finely divided mineral may be used with a portland cement.
- d) Mixture Option 4. The cement used shall have a maximum total equivalent alkali content ( $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ ) of 0.45 percent. When aggregate in Group II or III is involved, any finely divided mineral may be used with a portland cement.
- e) Mixture Option 5. The proposed cement or finely divided mineral may be used if the ASTM C 1567 expansion value is  $\leq 0.16$  percent when performed on the aggregate in the concrete mixture with the highest ASTM C 1260 test result. The ASTM C 1567 test will be valid for two years, unless the Engineer determines the materials have changed significantly. For latex concrete, the ASTM C 1567 test shall be performed without the latex. The 0.20 percent autoclave expansion limit in ASTM C 1567 shall not apply.

If during the two year time period the Contractor needs to replace the cement, and the replacement cement has an equal or lower total equivalent alkali content ( $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ ), a new ASTM C 1567 test will not be required.

Testing. If an individual aggregate has an ASTM C 1260 expansion value  $> 0.16$  percent, an ASTM C 1293 test may be performed by the Contractor to evaluate the Department's ASTM C 1260 test result. The ASTM C 1293 test shall be performed with Type I or II cement having a total equivalent alkali content ( $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ ) of 0.80 percent or greater. The interior vertical wall of the ASTM C 1293 recommended container (pail) shall be half covered with a wick of absorbent material consisting of blotting paper. If the testing laboratory desires to use an alternate container or wick of absorbent material, ASTM C 1293 test results with an alkali-reactive aggregate of known expansion characteristics shall be provided to the Engineer for review and approval. If the expansion is less than 0.040 percent after one year, the aggregate will be assigned an ASTM C 1260 expansion value of 0.08 percent that will be valid for two years, unless the Engineer determines the aggregate has changed significantly.

The Engineer reserves the right to verify a Contractor's ASTM C 1293 or 1567 test result. The Engineer will not accept the result if the precision and bias for the test methods are not met.

The laboratory performing the ASTM C 1567 test shall either be accredited by the AASHTO Materials Reference Laboratory (AMRL) for ASTM C 227 under Portland Cement Concrete or Aggregate; or shall be inspected for Hydraulic Cement - Physical Tests by the Cement and Concrete Reference Laboratory (CCRL) and shall be approved by the Department. The laboratory performing the ASTM C 1293 test shall be inspected for Portland Cement Concrete by CCRL and shall be approved by the Department.

**APPROVAL OF PROPOSED BORROW AREAS, USE AREAS, AND/OR WASTE AREAS  
INSIDE ILLINOIS STATE BORDERS (BDE)**

Effective: November 1, 2008

Revise the title of Article 107.22 of the Standard Specifications to read:

**“107.22 Approval of Proposed Borrow Areas, Use Areas, and/or Waste Areas Inside  
Illinois State Borders.”**

Add the following sentence to the end of the first paragraph of Article 107.22 of the Standard Specifications:

“Proposed borrow areas, use areas, and/or waste areas outside of Illinois shall comply with Article 107.01.”

**CEMENT (BDE)**

Effective: January 1, 2007

Revised: April 1, 2009

Revise Section 1001 of the Standard Specifications to read:

**“SECTION 1001. CEMENT**

**1001.01 Cement Types.** Cement shall be according to the following.

- (a) Portland Cement. Acceptance of portland cement shall be according to the current Bureau of Materials and Physical Research’s Policy Memorandum, “Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants”.

Portland cement shall be according to ASTM C 150, and shall meet the standard physical and chemical requirements. Type I or Type II may be used for cast-in-place, precast, and precast prestressed concrete. Type III may be used according to Article 1020.04, or when approved by the Engineer. All other cements referenced in ASTM C 150 may be used when approved by the Engineer.

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. The total of all inorganic processing additions shall be a maximum of 4.0 percent by weight (mass) of the cement. However, a cement kiln dust inorganic processing addition shall be limited to a maximum of 1.0 percent. Organic processing additions shall be limited to grinding aids that improve the flowability of cement, reduce pack set, and improve grinding efficiency. Inorganic processing additions shall be limited to granulated blast-furnace slag according to the chemical requirements of AASHTO M 302, Class C fly ash according to the chemical requirements of AASHTO M 295, and cement kiln dust.

- (b) Portland-Pozzolan Cement. Acceptance of portland-pozzolan cement shall be according to the current Bureau of Materials and Physical Research’s Policy Memorandum, “Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants”.

Portland-pozzolan cement shall be according to ASTM C 595 and shall meet the standard physical and chemical requirements. Type IP may be used for cast-in-place, precast, and precast prestressed concrete, except when Class PP concrete is used. The pozzolan constituent for Type IP shall be a maximum of 21 percent of the weight (mass) of the portland-pozzolan cement.

For cast-in-place construction, portland-pozzolan cement shall not be used in concrete mixtures when the air temperature is below 40 °F (4 °C) without permission of the Engineer. If permission is given, the mix design strength requirement may require the Contractor to increase the cement or eliminate the cement factor reduction for a water-reducing or high range water-reducing admixture which is permitted according to Article 1020.05(b).

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. Organic processing additions shall be limited to grinding aids as defined in (a) above. Inorganic processing additions shall be limited to cement kiln dust at a maximum of 1.0 percent.

- (c) Portland Blast-Furnace Slag Cement. Acceptance of portland blast-furnace slag cement shall be according to the current Bureau of Materials and Physical Research's Policy Memorandum, "Portland or Blended Cement Acceptance Procedure for Qualified and Non-Qualified Plants".

Portland blast-furnace slag cement shall be according to ASTM C 595 and shall meet the standard physical and chemical requirements. Type IS portland blast-furnace slag cement may be used for cast-in-place, precast, and precast prestressed concrete, except when Class PP concrete is used. The blast-furnace slag constituent for Type IS shall be a maximum of 25 percent of the weight (mass) of the portland blast-furnace slag cement.

For cast-in-place construction, portland blast-furnace slag cement shall not be used in concrete mixtures when the air temperature is below 40 °F (4 °C) without permission of the Engineer. If permission is given, the mix design strength requirement may require the Contractor to increase the cement or eliminate the cement factor reduction for a water-reducing or high range water-reducing admixture which is permitted according to Article 1020.05(b).

The total of all organic processing additions shall be a maximum of 1.0 percent by weight (mass) of the cement. Organic processing additions shall be limited to grinding aids as defined in (a) above. Inorganic processing additions shall be limited to cement kiln dust at a maximum of 1.0 percent.

- (d) Rapid Hardening Cement. Rapid hardening cement shall be used according to Article 1020.04 or when approved by the Engineer. The cement shall be on the Department's current "Approved List of Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs", and shall be according to the following.

(1) The cement shall have a maximum final set of 25 minutes, according to Illinois Modified ASTM C 191.

- (2) The cement shall have a minimum compressive strength of 2000 psi (13,800 kPa) at 3.0 hours, 3200 psi (22,100 kPa) at 6.0 hours, and 4000 psi (27,600 kPa) at 24.0 hours, according to Illinois Modified ASTM C 109.
  - (3) The cement shall have a maximum drying shrinkage of 0.050 percent at seven days, according to Illinois Modified ASTM C 596.
  - (4) The cement shall have a maximum expansion of 0.020 percent at 14 days, according to Illinois Modified ASTM C 1038.
  - (5) The cement shall have a minimum 80 percent relative dynamic modulus of elasticity; and shall not have a weight (mass) gain in excess of 0.15 percent or a weight (mass) loss in excess of 1.0 percent, after 100 cycles, according to AASHTO T 161, Procedure B.
- (e) Calcium Aluminate Cement. Calcium aluminate cement shall be used only where specified by the Engineer. The cement shall meet the standard physical requirements for Type I cement according to ASTM C 150, except the time of setting shall not apply. The chemical requirements shall be determined according to ASTM C 114 and shall be as follows: minimum 38 percent aluminum oxide ( $Al_2O_3$ ), maximum 42 percent calcium oxide (CaO), maximum 1 percent magnesium oxide (MgO), maximum 0.4 percent sulfur trioxide ( $SO_3$ ), maximum 1 percent loss on ignition, and maximum 3.5 percent insoluble residue.

**1001.02 Uniformity of Color.** Cement contained in single loads or in shipments of several loads to the same project shall not have visible differences in color.

**1001.03 Mixing Brands and Types.** Different brands or different types of cement from the same manufacturing plant, or the same brand or type from different plants shall not be mixed or used alternately in the same item of construction unless approved by the Engineer.

**1001.04 Storage.** Cement shall be stored and protected against damage, such as dampness which may cause partial set or hardened lumps. Different brands or different types of cement from the same manufacturing plant, or the same brand or type from different plants shall be kept separate.”

## **CONCRETE ADMIXTURES (BDE)**

Effective: January 1, 2003

Revised: April 1, 2009

Replace the first paragraph of Article 1020.05(b) of the Standard Specifications to read:

- “(b) Admixtures. The use of admixtures to increase the workability or to accelerate the hardening of the concrete will be permitted when approved by the Engineer. Admixture dosages shall result in the mixture meeting the specified plastic and hardened properties. The Department will maintain an Approved List of Corrosion Inhibitors. Corrosion inhibitor dosage rates shall be according to Article 1020.05(b)(12). The Department will also maintain an Approved List of Concrete Admixtures, and an admixture technical representative shall be consulted when determining an admixture dosage from this list.

The dosage shall be within the range indicated on the approved list unless the influence by other admixtures, jobsite conditions (such as a very short haul time), or other circumstances warrant a dosage outside the range. The Engineer shall be notified when a dosage is proposed outside the range. To determine an admixture dosage, air temperature, concrete temperature, cement source and quantity, finely divided mineral sources(s) and quantity, influence of other admixtures, haul time, placement conditions, and other factors as appropriate shall be considered. The Engineer may request the Contractor to have a batch of concrete mixed in the lab or field to verify the admixture dosage is correct. An admixture dosage or combination of admixture dosages shall not delay the initial set of concrete by more than one hour. When a retarding admixture is required or appropriate for a bridge deck or bridge deck overlay pour, the initial set time shall be delayed until the deflections due to the concrete dead load are no longer a concern for inducing cracks in the completed work. However, a retarding admixture shall not be used to further extend the pour time and justify the alteration of a bridge deck pour sequence.

When determining water in admixtures for water/cement ratio, the Contractor shall calculate 70 percent of the admixture dosage as water, except a value of 50 percent shall be used for a latex admixture used in bridge deck latex concrete overlays.”

Revise Section 1021 of the Standard Specifications to read:

#### **“SECTION 1021. CONCRETE ADMIXTURES**

**1021.01 General.** Admixtures shall be furnished in liquid form ready for use. The admixtures shall be delivered in the manufacturer's original containers, bulk tank trucks or such containers or tanks as are acceptable to the Engineer. Delivery shall be accompanied by a ticket which clearly identifies the manufacturer and trade name of the material. Containers shall be readily identifiable as to manufacturer and trade name of the material they contain.

Corrosion inhibitors will be maintained on the Department's Approved List of Corrosion Inhibitors. All other concrete admixture products will be maintained on the Department's Approved List of Concrete Admixtures. For the admixture submittal, a report prepared by an independent laboratory accredited by the AASHTO Materials Reference Laboratory (AMRL) for Portland Cement Concrete shall be provided. The report shall show the results of physical tests conducted no more than five years prior to the time of submittal, according to applicable specifications. However, for corrosion inhibitors the ASTM G 109 test information specified in ASTM C 1582 is not required to be from an independent lab. All other information in ASTM C 1582 shall be from an independent lab.

Tests shall be conducted using materials and methods specified on a "test" concrete and a "reference" concrete, together with a certification that no changes have been made in the formulation of the material since the performance of the tests. Per the manufacturer's option, the cement content for all required tests shall either be according to applicable specifications or 5.65 cwt/cu yd (335 kg/cu m). Compressive strength test results for six months and one year will not be required.

Prior to the approval of an admixture, the Engineer reserves the right to request a sample for testing. The test and reference concrete mixtures tested by the Engineer will contain a cement content of 5.65 cwt/cu yd (335 kg/cu m).

For freeze-thaw testing, the Department will perform the test according to AASHTO T 161, Procedure B. The flexural strength test will be performed according to AASHTO T 177. If the Engineer decides to test the admixture, the manufacturer shall submit AASHTO T 197 water content and set time test results on the standard cement used by the Department. The test and reference concrete mixture shall contain a cement content of 5.65 cwt/cu yd (335 kg/cu m). The manufacturer may select their lab or an independent lab to perform this testing. The laboratory is not required to be accredited by AASHTO.

The manufacturer shall include in the submittal the following admixture information: the manufacturing range for specific gravity, the midpoint and manufacturing range for residue by oven drying, and the manufacturing range for pH. The submittal shall also include an infrared spectrophotometer trace no more than five years old.

For air-entraining admixtures according to Article 1021.02, the specific gravity allowable manufacturing range shall be established by the manufacturer and the test method shall be according to ASTM C 494. For residue by oven drying and pH, the allowable manufacturing range and test methods shall be according to ASTM C 260.

For admixtures according to Articles 1021.03, 1021.04, 1021.05, 1021.06, and 1021.07, the pH allowable manufacturing range shall be established by the manufacturer and the test method shall be according to ASTM E 70. For specific gravity and residue by oven drying, the allowable manufacturing range and test methods shall be according to ASTM C 494.

When test results are more than seven years old, the manufacturer shall re-submit the infrared spectrophotometer trace and the report prepared by an independent laboratory accredited by AASHTO.

All admixtures, except chloride-based accelerators, shall contain a maximum of 0.3 percent chloride by weight (mass).

Random field samples may be taken by the Department to verify an admixture meets specification. A split sample will be provided to the manufacturer if requested. Admixtures that do not meet specification requirements or an allowable manufacturing range established by the manufacturer shall be replaced with new material.

**1021.02 Air-Entraining Admixtures.** Air-entraining admixtures shall be according to AASHTO M 154.

**1021.03 Retarding and Water-Reducing Admixtures.** The admixture shall be according to the following.

- (a) The retarding admixture shall be according to AASHTO M 194, Type B (retarding) or Type D (water-reducing and retarding).
- (b) The water-reducing admixture shall be according to AASHTO M 194, Type A.
- (c) The high range water-reducing admixture shall be according to AASHTO M 194, Type F (high range water-reducing) or Type G (high range water-reducing and retarding).

**1021.04 Accelerating Admixtures.** The admixture shall be according to AASHTO M 194, Type C (accelerating) or Type E (water reducing and accelerating).

**1021.05 Self-Consolidating Admixtures.** The self-consolidating admixture system shall consist of either a high range water-reducing admixture only or a high range water-reducing admixture combined with a separate viscosity modifying admixture. The one or two component admixture system shall be capable of producing a concrete mixture that can flow around reinforcement and consolidate under its own weight without additional effort and without segregation.

The high range water-reducing admixture shall be according to AASHTO M 194, Type F.

The viscosity modifying admixture shall be according to ASTM C 494, Type S (specific performance).

**1021.06 Rheology-Controlling Admixture.** The rheology-controlling admixture shall be capable of producing a concrete mixture with a lower yield stress that will consolidate easier for slipform applications used by the Contractor. The rheology-controlling admixture shall be according to ASTM C 494, Type S (specific performance).

**1021.07 Corrosion Inhibitor.** The corrosion inhibitor shall be according to one of the following.

- (a) Calcium Nitrite. The corrosion inhibitor shall contain a minimum 30 percent calcium nitrite by weight (mass) of solution, and shall comply with the requirements of AASHTO M 194, Type C (accelerating).
- (b) Other Materials. The corrosion inhibitor shall be according to ASTM C 1582.”

#### **CONSTRUCTION AIR QUALITY – DIESEL RETROFIT (BDE)**

Effective: June 1, 2010

The reduction of emissions of particulate matter (PM) for off-road equipment shall be accomplished by installing retrofit emission control devices. The term “equipment” refers to diesel fuel powered devices rated at 50 hp and above, to be used on the jobsite in excess of seven calendar days over the course of the construction period on the jobsite (including rental equipment).

Contractor and subcontractor diesel powered off-road equipment assigned to the contract shall be retrofitted using the phased in approach shown below. Equipment that is of a model year older than the year given for that equipment’s respective horsepower range shall be retrofitted:

Effective Dates	Horsepower Range	Model Year
June 1, 2010 <sup>1/</sup>	600-749	2002
	750 and up	2006



June 1, 2011 <sup>2/</sup>	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006
June 1, 2012 <sup>2/</sup>	50-99	2004
	100-299	2003
	300-599	2001
	600-749	2002
	750 and up	2006

- 1/ Effective dates apply to Contractor diesel powered off-road equipment assigned to the contract.
- 2/ Effective dates apply to Contractor and subcontractor diesel powered off-road equipment assigned to the contract.

The retrofit emission control devices shall achieve a minimum PM emission reduction of 50 percent and shall be:

- a) Included on the U.S. Environmental Protection Agency (USEPA) *Verified Retrofit Technology List* (<http://www.epa.gov/otaq/retrofit/verif-list.htm>), or verified by the California Air Resources Board (CARB) (<http://www.arb.ca.gov/diesel/verde/verdev.htm>); or
- b) Retrofitted with a non-verified diesel retrofit emission control device if verified retrofit emission control devices are not available for equipment proposed to be used on the project, and if the Contractor has obtained a performance certification from the retrofit device manufacturer that the emission control device provides a minimum PM emission reduction of 50 percent.

Note: Large cranes (Crawler mounted cranes) which are responsible for critical lift operations are exempt from installing retrofit emission control devices if such devices adversely affect equipment operation.

Diesel powered off-road equipment with engine ratings of 50 hp and above, which are unable to be retrofitted with verified emission control devices or if performance certifications are not available which will achieve a minimum 50 percent PM reduction, may be granted a waiver by the Department if documentation is provided showing good faith efforts were made by the Contractor to retrofit the equipment.

Construction shall not proceed until the Contractor submits a certified list of the diesel powered off-road equipment that will be used, and as necessary, retrofitted with emission control devices. The list(s) shall include (1) the equipment number, type, make, Contractor/rental company name; and (2) the emission control devices make, model, USEPA or CARB verification number, or performance certification from the retrofit device manufacturer. Equipment reported as fitted with emissions control devices shall be made available to the Engineer for visual inspection of the device installation, prior to being used on the jobsite.

The Contractor shall submit an updated list of retrofitted off-road construction equipment as retrofitted equipment changes or comes on to the jobsite. The addition or deletion of any diesel powered equipment shall be included on the updated list.

If any diesel powered off-road equipment is found to be in non-compliance with any portion of this special provision, the Engineer will issue the Contractor a diesel retrofit deficiency deduction.

Any costs associated with retrofitting any diesel powered off-road equipment with emission control devices shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall not be grounds for a claim.

### **Diesel Retrofit Deficiency Deduction**

When the Engineer determines that a diesel retrofit deficiency exists, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

The deficiency will be based on lack of diesel retrofit emissions control.

If a Contractor accumulates three diesel retrofit deficiency deductions for the same piece of equipment in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of the contract time, waiver of penalties, or be grounds for any claim.

### **CONSTRUCTION AIR QUALITY - DIESEL VEHICLE EMISSIONS CONTROL (BDE)**

Effective: April 1, 2009

Revised: July 1, 2009

Diesel Vehicle Emissions Control. The reduction of construction air emissions shall be accomplished by using cleaner burning diesel fuel. The term "equipment" refers to any and all diesel fuel powered devices rated at 50 hp and above, to be used on the project site in excess of seven calendar days over the course of the construction period on the project site (including any "rental" equipment).

All equipment on the jobsite, with engine ratings of 50 hp and above, shall be required to: use Ultra Low Sulfur Diesel fuel (ULSD) exclusively (15 ppm sulfur content or less).

Diesel powered equipment in non-compliance will not be allowed to be used on the project site, and is also subject to a notice of non-compliance as outlined below.

The Contractor shall submit copies of monthly summary reports and include certified copies of the ULSD diesel fuel delivery slips for diesel fuel delivered to the jobsite for the reporting time period, noting the quantity of diesel fuel used.

If any diesel powered equipment is found to be in non-compliance with any portion of this specification, the Engineer will issue the Contractor a notice of non-compliance and identify an appropriate period of time, as outlined below under environmental deficiency deduction, in which to bring the equipment into compliance or remove it from the project site.

Any costs associated with bringing any diesel powered equipment into compliance with these diesel vehicle emissions controls shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed. The Contractor's compliance with this notice and any associated regulations shall also not be grounds for a claim.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists, he/she will notify the Contractor in writing, and direct the Contractor to correct the deficiency within a specified time period. The specified time-period, which begins upon Contractor notification, will be from 1/2 hour to 24 hours long, based on the urgency of the situation and the nature of the deficiency. The Engineer shall be the sole judge regarding the time period.

The deficiency will be based on lack of repair, maintenance and diesel vehicle emissions control.

If the Contractor fails to correct the deficiency within the specified time frame, a daily monetary deduction will be imposed for each calendar day or fraction thereof the deficiency continues to exist. The calendar day(s) will begin when the time period for correction is exceeded and end with the Engineer's written acceptance of the correction. The daily monetary deduction will be \$1,000.00 for each deficiency identified.

If a Contractor or subcontractor accumulates three environmental deficiency deductions in a contract period, the Contractor will be shutdown until the deficiency is corrected. Such a shutdown will not be grounds for any extension of contract time, waiver of penalties, or be grounds for any claim.

## **CONSTRUCTION AIR QUALITY - IDLING RESTRICTIONS (BDE)**

Effective: April 1, 2009

Idling Restrictions. The Contractor shall establish truck-staging areas for all diesel powered vehicles that are waiting to load or unload material at the jobsite. Staging areas shall be located where the diesel emissions from the equipment will have a minimum impact on adjacent sensitive receptors. The Department will review the selection of staging areas, whether within or outside the existing highway right-of-way, to avoid locations near sensitive areas or populations to the extent possible. Sensitive receptors include, but are not limited to, hospitals, schools, residences, motels, hotels, daycare facilities, elderly housing and convalescent facilities. Diesel powered engines shall also be located as far away as possible from fresh air intakes, air conditioners, and windows. The Engineer will approve staging areas before implementation.

Diesel powered vehicle operators may not cause or allow the motor vehicle, when it is not in motion, to idle for more than a total of 10 minutes within any 60 minute period, except under any of the following circumstances:

- 1) The motor vehicle has a gross vehicle weight rating of less than 8000 lb (3630 kg).
- 2) The motor vehicle idles while forced to remain motionless because of on-highway traffic, an official traffic control device or signal, or at the direction of a law enforcement official.
- 3) The motor vehicle idles when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency.
- 4) A police, fire, ambulance, public safety, other emergency or law enforcement motor vehicle, or any motor vehicle used in an emergency capacity, idles while in an emergency or training mode and not for the convenience of the vehicle operator.
- 5) The primary propulsion engine idles for maintenance, servicing, repairing, or diagnostic purposes if idling is necessary for such activity.
- 6) A motor vehicle idles as part of a government inspection to verify that all equipment is in good working order, provided idling is required as part of the inspection.
- 7) When idling of the motor vehicle is required to operate auxiliary equipment to accomplish the intended use of the vehicle (such as loading, unloading, mixing, or processing cargo; controlling cargo temperature; construction operations, lumbering operations; oil or gas well servicing; or farming operations), provided that this exemption does not apply when the vehicle is idling solely for cabin comfort or to operate non-essential equipment such as air conditioning, heating, microwave ovens, or televisions.
- 8) When the motor vehicle idles due to mechanical difficulties over which the operator has no control.
- 9) The outdoor temperature is less than 32 °F (0 °C) or greater than 80 °F (26 °C).

When the outdoor temperature is greater than or equal to 32 °F (0 °C) or less than or equal to 80 °F (26 °C), a person who operates a motor vehicle operating on diesel fuel shall not cause or allow the motor vehicle to idle for a period greater than 30 minutes in any 60 minute period while waiting to weigh, load, or unload cargo or freight, unless the vehicle is in a line of vehicles that regularly and periodically moves forward.

The above requirements do not prohibit the operation of an auxiliary power unit or generator set as an alternative to idling the main engine of a motor vehicle operating on diesel fuel.

Environmental Deficiency Deduction. When the Engineer is notified, or determines that an environmental control deficiency exists based on non-compliance with the idling restrictions, he/she will notify the Contractor, and direct the Contractor to correct the deficiency.

If the Contractor fails to correct the deficiency a monetary deduction will be imposed. The monetary deduction will be \$1,000.00 for each deficiency identified.

#### **DETERMINATION OF THICKNESS (BDE)**

Effective: April 1, 2009

Revise Articles 353.12 and 353.13 of the Standard Specifications to Articles 353.13 and 353.14 respectively.

Add the following Article to the Standard Specifications:

**“353.12 Tolerance in Thickness.** The thickness of base course pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction, bike paths, and individual locations less than 500 ft (150 m) long, will be evaluated.

Temporary construction is defined as those areas constructed and removed under the same contract. If the base course cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course thickness.

The procedure described in Article 407.10(b) will be followed, except the option of correcting deficient pavement with additional lift(s) shall not apply.”

Revise Article 354.09 of the Standard Specifications to read:

**“354.09 Tolerance in Thickness.** The thickness of base course widening pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 3 ft (1 m) wide or 1000 ft (300 m) long, will be evaluated. Temporary construction is defined as those areas constructed and removed under the same contract. If the base course widening cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course widening thickness.

The procedure described in Article 407.10(b) will be followed, except:

- (a) The width of a unit shall be the width of the widening along one edge of the pavement.
- (b) The length of the unit shall be 1000 ft (300 m).
- (c) The option of correcting deficient pavement with additional lift(s) shall not apply.”

Revise Article 355.09 of the Standard Specifications to read:

**“355.09 Tolerance in Thickness.** The thickness of HMA base course pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 500 ft (150 m) long, will be evaluated according to Article 407.10(b). Temporary construction is defined as those areas constructed and removed under the same contract. If the base course cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s), and subtract them from the measured core thickness to determine the base course thickness.”

Revise Article 356.07 of the Standard Specifications to read:

**“356.07 Tolerance in Thickness.** The thickness of HMA base course widening pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous area, except for temporary construction; bike paths and individual locations less than 3 ft (1 m) wide or 1000 ft (300 m) long, will be evaluated according to Article 407.10(b) except, the width of a unit shall be the width of the widening along one edge of the pavement and the length of a unit shall be 1000 ft (300 m). Temporary locations are defined as those constructed and removed under the same contract. If the base course widening cannot be cored for thickness prior to placement of the cover layer(s), the Engineer will determine the thickness of the cover layer(s) and subtract them from the measured core thickness to determine the base course widening thickness.”

Revise Article 407.10 of the Standard Specifications to read:

**“407.10 Tolerance in Thickness.** Determination of pavement thickness shall be performed after the pavement surface tests and corrective action have been completed according to Article 407.09. Pay adjustments made for pavement thickness will be in addition to and independent of those made for pavement smoothness. Pavement pay items that individually contain at least 1000 sq yd (840 sq m) of contiguous pavement shall be evaluated with the following exclusions: temporary pavements; variable width pavements; radius returns; short lengths of contiguous pavements less than 500 ft (125 m) in length; and constant width portions of turn lanes less than 500 ft (125 m) in length. Temporary pavements are defined as pavements constructed and removed under the same contract.

The method described in Article 407.10(a), shall be used except for those pavements constructed in areas where access to side streets and entrances necessitates construction in segments less than 1000 ft (300 m). The method described in Article 407.10(b) shall be used in areas where access to side streets and entrances necessitates construction in segments less than 1000 ft (300 m).

(a) Percent Within Limits. The percent within limits (PWL) method shall be as follows.

- (1) Lots and Sublots. The pavement will be divided into approximately equal lots of not more than 5000 ft (1500 m) in length. When the length of a continuous strip of pavement is 500 ft (150 m) or greater but less than 5000 ft (1500 m), these short lengths of pavement, ramps, turn lanes, and other short sections of continuous pavement will be grouped together to form lots approximately 5000 ft (1500 m) in length. Short segments between structures will be measured continuously with the structure segments omitted. Each lot will be subdivided into ten equal sublots. The width of a subplot and lot will be the width from the pavement edge to the adjacent lane line, from one lane line to the next, or between pavement edges for single-lane pavements.
- (2) Cores. Cores 2 in. (50 mm) in diameter shall be taken from the pavement by the Contractor, at locations selected by the Engineer. The exact location for each core will be selected at random, but will result in one core per subplot. Core locations will be specified prior to beginning the coring operations.

The Contractor and the Engineer shall witness the coring operations, as well as the measuring and recording of the core lengths. The cores will be measured with a device supplied by the Department immediately upon removal from the core bit and prior to moving to the next core location. Upon concurrence of the length, the core samples shall be disposed of according to Article 202.03.

Upon completion of each core, all water shall be removed from the hole and the hole then filled with a rapid hardening mortar or concrete. The material shall be mixed in a separate container, placed in the hole, consolidated by rodding, and struck-off flush with the adjacent pavement.

- (3) Deficient Sublot. When the length of the core in a subplot is deficient by more than ten percent of plan thickness, the Contractor may take three additional cores within that subplot at locations selected at random by the Engineer. If the Contractor chooses not to take additional cores, the pavement in that subplot shall be removed and replaced.

When the three additional cores are taken, the length of those cores will be averaged with the original core length. If the average shows the subplot to be deficient by ten percent or less, no additional action is necessary. If the average shows the subplot to be deficient by more than ten percent, the pavement in that subplot shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such deficient sublots to remain in place. For deficient sublots allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When a deficient subplot is removed and replaced, or additional lifts are placed, the corrected subplot shall be retested for thickness. The length of the new core taken in the subplot will be used in determining the PWL for the lot.

When a deficient subplot is left in place, and no additional lift(s) are placed, no payment will be made for the deficient subplot. The length of the original core taken in the subplot will be used in determining the PWL for the lot.

- (4) Deficient Lot. After addressing deficient sublots, the PWL for each lot will be determined. When the PWL of a lot is 60 percent or less, the pavement in that lot shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such deficient lots to remain in place. For deficient lots allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When a deficient lot is removed and replaced, or additional lifts are placed, the corrected lot shall be retested for thickness. The PWL for the lot will then be recalculated based upon the new cores; however, the pay factor for the lot shall be a maximum of 100 percent.

When a deficient lot is left in place, and no additional lift(s) are placed, the PWL for the lot will not be recalculated.

- (5) Right of Discovery. When the Engineer has reason to believe the random core selection process will not accurately represent the true conditions of the work, he/she may order additional cores. The additional cores shall be taken at specific locations determined by the Engineer. The Engineer will provide notice to the Contractor containing an explanation of the reasons for his/her action. The need for, and location of, additional cores will be determined prior to commencement of coring operations.

When the additional cores show the pavement to be deficient by more than ten percent of plan thickness, more additional cores shall be taken to determine the limits of the deficient pavement and that area shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such areas of deficient pavement to remain in place.

The area of deficient pavement will be defined using the length between two acceptable cores and the full width of the subplot. An acceptable core is a core with a length of at least 90 percent of plan thickness.

For deficient areas allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When an area of deficient pavement is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness.

When an area of deficient pavement is left in place, and no additional lift(s) are placed, no payment will be made for the deficient pavement.

When the additional cores show the pavement to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04.

(6) Profile Index Adjustment. After any area of pavement is removed and replaced or any additional lifts are placed, the corrected areas shall be retested for pavement smoothness and any necessary profile index adjustments and/or corrections will be made based on these final profile readings prior to retesting for thickness.

(7) Determination of PWL. The PWL for each lot will be determined as follows.

Definitions:

- $x_i$  = Individual values (core lengths) under consideration
- $n$  = Number of individual values under consideration (10 per lot)
- $\bar{x}$  = Average of the values under consideration
- LSL = Lower Specification Limit (98% of plan thickness)
- $Q_L$  = Lower Quality Index
- $s$  = Sample Standard Deviation
- PWL = Percent Within Limits

Determine  $\bar{x}$  for the lot to the nearest two decimal places.

Determine  $s$  for the lot to the nearest three decimal places using:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}} \quad \text{where} \quad \sum(x_i - \bar{x})^2 = (x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_{10} - \bar{x})^2$$

Determine  $Q_L$  for the lot to the nearest two decimal places using:

$$Q_L = \frac{(\bar{x} - LSL)}{s}$$



Determine PWL for the lot using the  $Q_L$  and the following table. For  $Q_L$  values less than zero the value shown in the table must be subtracted from 100 to obtain PWL.

- (8) Pay Factors. The pay factor (PF) for each lot will be determined, to the nearest two decimal places, using:

$$\text{PF (in percent)} = 55 + 0.5 (\text{PWL})$$

If  $\bar{x}$  for a lot is less than the plan thickness, the maximum PF for that lot shall be 100 percent.

- (9) Payment. Payment of incentive or disincentive for pay items subject to the PWL method will be calculated using:

$$\text{Payment} = (((\text{TPF}/100) - 1) \times \text{CUP}) \times (\text{TOTPAVT} - \text{DEFPAVT})$$

TPF = Total Pay Factor

CUP = Contract Unit Price

TOTPAVT = Area of Pavement Subject to Coring

DEFPAVT = Area of Deficient Pavement

The TPF for the pavement shall be the average of the PF for all the lots; however, the TPF shall not exceed 102 percent.

Area of Deficient pavement (DEFPAVT) is defined as an area of pavement represented by a subplot deficient by more than ten percent which is left in place with no additional thickness added.

Area of Pavement Subject to Coring (TOTPAVT) is defined as those pavement areas included in lots for pavement thickness determination.

PERCENT WITHIN LIMITS							
Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)	Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)	Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)	Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)
0.00	50.00	0.40	65.07	0.80	78.43	1.20	88.76
0.01	50.38	0.41	65.43	0.81	78.72	1.21	88.97
0.02	50.77	0.42	65.79	0.82	79.02	1.22	89.17
0.03	51.15	0.43	66.15	0.83	79.31	1.23	89.38
0.04	51.54	0.44	66.51	0.84	79.61	1.24	89.58
0.05	51.92	0.45	66.87	0.85	79.90	1.25	89.79
0.06	52.30	0.46	67.22	0.86	80.19	1.26	89.99
0.07	52.69	0.47	67.57	0.87	80.47	1.27	90.19
0.08	53.07	0.48	67.93	0.88	80.76	1.28	90.38
0.09	53.46	0.49	68.28	0.89	81.04	1.29	90.58
0.10	53.84	0.50	68.63	0.90	81.33	1.30	90.78
0.11	54.22	0.51	68.98	0.91	81.61	1.31	90.96
0.12	54.60	0.52	69.32	0.92	81.88	1.32	91.15
0.13	54.99	0.53	69.67	0.93	82.16	1.33	91.33
0.14	55.37	0.54	70.01	0.94	82.43	1.34	91.52
0.15	55.75	0.55	70.36	0.95	82.71	1.35	91.70
0.16	56.13	0.56	70.70	0.96	82.97	1.36	91.87
0.17	56.51	0.57	71.04	0.97	83.24	1.37	92.04
0.18	56.89	0.58	71.38	0.98	83.50	1.38	92.22
0.19	57.27	0.59	71.72	0.99	83.77	1.39	92.39
0.20	57.65	0.60	72.06	1.00	84.03	1.40	92.56
0.21	58.03	0.61	72.39	1.01	84.28	1.41	92.72
0.22	58.40	0.62	72.72	1.02	84.53	1.42	92.88
0.23	58.78	0.63	73.06	1.03	84.79	1.43	93.05
0.24	59.15	0.64	73.39	1.04	85.04	1.44	93.21
0.25	59.53	0.65	73.72	1.05	85.29	1.45	93.37
0.26	59.90	0.66	74.04	1.06	85.53	1.46	93.52
0.27	60.28	0.67	74.36	1.07	85.77	1.47	93.67
0.28	60.65	0.68	74.69	1.08	86.02	1.48	93.83
0.29	61.03	0.69	75.01	1.09	86.26	1.49	93.98
0.30	61.40	0.70	75.33	1.10	86.50	1.50	94.13
0.31	61.77	0.71	75.64	1.11	86.73	1.51	94.27
0.32	62.14	0.72	75.96	1.12	86.96	1.52	94.41
0.33	62.51	0.73	76.27	1.13	87.20	1.53	94.54
0.34	62.88	0.74	76.59	1.14	87.43	1.54	94.68
0.35	63.25	0.75	76.90	1.15	87.66	1.55	94.82
0.36	63.61	0.76	77.21	1.16	87.88	1.56	94.95
0.37	63.98	0.77	77.51	1.17	88.10	1.57	95.08
0.38	64.34	0.78	77.82	1.18	88.32	1.58	95.20
0.39	64.71	0.79	78.12	1.19	88.54	1.59	95.33

\*For Q<sub>L</sub> values less than zero, subtract the table value from 100 to obtain PWL

PERCENT WITHIN LIMITS (continued)					
Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)	Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)	Quality Index (Q <sub>L</sub> )*	Percent Within Limits (PWL)
1.60	95.46	2.00	98.83	2.40	99.89
1.61	95.58	2.01	98.88	2.41	99.90
1.62	95.70	2.02	98.92	2.42	99.91
1.63	95.81	2.03	98.97	2.43	99.91
1.64	95.93	2.04	99.01	2.44	99.92
1.65	96.05	2.05	99.06	2.45	99.93
1.66	96.16	2.06	99.10	2.46	99.94
1.67	96.27	2.07	99.14	2.47	99.94
1.68	96.37	2.08	99.18	2.48	99.95
1.69	96.48	2.09	99.22	2.49	99.95
1.70	96.59	2.10	99.26	2.50	99.96
1.71	96.69	2.11	99.29	2.51	99.96
1.72	96.78	2.12	99.32	2.52	99.97
1.73	96.88	2.13	99.36	2.53	99.97
1.74	96.97	2.14	99.39	2.54	99.98
1.75	97.07	2.15	99.42	2.55	99.98
1.76	97.16	2.16	99.45	2.56	99.98
1.77	97.25	2.17	99.48	2.57	99.98
1.78	97.33	2.18	99.50	2.58	99.99
1.79	97.42	2.19	99.53	2.59	99.99
1.80	97.51	2.20	99.56	2.60	99.99
1.81	97.59	2.21	99.58	2.61	99.99
1.82	97.67	2.22	99.61	2.62	99.99
1.83	97.75	2.23	99.63	2.63	100.00
1.84	97.83	2.22	99.66	2.64	100.00
1.85	97.91	2.25	99.68	≥ 2.65	100.00
1.86	97.98	2.26	99.70		
1.87	98.05	2.27	99.72		
1.88	98.11	2.28	99.73		
1.89	98.18	2.29	99.75		
1.90	98.25	2.30	99.77		
1.91	98.31	2.31	99.78		
1.92	98.37	2.32	99.80		
1.93	98.44	2.33	99.81		
1.94	98.50	2.34	99.83		
1.95	98.56	2.35	99.84		
1.96	98.61	2.36	99.85		
1.97	98.67	2.37	99.86		
1.98	98.72	2.38	99.87		
1.99	98.78	2.39	99.88		

\*For Q<sub>L</sub> values less than zero, subtract the table value from 100 to obtain PWL

(b) Minimum Thickness. The minimum thickness method shall be as follows.

- (1) Length of Units. The length of a unit will be a continuous strip of pavement 500 ft (150 m) in length.
- (2) Width of Units. The width of a unit will be the width from the pavement edge to the adjacent lane line, from one lane line to the next, or between pavement edges for single-lane pavements.
- (3) Thickness Measurements. Pavement thickness will be based on 2 in. (50 mm) diameter cores.

Cores shall be taken from the pavement by the Contractor at locations selected by the Engineer. When determining the thickness of a unit, one core shall be taken in each unit.

The Contractor and the Engineer shall witness the coring operations, as well as the measuring and recording of the cores. Core measurements will be determined immediately upon removal from the core bit and prior to moving to the next core location. Upon concurrence of the length, the core samples may be disposed of according to Article 202.03.

Upon completion of each core, all water shall be removed from the hole and the hole then filled with a rapid hardening mortar or concrete. The material shall be mixed in a separate container, placed in the hole, consolidated by rodding, and struck-off flush with the adjacent pavement.

- (4) Unit Deficient in Thickness. In considering any portion of the pavement that is deficient, the entire limits of the unit will be used in computing the deficiency or determining the remedial action required.
- (5) Thickness Equals or Exceeds Specified Thickness. When the thickness of a unit equals or exceeds the specified plan thickness, payment will be made at the contract unit price per square yard (square meter) for the specified thickness.
- (6) Thickness Deficient by Ten Percent or Less. When the thickness of a unit is less than the specified plan thickness by ten percent or less, a deficiency deduction will be assessed against payment for the item involved. The deficiency will be a percentage of the contract unit price as given in the following table.

Percent Deficiency (of Plan Thickness)	Percent Deduction (of Contract Unit Price)
0.0 to 2.0	0
2.1 to 3.0	20
3.1 to 4.0	28
4.1 to 5.0	32
5.1 to 7.5	43
7.6 to 10.0	50

- (7) Thickness Deficient by More than Ten Percent. When a core shows the pavement to be deficient by more than ten percent of plan thickness, additional cores shall be taken on each side of the deficient core, at stations selected by the Contractor and offsets selected by the Engineer, to determine the limits of the deficient pavement. No core shall be located within 5 ft (1.5 m) of a previous core obtained for thickness determination. The first acceptable core obtained on each side of a deficient core will be used to determine the length of the deficient pavement. An acceptable core is a core with a thickness of at least 90 percent of plan thickness. The area of deficient pavement will be defined using the length between two acceptable cores and the full width of the unit. The area of deficient pavement shall be removed and replaced; however, when requested in writing by the Contractor, the Engineer may permit in writing such areas of deficient pavement to remain in place. For deficient areas allowed to remain in place, additional lift(s) may be placed, at no additional cost to the Department, to bring the deficient pavement to plan thickness when the Engineer determines grade control conditions will permit such lift(s). The area(s) to be overlaid, material to be used, thickness(es) of the lift(s), and method of placement will be approved by the Engineer.

When an area of deficient pavement is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness. The thickness of the new core will be used to determine the pay factor for the corrected area.

When an area of deficient pavement is left in place, and no additional lift(s) are placed, no payment will be made for the deficient pavement. In addition, an amount equal to two times the contract cost of the deficient pavement will be deducted from the compensation due the Contractor.

The thickness of the first acceptable core on each side of the core more than ten percent deficient will be used to determine any needed pay adjustments for the remaining areas on each side of the area deficient by more than ten percent. The pay adjustment will be determined according to Article 407.10(b)(6).

- (8) Right of Discovery. When the Engineer has reason to believe any core location does not accurately represent the true conditions of the work, he/she may order additional cores. These additional cores shall be taken at specific locations determined by the Engineer. The Engineer will provide notice to the Contractor containing an explanation of the reasons for his/her action.

When the additional cores show the pavement to be deficient by more than ten percent of plan thickness, the procedures outlined in Article 407.10(b)(7) shall be followed, except the Engineer will determine the additional core locations.

When the additional cores, ordered by the Engineer, show the pavement to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04.

- (9) Profile Index Adjustment. After any area of pavement is removed and replaced or any additional lifts are added, the corrected areas shall be retested for pavement smoothness and any necessary profile index adjustments and/or corrections will be made based on these final profile readings prior to retesting for thickness.”

Revise Article 482.06 of the Standard Specifications to read:

**“482.06 Tolerance in Thickness.** The shoulder shall be constructed to the thickness shown on the plans. When the contract includes square yards (square meters) as the unit of measurement for HMA shoulder, thickness determinations shall be made according to Article 407.10(b)(3) and the following.

- (a) Length of the Units. The length of a unit shall be a continuous strip of shoulder 2500 ft (750 m) long.
- (b) Width of the Units. The width of the unit shall be the full width of the shoulder.
- (c) Thickness Deficient by More than Ten Percent. When a core shows the shoulder to be deficient by more than ten percent of plan thickness, additional cores shall be taken on each side of the deficient core, at stations selected by the Contractor and offsets selected by the Engineer, to determine the limits of the deficient shoulder. No core shall be located within 5 ft (1.5 m) of a previous core obtained for thickness determination. The first acceptable core obtained on each side of a deficient core will be used to determine the length of the deficient shoulder. An acceptable core is a core with a thickness of at least 90 percent of plan thickness. The area of deficient shoulder will be defined using the length between two acceptable cores and the full width of the unit. The area of deficient shoulder shall be brought to specified thickness by the addition of the applicable mixture, at no additional cost to the Department and subject to the lift thickness requirements of Article 312.05, or by removal and replacement with a new mixture. However, the surface elevation of the completed shoulder shall not exceed by more than 1/8 in. (3 mm) the surface elevation of the adjacent pavement. When requested in writing by the Contractor, the Engineer may permit in writing such thin shoulder to remain in place. When an area of thin shoulder is left in place, and no additional lift(s) are placed, no payment will be made for the thin shoulder. In addition, an amount equal to two times the contract unit price of the shoulder will be deducted from the compensation due the Contractor.

When an area of deficient shoulder is removed and replaced, or additional lifts are placed, the corrected pavement shall be retested for thickness.

- (d) Right of Discovery. When the Engineer has reason to believe any core location does not accurately represent the true conditions of the work, he/she may order additional cores. When the additional cores, ordered by the Engineer, show the shoulder to be at least 90 percent of plan thickness, the additional cores will be paid for according to Article 109.04. When the additional core shows the shoulder to be less than 90 percent of plan thickness, the procedure in (c), above shall be followed.”

Revise Article 483.07 of the Standard Specifications to read:

**“483.07 Tolerance in Thickness.** The shoulder shall be constructed to the thickness shown on the plans. Thickness determinations shall be made according to Article 482.06 except the option of correcting deficient pavement with additional lift(s) shall not apply.”

**DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION (BDE)**

Effective: September 1, 2000

Revised: January 1, 2010

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

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

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

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

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

CONTRACT GOAL TO BE ACHIEVED BY THE CONTRACTOR. This contract includes a specific DBE utilization goal established by the Department. The goal has been included because the Department has determined that the work of this contract has subcontracting opportunities that may be suitable for performance by DBE companies. This determination is based on an assessment of the type of work, the location of the work, and the availability of DBE companies to do a part of the work. The assessment indicates that, in the absence of unlawful discrimination, and in an arena of fair and open competition, DBE companies can be expected to perform **0.0%** of the work. This percentage is set as the DBE participation goal for this contract. Consequently, in addition to the other award criteria established for this contract, the Department will only award this contract to a bidder who makes a good faith effort to meet this goal of DBE participation in the performance of the work.

A bidder makes a good faith effort for award consideration if either of the following is done in accordance with the procedures set forth in this Special Provision:

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

DBE LOCATOR REFERENCES. Bidders may consult the IL UCP DBE Directory as a reference source for DBE-certified companies. In addition, the Department maintains a letting and item specific DBE locator information system whereby DBE companies can register their interest in providing quotes on particular bid items advertised for letting. Information concerning DBE companies willing to quote work for particular contracts may be obtained by contacting the Department's Bureau of Small Business Enterprises at telephone number (217)785-4611, or by visiting the Department's web site at [www.dot.il.gov](http://www.dot.il.gov).

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

(a) The bidder shall submit a Disadvantaged Business Utilization Plan on Department forms SBE 2025 and 2026 with the bid.

(b) The Utilization Plan shall indicate that the bidder either has obtained sufficient DBE participation commitments to meet the contract goal or has not obtained enough DBE participation commitments in spite of a good faith effort to meet the goal. The Utilization Plan shall further provide the name, telephone number, and telefax number of a responsible official of the bidder designated for purposes of notification of plan approval or disapproval under the procedures of this Special Provision.

(c) The Utilization Plan shall include a DBE Participation Commitment Statement, Department form SBE 2025, for each DBE proposed for the performance of work to achieve the contract goal. For bidding purposes, submission of the completed SBE 2025 forms, signed by the DBEs and faxed to the bidder will be acceptable as long as the original is available and provided upon request. All elements of information indicated on the said form shall be provided, including but not limited to the following:

(1) The names and addresses of DBE firms that will participate in the contract;

(2) A description, including pay item numbers, of the work each DBE will perform;

(3) The dollar amount of the participation of each DBE firm participating. The dollar amount of participation for identified work shall specifically state the quantity, unit price, and total subcontract price for the work to be completed by the DBE. If partial pay items are to be performed by the DBE, indicate the portion of each item, a unit price where appropriate and the subcontract price amount;

(4) DBE Participation Commitment Statements, form SBE 2025, signed by the bidder and each participating DBE firm documenting the commitment to use the DBE subcontractors whose participation is submitted to meet the contract goal;



- (5) If the bidder is a joint venture comprised of DBE companies and non-DBE companies, the plan must also include a clear identification of the portion of the work to be performed by the DBE partner(s); and,
- (6) If the contract goal is not met, evidence of good faith efforts.

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

(a) The following is a list of types of action that the Department will consider as part of the evaluation of the bidder's good faith efforts to obtain participation. These listed factors are not intended to be a mandatory checklist and are not intended to be exhaustive. Other factors or efforts brought to the attention of the Department may be relevant in appropriate cases, and will be considered by the Department.

(1) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified DBE companies that have the capability to perform the work of the contract. The bidder must solicit this interest within sufficient time to allow the DBE companies to respond to the solicitation. The bidder must determine with certainty if the DBE companies are interested by taking appropriate steps to follow up initial solicitations.

(2) Selecting portions of the work to be performed by DBE companies in order to increase the likelihood that the DBE goals will be achieved. This includes, where appropriate, breaking out contract work items into economically feasible units to facilitate DBE participation, even when the prime Contractor might otherwise prefer to perform these work items with its own forces.

(3) Providing interested DBE companies with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

(4) a. Negotiating in good faith with interested DBE companies. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBE companies that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBE companies to perform the work.

b. A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBE companies is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also, the ability or desire of a bidder to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidders are not, however, required to accept higher quotes from DBE companies if the price difference is excessive or unreasonable.

(5) Not rejecting DBE companies as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.

(6) Making efforts to assist interested DBE companies in obtaining bonding, lines of credit, or insurance as required by the recipient or Contractor.

(7) Making efforts to assist interested DBE companies in obtaining necessary equipment, supplies, materials, or related assistance or services.

(8) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBE companies.

(b) If the Department determines that the apparent successful bidder has made a good faith effort to secure the work commitment of DBE companies to meet the contract goal, the Department will award the contract provided that it is otherwise eligible for award. If the Department determines that the bidder has failed to meet the requirements of this Special Provision and that a good faith effort has not been made, the Department will notify the responsible company official designated in the Utilization Plan that the bid is not responsive. The notification shall include a statement of reasons why good faith efforts have not been found.

(c) The bidder may request administrative reconsideration of a determination adverse to the bidder within the five working days after receipt of the notification date of the determination by delivering the request to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764 (Telefax: (217)785-1524). Deposit of the request in the United States mail on or before the fifth business day shall not be deemed delivery.

The determination shall become final if a request is not made and delivered. A request may provide additional written documentation and/or argument concerning the issue of whether an adequate good faith effort was made to meet the contract goal. The request will be forwarded to the Department's Reconsideration Officer. The Reconsideration Officer will extend an opportunity to the bidder to meet in person in order to consider all issues of whether the bidder made a good faith effort to meet the goal. After the review by the Reconsideration Officer, the bidder will be sent a written decision within ten working days after receipt of the request for reconsideration, explaining the basis for finding that the bidder did or did not meet the goal or make adequate good faith efforts to do so. A final decision by the Reconsideration Officer that a good faith effort was made shall approve the Utilization Plan submitted by the bidder and shall clear the contract for award. A final decision that a good faith effort was not made shall render the bid not responsive.

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

- (a) DBE as the Contractor: 100 percent goal credit for that portion of the work performed by the DBE's own forces, including the cost of materials and supplies. Work that a DBE subcontracts to a non-DBE does not count toward the DBE goals.
- (b) DBE as a joint venture Contractor: 100 percent goal credit for that portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work performed by the DBE's own forces.
- (c) DBE as a subcontractor: 100 percent goal credit for the work of the subcontract performed by the DBE's own forces, including the cost of materials and supplies, excluding the purchase of materials and supplies or the lease of equipment by the DBE subcontractor from the prime Contractor or its affiliates. Work that a DBE subcontractor in turn subcontracts to a non-DBE does not count toward the DBE goal.
- (d) DBE as a trucker: 100 percent goal credit for trucking participation provided the DBE is responsible for the management and supervision of the entire trucking operation for which it is responsible. At least one truck owned, operated, licensed, and insured by the DBE must be used on the contract. Credit will be given for the following:
  - (1) The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the contract.

- (2) The DBE may also lease trucks from a non-DBE firm, including from an owner-operator. The DBE who leases trucks from a non-DBE is entitled to credit only for the fee or commission it receives as a result of the lease arrangement.
- (e) DBE as a material supplier:
  - (1) 60 percent goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.
  - (2) 100 percent goal credit for the cost of materials or supplies obtained from a DBE manufacturer.
  - (3) 100 percent credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a regular dealer or manufacturer.

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

- (a) No amendment to the Utilization Plan may be made without prior written approval from the Department's Bureau of Small Business Enterprises. All requests for amendment to the Utilization Plan shall be submitted to the Department of Transportation, Bureau of Small Business Enterprises, Contract Compliance Section, 2300 South Dirksen Parkway, Room 319, Springfield, Illinois 62764. Telephone number (217) 785-4611. Telefax number (217) 785-1524.
- (b) The Contractor must notify and obtain written approval from the Department's Bureau of Small Business Enterprises prior to replacing a DBE or making any change in the participation of a DBE. Approval for replacement will be granted only if it is demonstrated that the DBE is unable or unwilling to perform. The Contractor must make every good faith effort to find another certified DBE subcontractor to substitute for the original DBE. The good faith efforts shall be directed at finding another DBE to perform at least the same amount of work under the contract as the original DBE, to the extent needed to meet the contract goal.
- (c) Any deviation from the DBE condition-of-award or contract specifications must be approved, in writing, by the Department. The Contractor shall notify affected DBEs in writing of any changes in the scope of work which result in a reduction in the dollar amount condition-of-award to the contract.
- (d) In addition to the above requirements for reductions in the condition of award, additional requirements apply to the two cases of Contractor-initiated work substitution proposals.

Where the contract allows alternate work methods which serve to delete or create underruns in condition of award DBE work, and the Contractor selects that alternate method or, where the Contractor proposes a substitute work method or material that serves to diminish or delete work committed to a DBE and replace it with other work, then the Contractor must demonstrate one of the following:

- (1) That the replacement work will be performed by the same DBE (as long as the DBE is certified in the respective item of work) in a modification of the condition of award; or
- (2) That the DBE is aware that its work will be deleted or will experience underruns and has agreed in writing to the change. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so; or
- (3) That the DBE is not capable of performing the replacement work or has declined to perform the work at a reasonably competitive price. If this occurs, the Contractor shall substitute other work of equivalent value to a certified DBE or provide documentation of good faith efforts to do so.

(e) Where the revision includes work committed to a new DBE subcontractor, not previously involved in the project, then a Request for Approval of Subcontractor, Department form BC 260A, must be signed and submitted.

(f) If the commitment of work is in the form of additional tasks assigned to an existing subcontract, then a new Request for Approval of Subcontractor shall not be required. However, the Contractor must document efforts to assure that the existing DBE subcontractor is capable of performing the additional work and has agreed in writing to the change.

(g) All work indicated for performance by an approved DBE shall be performed, managed, and supervised by the DBE executing the Participation Statement. The Contractor shall not terminate for convenience a DBE listed in the Utilization Plan and then perform the work of the terminated DBE with its own forces, those of an affiliate or those of another subcontractor, whether DBE or not, without first obtaining the written consent of the Bureau of Small Business Enterprises to amend the Utilization Plan. The Contractor shall notify the Bureau of Small Business Enterprises of any termination for reasons other than convenience, and shall obtain approval for inclusion of the substitute DBE in the Utilization Plan. If good faith efforts following a termination of a DBE for cause are not successful, the Contractor shall contact the Bureau of Small Business Enterprises and provide a full accounting of the efforts undertaken to obtain substitute DBE participation. The Bureau of Small Business Enterprises will evaluate the good faith efforts in light of all circumstances surrounding the performance status of the contract, and determine whether the contract goal should be amended.

(h) The Contractor shall maintain a record of payments for work performed to the DBE participants. The records shall be made available to the Department for inspection upon request. After the performance of the final item of work or delivery of material by a DBE and final payment therefore to the DBE by the Contractor, but not later than thirty calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Agreement on Department form SBE 2115 to the Regional Engineer.

If full and final payment has not been made to the DBE, the DBE Payment Agreement shall indicate whether a disagreement as to the payment required exists between the Contractor and the DBE or if the Contractor believes that the work has not been satisfactorily completed. If the Contractor does not have the full amount of work indicated in the Utilization Plan performed by the DBE companies indicated in the Utilization Plan and after good faith efforts are reviewed, the Department may deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages. The Contractor may request an administrative reconsideration of any amount deducted as damages pursuant to subsection (j) of this part.

(i) The Department reserves the right to withhold payment to the Contractor to enforce the provisions of this Special Provision. Final payment shall not be made on the contract until such time as the Contractor submits sufficient documentation demonstrating achievement of the goal in accordance with this Special Provision or after liquidated damages have been determined and collected.

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

#### **DOWEL BARS (BDE)**

Effective: April 1, 2007

Revised: January 1, 2008

Revise the fifth and sixth sentences of Article 1006.11(b) of the Standard Specifications to read:

"The bars shall be epoxy coated according to AASHTO M 284, except the thickness of the epoxy shall be 7 to 12 mils (0.18 to 0.30 mm) and patching of the ends will not be required. The epoxy coating applicator shall be certified according to the current Bureau of Materials and Physical Research Policy Memorandum, "Epoxy Coating Plant Certification Procedure". The Department will maintain an approved list."

#### **ENGINEER'S FIELD OFFICE TYPE A (BDE)**

Effective: April 1, 2007

Revised: August 1, 2008

Revise Article 670.02 of the Standard Specifications to read:

**"670.02 Engineer's Field Office Type A.** Type A field offices shall have a minimum ceiling height of 7 ft (2 m) and a minimum floor space 450 sq ft (42 sq m). The office shall be provided with sufficient heat, natural and artificial light, and air conditioning.

The office shall have an electronic security system that will respond to any breach of exterior doors and windows. Doors and windows shall be equipped with locks. Doors shall also be equipped with dead bolt locks or other secondary locking device.

Windows shall be equipped with exterior screens to allow adequate ventilation. All windows shall be equipped with interior shades, curtains, or blinds. Adequate all-weather parking space shall be available to accommodate a minimum of ten vehicles.

Suitable on-site sanitary facilities meeting Federal, State, and local health department requirements shall be provided, maintained clean and in good working condition, and shall be stocked with lavatory and sanitary supplies at all times.

Sanitary facilities shall include hot and cold potable running water, lavatory and toilet as an integral part of the office where available. Solid waste disposal consisting of two waste baskets and an outside trash container of sufficient size to accommodate a weekly provided pick-up service.

In addition, the following furniture and equipment shall be furnished.

- (a) Four desks with minimum working surface 42 x 30 in. (1.1 m x 750 mm) each and five non-folding chairs with upholstered seats and backs.
- (b) One desk with minimum working surface 48 x 72 in. (1.2 x 1.8 m) with height adjustment of 23 to 30 in. (585 to 750 mm).
- (c) One four-post drafting table with minimum top size of 37 1/2 x 48 in. (950 mm x 1.2 m). The top shall be basswood or equivalent and capable of being tilted through an angle of 50 degrees. An adjustable height drafting stool with upholstered seat and back shall also be provided.
- (d) Two free standing four drawer legal size file cabinet with lock and an underwriters' laboratories insulated file device 350 degrees one hour rating.
- (e) One 6 ft (1.8 m) folding table with six folding chairs.
- (f) One equipment cabinet of minimum inside dimension of 44 in. (1100 mm) high x 24 in. (600 mm) wide x 30 in. (750 mm) deep with lock. The walls shall be of steel with a 3/32 in. (2 mm) minimum thickness with concealed hinges and enclosed lock constructed in such a manner as to prevent entry by force. The cabinet assembly shall be permanently attached to a structural element of the field office in a manner to prevent theft of the entire cabinet.
- (g) One refrigerator with a minimum size of 16 cu ft (0.45 cu m) with a freezer unit.
- (h) One electric desk type tape printing calculator.
- (i) A minimum of two communication paths. The configuration shall include:
  - (1) Internet Connection. An internet service connection using telephone DSL, cable broadband, or CDMA wireless technology. Additionally, an 802.11g/N wireless router shall be provided, which will allow connection by the Engineer and up to four Department staff.
  - (2) Telephone Lines. Three separate telephone lines.

- (j) One plain paper copy machine capable of reproducing prints up to 11 x 17 in. (280 x 432 mm) with an automatic feed tray capable of storing 30 sheets of paper. Letter size and 11 x 17 in. (280 x 432 mm) paper shall be provided.
- (k) One plain paper fax machine with paper.
- (l) Two telephones, with touch tone, where available, and a digital telephone answering machine, for exclusive use by the Engineer.
- (m) One electric water cooler dispenser.
- (n) One first-aid cabinet fully equipped.
- (o) One microwave oven, 1 cu ft (0.03 cu m) minimum capacity.
- (p) One fire-proof safe, 0.5 cu ft (0.01 cu m) minimum capacity.
- (q) One electric paper shredder.
- (r) One post mounted rain gauge, located on the project site for each 5 miles (8 km) of project length.”

Revise the first sentence of the first paragraph of Article 670.07 of the Standard Specifications to read:

“The building or buildings fully equipped as specified will be paid for on a monthly basis until the building or buildings are released by the Engineer.”

Revise the last sentence of the first paragraph of Article 670.07 of the Standard Specifications to read:

“This price shall include all utility costs and shall reflect the salvage value of the building or buildings, equipment, and furniture which become the property of the Contractor after release by the Engineer, except that the Department will pay that portion of the monthly long distance telephone bills that, when combined, exceed \$150.”

#### **EQUIPMENT RENTAL RATES (BDE)**

Effective: August 2, 2007

Revised: January 2, 2008

Replace the second and third paragraphs of Article 105.07(b)(4)a. of the Standard Specifications with the following:

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

Replace Article 109.04(b)(4) of the Standard Specifications with the following:



“(4) Equipment. Equipment used for extra work shall be authorized by the Engineer. The equipment shall be specifically described, be of suitable size and capacity for the work to be performed, and be in good operating condition. For such equipment, the Contractor will be paid as follows.

- a. Contractor Owned Equipment. Contractor owned equipment will be paid for by the hour using the applicable FHWA hourly rate from the “Equipment Watch Rental Rate Blue Book” (Blue Book) in effect when the force account work begins. The FHWA hourly rate is calculated as follows.

$$\text{FHWA hourly rate} = (\text{monthly rate}/176) \times (\text{model year adj.}) \times (\text{Illinois adj.}) + \text{EOC}$$

Where: EOC = Estimated Operating Costs per hour (from the Blue Book)

The time allowed will be the actual time the equipment is operating on the extra work. For the time required to move the equipment to and from the site of the extra work and any authorized idle (standby) time, payment will be made at the following hourly rate:  $0.5 \times (\text{FHWA hourly rate} - \text{EOC})$ .

All time allowed shall fall within the working hours authorized for the extra work.

The rates above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, and all incidentals. The rates do not include labor.

The Contractor shall submit to the Engineer sufficient information for each piece of equipment and its attachments to enable the Engineer to determine the proper equipment category. If a rate is not established in the Blue Book for a particular piece of equipment, the Engineer will establish a rate for that piece of equipment that is consistent with its cost and use in the industry.

- b. Rented Equipment. Whenever it is necessary for the Contractor to rent equipment to perform extra work, the rental and transportation costs of the equipment plus five percent for overhead will be paid. In no case shall the rental rates exceed those of established distributors or equipment rental agencies.

All prices shall be agreed to in writing before the equipment is used.”

### **HOT-MIX ASPHALT – ANTI-STRIPPING ADDITIVE (BDE)**

Effective: November 1, 2009

Revise the first and second paragraphs of Article 1030.04(c) of the Standard Specifications to read:

- “(c) Determination of Need for Anti-Stripping Additive. The mixture designer shall determine if an additive is needed in the mix to prevent stripping. The determination will be made on the basis of tests performed according to Illinois Modified AASHTO T 283.

To be considered acceptable by the Department as a mixture not susceptible to stripping, the conditioned to unconditioned split tensile strength ratio (TSR) shall be equal to or greater than 0.85 for 6 in. (150 mm) specimens. Mixtures, either with or without an additive, with TSRs less than 0.85 for 6 in. (150 mm) specimens will be considered unacceptable. Also, the conditioned tensile strength for mixtures containing an anti-strip additive shall not be lower than the original conditioned tensile strength determined for the same mixture without the anti-strip additive.

If it is determined that an additive is required, the additive may be hydrated lime, slaked quicklime, or a liquid additive, at the Contractor's option.”

### **HOT-MIX ASPHALT - DENSITY TESTING OF LONGITUDINAL JOINTS (BDE)**

Effective: January 1, 2010

Description. This work shall consist of testing the density of longitudinal joints as part of the quality control/quality assurance (QC/QA) of hot-mix asphalt (HMA). Work shall be according to Section 1030 of the Standard Specifications except as follows.

Quality Control/Quality Assurance (QC/QA). Delete the second and third sentence of the third paragraph of Article 1030.05(d)(3) of the Standard Specifications.

Add the following paragraphs to the end of Article 1030.05(d)(3) of the Standard Specifications:

“Longitudinal joint density testing shall be performed at each random density test location. Longitudinal joint testing shall be located at a distance equal to the lift thickness or a minimum of 2 in. (50 mm), from each pavement edge. (i.e. for a 4 in. (100 mm) lift the near edge of the density gauge or core barrel shall be within 4 in. (100 mm) from the edge of pavement.) Longitudinal joint density testing shall be performed using either a correlated nuclear gauge or cores.

- a. Confined Edge. Each confined edge density shall be represented by a one-minute nuclear density reading or a core density and shall be included in the average of density readings or core densities taken across the mat which represents the Individual Test.
- b. Unconfined Edge. Each unconfined edge joint density shall be represented by an average of three one-minute density readings or a single core density at the given density test location and shall meet the density requirements specified herein. The three one-minute readings shall be spaced ten feet apart longitudinally along the unconfined pavement edge and centered at the random density test location.”

Revise the Density Control Limits table in Article 1030.05(d)(4) of the Standard Specifications to read:

"Mixture Composition	Parameter	Individual Test (includes confined edges)	Unconfined Edge Joint Density Minimum
IL-9.5, IL-12.5	Ndesign ≥ 90	92.0 – 96.0%	90.0%
IL-9.5,IL-9.5L, IL-12.5	Ndesign < 90	92.5 – 97.4%	90.0%
IL-19.0, IL-25.0	Ndesign ≥ 90	93.0 – 96.0%	90.0%
IL-19.0, IL-19.0L, IL-25.0	Ndesign < 90	93.0 – 97.4%	90.0%
SMA	Ndesign = 50 & 80	93.5 – 97.4%	91.0%
All Other	Ndesign = 30	93.0 - 97.4%	90.0%"

**HOT-MIX ASPHALT – DROP-OFFS (BDE)**

Effective: January 1, 2010

Revise the third paragraph of Article 701.07 of the Standard Specifications to read:

“At locations where construction operations result in a differential in elevation exceeding 3 in. (75 mm) between the edge of pavement or edge of shoulder within 3 ft (900 mm) of the edge of the pavement and the earth or aggregate shoulders, Type I or II barricades or vertical panels shall be placed at 100 ft (30 m) centers on roadways where the posted speed limit is 45 mph or greater and at 50 ft (15 m) centers on roadways where the posted speed limit is less than 45 mph.”

**HOT-MIX ASPHALT – PLANT TEST FREQUENCY (BDE)**

Effective: April 1, 2008

Revised: January 1, 2010

Revise the table in Article 1030.05(d)(2)a. of the Standard Specifications to read:

"Parameter	Frequency of Tests		Test Method See Manual of Test Procedures for Materials
	High ESAL Mixture Low ESAL Mixture	Frequency of Tests All Other Mixtures	
Aggregate Gradation  % passing sieves: 1/2 in. (12.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 30 (600 μm) No. 200 (75 μm)  Note 1.	1 washed ignition oven test on the mix per half day of production  Note 4.	1 washed ignition oven test on the mix per day of production  Note 4.	Illinois Procedure

Asphalt Binder Content by Ignition Oven  Note 2.	1 per half day of production	1 per day	Illinois-Modified AASHTO T 308
VMA  Note 3.	Day's production $\geq$ 1200 tons:  1 per half day of production	N/A	Illinois Modified AASHTO R 35
	Day's production < 1200 tons:  1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)		
Air Voids  Bulk Specific Gravity of Gyratory Sample	Day's production $\geq$ 1200 tons:  1 per half day of production	1 per day	Illinois-Modified AASHTO T 312
	Day's production < 1200 tons:  1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)		
Maximum Specific Gravity of Mixture	Day's production $\geq$ 1200 tons:  1 per half day of production	1 per day	Illinois-Modified AASHTO T 209
	Day's production < 1200 tons:  1 per half day of production for first 2 days and 1 per day thereafter (first sample of the day)		

Note 1. The No. 8 (2.36 mm) and No. 30 (600  $\mu$ m) sieves are not required for All Other Mixtures.

Note 2. The Engineer may waive the ignition oven requirement for asphalt binder content if the aggregates to be used are known to have ignition asphalt binder content calibration factors which exceed 1.5 percent. If the ignition oven requirement is waived, other Department approved methods shall be used to determine the asphalt binder content.

Note 3. The  $G_{sb}$  used in the voids in the mineral aggregate (VMA) calculation shall be the same average  $G_{sb}$  value listed in the mix design.

Note 4. The Engineer reserves the right to require additional hot bin gradations for batch plants if control problems are evident.”

**HOT-MIX ASPHALT – QC/QA ACCEPTANCE CRITERIA (BDE)**

Effective: January 1, 2010

Revise Article 1030.05(f)(3) of the Standard Specifications to read:

“(3) Department assurance tests for voids, field VMA, and density.”

**HOT-MIX ASPHALT – TRANSPORTATION (BDE)**

Effective: April 1, 2008

Revise Article 1030.08 of the Standard Specifications to read:

**“1030.08 Transportation.** Vehicles used in transporting HMA shall have clean and tight beds. The beds shall be sprayed with asphalt release agents from the Department’s approved list. In lieu of a release agent, the Contractor may use a light spray of water with a light scatter of manufactured sand (FA 20 or FA 21) evenly distributed over the bed of the vehicle. After spraying, the bed of the vehicle shall be in a completely raised position and it shall remain in this position until all excess asphalt release agent or water has been drained.

When the air temperature is below 60 °F (15 °C), the bed, including the end, endgate, sides and bottom shall be insulated with fiberboard, plywood or other approved insulating material and shall have a thickness of not less than 3/4 in (20 mm). When the insulation is placed inside the bed, the insulation shall be covered with sheet steel approved by the Engineer. Each vehicle shall be equipped with a cover of canvas or other suitable material meeting the approval of the Engineer which shall be used if any one of the following conditions is present.

- (a) Ambient air temperature is below 60 °F (15 °C).
- (b) The weather is inclement.
- (c) The temperature of the HMA immediately behind the paver screed is below 250 °F (120 °C).

The cover shall extend down over the sides and ends of the bed for a distance of approximately 12 in. (300 mm) and shall be fastened securely. The covering shall be rolled back before the load is dumped into the finishing machine.”

**LIQUIDATED DAMAGES (BDE)**

Effective: April 1, 2009

Revise the table in Article 108.09 of the Standard Specifications to read:

“Schedule of Deductions for Each Day of Overrun in Contract Time			
Original Contract Amount		Daily Charges	
From More Than	To and Including	Calendar Day	Work Day
\$ 0	\$ 100,000	\$ 375	\$ 500
100,000	500,000	625	875
500,000	1,000,000	1,025	1,425
1,000,000	3,000,000	1,125	1,550
3,000,000	5,000,000	1,425	1,950
5,000,000	10,000,000	1,700	2,350
10,000,000	And over	3,325	4,650”

**METAL HARDWARE CAST INTO CONCRETE (BDE)**

Effective: April 1, 2008

Revised: April 1, 2009

Add the following to Article 503.02 of the Standard Specifications:

“(g) Metal Hardware Cast into Concrete ..... 1006.13”

Add the following to Article 504.02 of the Standard Specifications:

“(j) Metal Hardware Cast into Concrete ..... 1006.13”

Revise Article 1006.13 of the Standard Specifications to read:

“**1006.13 Metal Hardware Cast into Concrete.** Unless otherwise noted, all steel hardware cast into concrete, such as inserts, brackets, cable clamps, metal casings for formed holes, and other miscellaneous items, shall be galvanized according to AASHTO M 232 or AASHTO M 111. Aluminum inserts will not be allowed. Zinc alloy inserts shall be according to ASTM B 86, Alloys 3, 5, or 7.

The inserts shall be UNC threaded type anchorages having the following minimum certified proof load.

Insert Diameter	Proof Load
5/8 in. (16 mm)	6600 lb (29.4 kN)
3/4 in. (19 mm)	6600 lb (29.4 kN)
1 in. (25 mm)	9240 lb (41.1 kN)”

**MONTHLY EMPLOYMENT REPORT (BDE)**

Effective: April 1, 2009

Revised: January 1, 2010

In addition to any other reporting required by the contract, the Contractor shall provide to the Engineer an employment summary for all employees working on the contract from the contract execution date to the last full pay period each month for the duration of the contract. The report may include but is not limited to:

- a) Total number of employees.
- b) The total hours worked.
- c) Total payroll.

The report shall be completed by the Contractor. The Contractor shall also report for each subcontractor. Employee hours worked from home office or other off-site office hours worked related directly to this contract shall be included. Engineering consulting firms performing construction layout and material testing for the Contractor shall also be included.

Hours worked for material suppliers, services provided by purchase orders, Department employees or consulting firms performing inspection or testing for the Department shall not be included in the report.

The report shall contain all hours worked under the contract from the start of the month to the last full pay period each month and shall be submitted no later than five business days after the end of each month.

The report shall be submitted electronically by accessing the Department's website (<http://www.dot.il.gov/stimulus/index.html>).

Any costs associated with complying with this provision shall be considered as included in the contract unit prices bid for the various items of work involved and no additional compensation will be allowed.

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM / EROSION AND SEDIMENT CONTROL DEFICIENCY DEDUCTION (BDE)**

Effective: April 1, 2007

Revised: November 1, 2009

Revise Article 105.03(a) of the Standard Specifications to read:

- “(a) National Pollutant Discharge Elimination System (NPDES) / Erosion and Sediment Control Deficiency Deduction When the Engineer is notified or determines an erosion and/or sediment control deficiency(s) exists, or the Contractor's activities represents a violation of the Department's NPDES permits, the Engineer will notify and direct the Contractor to correct the deficiency within a specified time. The specified time, which begins upon notification to the Contractor, will be from 1/2 hour to 1 week based on the urgency of the situation and the nature of the work effort required. The Engineer will be the sole judge.

A deficiency may be any lack of repair, maintenance, or implementation of erosion and/or sediment control devices included in the contract, or any failure to comply with the conditions of the Department's NPDES permits. A deficiency may also be applied to situations where corrective action is not an option such as the failure to participate in a jobsite inspection of the project, failure to install required measures prior to initiating earth moving operations, disregard of concrete washout requirements, or other disregard of the NPDES permit.

If the Contractor fails to correct a deficiency within the specified time, a daily monetary deduction will be imposed for each calendar day or portion of a calendar day until the deficiency is corrected to the satisfaction of the Engineer. The calendar day(s) will begin with notification to the Contractor and end with the Engineer's acceptance of the correction. The base value of the daily monetary deduction is \$1000.00 and will be applied to each location for which a deficiency exists. The value of the deficiency deduction assessed for each infraction will be determined by multiplying the base value by a Gravity Adjustment Factor provided in Table A. Except for failure to participate in a required jobsite inspection of the project prior to initiating earthmoving operations which will be based on the total acreage of planned disturbance at the following multipliers: <5 Acres: 1; 5-10 Acres: 2; >10-25 Acres: 3; >25 Acres: 5. For those deficiencies where corrective action was not an option, the monetary deduction will be immediate and will be valued at one calendar day multiplied by a Gravity Adjustment Factor.

Table A Deficiency Deduction Gravity Adjustment Factors				
Types of Violations	Soil Disturbed and Not Permanently Stabilized At Time of Violation			
	< 5 Acres	5 - 10 Acres	>10 - 25 Acres	> 25 Acres
Failure to Install or Properly Maintain BMP	0.1 - 0.5	0.2 - 1.0	0.5 - 2.5	1.0 - 5
Careless Destruction of BMP	0.2 - 1	0.5 - 2.5	1.0 - 5.	1.0 - 5
Intrusion into Protected Resource	1.0 - 5	1.0 - 5	2.0 - 10	2.0 - 10
Failure to properly manage Chemicals, Concrete Washouts or Residuals, Litter or other Wastes	0.2 - 1	0.2 - 1	0.5 - 2.5	1.0 - 5
Improper Vehicle and Equipment Maintenance, Fueling or Cleaning	0.1 - 0.5	0.2 - 1	0.2 - 1	0.5 - 2.5
Failure to Provide or Update Written or Graphic Plans Required by SWPPP	0.2 - 1	0.5 - 2.5	1.0 - 5	1.0 - 5
Failure to comply with Other Provisions of the NPDES Permit	0.1 - 0.5	0.2 - 1	0.2 - 1	0.5 - 2.5"

**PAVEMENT PATCHING (BDE)**

Effective: January 1, 2010

Revise the first sentence of the second paragraph of Article 701.17(e)(1) of the Standard Specifications to read:

“In addition to the traffic control and protection shown elsewhere in the contract for pavement, two devices shall be placed immediately in front of each open patch, open hole, and broken pavement where temporary concrete barriers are not used to separate traffic from the work area.”

**PAYMENTS TO SUBCONTRACTORS (BDE)**

Effective: June 1, 2000

Revised: January 1, 2006

Federal regulations found at 49 CFR §26.29 mandate the Department to establish a contract clause to require Contractors to pay subcontractors for satisfactory performance of their subcontracts and to set the time for such payments.

State law also addresses the timing of payments to be made to subcontractors and material suppliers. Section 7 of the Prompt Payment Act, 30 ILCS 540/7, requires that when a Contractor receives any payment from the Department, the Contractor shall make corresponding, proportional payments to each subcontractor and material supplier performing work or supplying material within 15 calendar days after receipt of the Department payment. Section 7 of the Act further provides that interest in the amount of two percent per month, in addition to the payment due, shall be paid to any subcontractor or material supplier by the Contractor if the payment required by the Act is withheld or delayed without reasonable cause.



The Act also provides that the time for payment required and the calculation of any interest due applies to transactions between subcontractors and lower-tier subcontractors and material suppliers throughout the contracting chain.

This Special Provision establishes the required federal contract clause, and adopts the 15 calendar day requirement of the State Prompt Payment Act for purposes of compliance with the federal regulation regarding payments to subcontractors. This contract is subject to the following payment obligations.

When progress payments are made to the Contractor according to Article 109.07 of the Standard Specifications, the Contractor shall make a corresponding payment to each subcontractor and material supplier in proportion to the work satisfactorily completed by each subcontractor and for the material supplied to perform any work of the contract. The proportionate amount of partial payment due to each subcontractor and material supplier throughout the contracting chain shall be determined by the quantities measured or otherwise determined as eligible for payment by the Department and included in the progress payment to the Contractor. Subcontractors and material suppliers shall be paid by the Contractor within 15 calendar days after the receipt of payment from the Department. The Contractor shall not hold retainage from the subcontractors. These obligations shall also apply to any payments made by subcontractors and material suppliers to their subcontractors and material suppliers; and to all payments made to lower tier subcontractors and material suppliers throughout the contracting chain. Any payment or portion of a payment subject to this provision may only be withheld from the subcontractor or material supplier to whom it is due for reasonable cause.

This Special Provision does not create any rights in favor of any subcontractor or material supplier against the State or authorize any cause of action against the State on account of any payment, nonpayment, delayed payment, or interest claimed by application of the State Prompt Payment Act. The Department will not approve any delay or postponement of the 15 day requirement except for reasonable cause shown after notice and hearing pursuant to Section 7(b) of the State Prompt Payment Act. State law creates other and additional remedies available to any subcontractor or material supplier, regardless of tier, who has not been paid for work properly performed or material furnished. These remedies are a lien against public funds set forth in Section 23(c) of the Mechanics Lien Act, 770 ILCS 60/23(c), and a recovery on the Contractor's payment bond according to the Public Construction Bond Act, 30 ILCS 550.

#### **PERSONAL PROTECTIVE EQUIPMENT (BDE)**

Effective: November 1, 2008

Revise the first sentence of Article 701.12 of the Standard Specifications to read:

“All personnel on foot, excluding flaggers, within the highway right-of-way shall wear a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments.”

**PORTLAND CEMENT CONCRETE PLANTS (BDE)**

Effective: January 1, 2007

Add the following to Article 1020.11(a) of the Standard Specifications.

- “(9) Use of Multiple Plants in the Same Construction Item. The Contractor may simultaneously use central-mixed, truck-mixed, and shrink-mixed concrete from more than one plant, for the same construction item, on the same day, and in the same pour. However, the following criteria shall be met.
- a. Each plant shall use the same cement, finely divided minerals, aggregates, admixtures, and fibers.
  - b. Each plant shall use the same mix design. However, material proportions may be altered slightly in the field to meet slump and air content criteria. Field water adjustments shall not result in a difference that exceeds 0.02 between plants for water/cement ratio. The required cement factor for central-mixed concrete shall be increased to match truck-mixed or shrink-mixed concrete, if the latter two types of mixed concrete are used in the same pour.
  - c. The maximum slump difference between deliveries of concrete shall be 3/4 in. (19 mm) when tested at the jobsite. If the difference is exceeded, but test results are within specification limits, the concrete may be used. The Contractor shall take immediate corrective action and shall test subsequent deliveries of concrete until the slump difference is corrected. For each day, the first three truck loads of delivered concrete from each plant shall be tested for slump by the Contractor. Thereafter, when a specified test frequency for slump is to be performed, it shall be conducted for each plant at the same time.
  - d. The maximum air content difference between deliveries of concrete shall be 1.5 percent when tested at the jobsite. If the difference is exceeded, but test results are within specification limits, the concrete may be used. The Contractor shall take immediate corrective action and shall test subsequent deliveries of concrete until the air content difference is corrected. For each day, the first three truck loads of delivered concrete from each plant shall be tested for air content by the Contractor. Thereafter, when a specified test frequency for air content is to be performed, it shall be conducted for each plant at the same time.
  - e. Strength tests shall be performed and taken at the jobsite for each plant. When a specified strength test is to be performed, it shall be conducted for each plant at the same time. The difference between plants for their mean strength shall not exceed 450 psi (3100 kPa) compressive and 80 psi (550 kPa) flexural. The strength standard deviation for each plant shall not exceed 650 psi (4480 kPa) compressive and 110 psi (760 kPa) flexural. The mean and standard deviation requirements shall apply to the test of record. If the strength difference requirements are exceeded, the Contractor shall take corrective action.

- f. The maximum haul time difference between deliveries of concrete shall be 15 minutes. If the difference is exceeded, but haul time is within specification limits, the concrete may be used. The Contractor shall take immediate corrective action and check subsequent deliveries of concrete until the haul time difference is corrected.”

**PRECAST CONCRETE HANDLING HOLES (BDE)**

Effective: January 1, 2007

Add the following to Article 540.02 of the Standard Specifications:

“(g) Handling Hole Plugs 1042.16”

Add the following paragraph after the sixth paragraph of Article 540.06 of the Standard Specifications:

“Handling holes shall be filled with a precast concrete plug and sealed with mastic or mortar, or filled with a polyethylene plug. The plug shall not project beyond the inside surface after installation. When metal lifting inserts are used, their sockets shall be filled with mastic or mortar.”

Add the following to Article 542.02 of the Standard Specifications:

“(ee) Handling Hole Plugs 1042.16”

Revise the fifth paragraph of Article 542.04(d) of the Standard Specifications to read:

“Handling holes in concrete pipe shall be filled with a precast concrete plug and sealed with mastic or mortar; or filled with a polyethylene plug. The plug shall not project beyond the inside surface after installation.”

Add the following to Article 550.02 of the Standard Specifications:

“(o) Handling Hole Plugs 1042.16”

Replace the fourth sentence of the fifth paragraph of Article 550.06 of the Standard Specifications with the following:

“Handling holes in concrete pipe shall be filled with a precast concrete plug and sealed with mastic or mortar; or filled with a polyethylene plug. The plug shall not project beyond the inside surface after installation.”

Add the following to Article 602.02 of the Standard Specifications:

“(p) Handling Hole Plugs 1042.16(a)”

Replace the fifth sentence of the first paragraph of Article 602.07 of the Standard Specifications with the following:

“Handling holes shall be filled with a precast concrete plug and sealed with mastic or mortar. The plug shall not project beyond the inside surface after installation. When metal lifting inserts are used, their sockets shall be filled with mastic or mortar.”

Add the following to Section 1042 of the Standard Specifications:

**“1042.16 Handling Hole Plugs.** Plugs for handling holes in precast concrete products shall be as follows.

- (a) **Precast Concrete Plug.** The precast concrete plug shall have a tapered shape and shall have a minimum compressive strength of 3000 psi (20,700 kPa) at 28 days.
- (b) **Polyethylene Plug.** The polyethylene plug shall have a “mushroom” shape with a flat round top and a stem with three different size ribs. The plug shall fit snugly and cover the handling hole.

The plug shall be according to the following.

Mechanical Properties	Test Method	Value (min.)
Flexural Modulus	ASTM D 790	3300 psi (22,750 kPa)
Tensile Strength (Break)	ASTM D 638	1600 psi (11,030 kPa)
Tensile Strength (Yield)	ASTM D 638	1200 psi (8270 kPa)

Thermal Properties	Test Method	Value (min.)
Brittle Temperature	ASTM D 746	-49 °F (-45 °C)
Vicat Softening Point	ASTM D 1525	194 °F (90 °C)”

**REFLECTIVE SHEETING ON CHANNELIZING DEVICES (BDE)**

Effective: April 1, 2007

Revised: November 1, 2008

Revise the seventh paragraph of Article 1106.02 of the Standard Specifications to read:

“At the time of manufacturing, the retroreflective prismatic sheeting used on channelizing devices shall meet or exceed the initial minimum coefficient of retroreflection as specified in the following table. Measurements shall be conducted according to ASTM E 810, without averaging. Sheeting used on cones, drums and flexible delineators shall be reboundable as tested according to ASTM D 4956. Prestriped sheeting for rigid substrates on barricades shall be white and orange. [The sheeting shall be uniform in color and devoid of streaks throughout the length of each roll. The color shall conform to the latest appropriate standard color tolerance chart issued by the U.S. Department of Transportation, Federal Highway Administration, and to the daytime and nighttime color requirements of ASTM D 4956.](#)

Initial Minimum Coefficient of Retroreflection candelas/foot candle/sq ft (candelas/lux/sq m) of material				
Observation Angle (deg.)	Entrance Angle (deg.)	White	Orange	Fluorescent Orange
0.2	-4	365	160	150
0.2	+30	175	80	70
0.5	-4	245	100	95
0.5	+30	100	50	40"

Revise the first sentence of the first paragraph of Article 1106.02(c) of the Standard Specifications to read:

“Barricades and vertical panels shall have alternating white and orange stripes sloping downward at 45 degrees toward the side on which traffic will pass.”

Revise the third sentence of the first paragraph of Article 1106.02(d) of the Standard Specifications to read:

“The bottom panels shall be 8 x 24 in. (200 x 600 mm) with alternating white and orange stripes sloping downward at 45 degrees toward the side on which traffic will pass.”

**REINFORCEMENT BARS - STORAGE AND PROTECTION (BDE)**

Effective: August 1, 2008

Revised: April 1, 2009

Revise Article 508.03 of the Standard Specifications to read:

**508.03 Storage and Protection.** Reinforcement bars shall be stored off the ground using platforms, skids, or other supports; and shall be protected from mechanical injury and from deterioration by exposure. Epoxy coated bars shall be stored on wooden or padded steel cribbing and all systems for handling shall have padded contact areas. The bars or bundles shall not be dragged or dropped.

When epoxy coated bars are stored in a manner where they will be exposed to the weather more than 60 days prior to use, they shall be protected from deterioration such as that caused by sunlight, salt spray, and weather exposure. The protection shall consist of covering with opaque polyethylene sheeting or other suitable opaque material. The covering shall be secured and allow for air circulation around the bars to minimize condensation under the cover.

Covering of the epoxy coated bars will not be required when the bars are installed and tied, or when they are partially incorporated into the concrete.”

**SELF-CONSOLIDATING CONCRETE FOR PRECAST PRODUCTS (BDE)**

Effective: July 1, 2004

Revised: January 1, 2007

Definition. Self-consolidating concrete is a flowable mixture that does not require mechanical vibration for consolidation.

Usage. Self-consolidating concrete may be used for precast concrete products.

Materials. Materials shall be according to Section 1021 of the Standard Specifications.

Mix Design Criteria. The mix design criteria shall be as follows:

- (a) The minimum cement factor shall be according to Article 1020.04 of the Standard Specifications. If the maximum cement factor is not specified, it shall not exceed 7.05 cwt/cu yd (418 kg/cu m).
- (b) The maximum allowable water/cement ratio shall be according to Article 1020.04 of the Standard Specifications or 0.44, whichever is lower.
- (c) The slump requirements of Article 1020.04 of the Standard Specifications shall not apply.
- (d) The coarse aggregate gradations shall be CA 13, CA 14, CA 16, or a blend of these gradations. CA 11 may be used when the Contractor provides satisfactory evidence to the Engineer that the mix will not segregate. The fine aggregate proportion shall be a maximum 50 percent by weight (mass) of the total aggregate used.
- (e) The slump flow range shall be  $\pm 2$  in. ( $\pm 50$  mm) of the Contractor target value, and within the overall Department range of 20 in. (510 mm) minimum to 28 in. (710 mm) maximum.
- (f) The visual stability index shall be a maximum of 1.
- (g) The J-ring value shall be a maximum of 4 in. (100 mm). The Contractor may specify a lower maximum in the mix design.
- (h) The L-box blocking ratio shall be a minimum of 60 percent. The Contractor may specify a higher minimum in the mix design.
- (i) The column segregation index shall be a maximum 15 percent.
- (j) The hardened visual stability index shall be a maximum of 1.

Placing and Consolidating. The maximum distance of horizontal flow from the point of deposit shall be 25 ft (7.6 m), unless approved otherwise by the Engineer.

Concrete shall be rodded with a piece of lumber, conduit, or vibrator if the material has lost its fluidity prior to placement of additional concrete. The vibrator shall be the pencil head type with a maximum diameter or width of 1 in. (25 mm). Any other method for restoring the fluidity of the concrete shall be approved by the Engineer.

Mix Design Approval. The Contractor shall obtain mix design approval according to the Department's Policy Memorandum "Quality Control/Quality Assurance Program for Precast Concrete Products".

### **SUBCONTRACTOR MOBILIZATION PAYMENTS (BDE)**

Effective: April 2, 2005

To account for the preparatory work and operations necessary for the movement of subcontractor personnel, equipment, supplies, and incidentals to the project site and for all other work or operations that must be performed or costs incurred when beginning work approved for subcontracting in accordance with Article 108.01 of the Standard Specifications, the Contractor shall make a mobilization payment to each subcontractor.

This mobilization payment shall be made at least 14 days prior to the subcontractor starting work. The amount paid shall be equal to 3 percent of the amount of the subcontract reported on form BC 260A submitted for the approval of the subcontractor's work.

This provision shall be incorporated directly or by reference into each subcontract approved by the Department.

### **STEEL COST ADJUSTMENT (BDE) (RETURN FORM WITH BID)**

Effective: April 2, 2004

Revised: April 1, 2009

Description. Steel cost adjustments will be made to provide additional compensation to the Contractor, or a credit to the Department, for fluctuations in steel prices when optioned by the Contractor. The bidder shall indicate on the attached form whether or not this special provision will be part of the contract and submit the completed form with his/her bid. Failure to submit the form or failure to indicate contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment.

Types of Steel Products. An adjustment will be made for fluctuations in the cost of steel used in the manufacture of the following items:

- Metal Piling (excluding temporary sheet piling)
- Structural Steel
- Reinforcing Steel

Other steel materials such as dowel bars, tie bars, mesh reinforcement, guardrail, steel traffic signal and light poles, towers and mast arms, metal railings (excluding wire fence), and frames and grates will be subject to a steel cost adjustment when the pay items they are used in has a contract value of \$10,000 or greater.

Documentation. Sufficient documentation shall be furnished to the Engineer to verify the following:

- (a) The dates and quantity of steel, in lb (kg), shipped from the mill to the fabricator.

(b) The quantity of steel, in lb (kg), incorporated into the various items of work covered by this special provision. The Department reserves the right to verify submitted quantities.

Method of Adjustment. Steel cost adjustments will be computed as follows:

$$SCA = Q \times D$$

Where: SCA = steel cost adjustment, in dollars  
Q = quantity of steel incorporated into the work, in lb (kg)  
D = price factor, in dollars per lb (kg)

$$D = MPI_M - MPI_L$$

Where:  $MPI_M$  = The Materials Cost Index for steel as published by the Engineering News-Record for the month the steel is shipped from the mill. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

$MPI_L$  = The Materials Cost Index for steel as published by the Engineering News-Record for the month prior to the letting. The indices will be converted from dollars per 100 lb to dollars per lb (kg).

The unit weights (masses) of steel that will be used to calculate the steel cost adjustment for the various items are shown in the attached table.

No steel cost adjustment will be made for any products manufactured from steel having a mill shipping date prior to the letting date.

If the Contractor fails to provide the required documentation, the method of adjustment will be calculated as described above; however, the  $MPI_M$  will be based on the date the steel arrives at the job site. In this case, an adjustment will only be made when there is a decrease in steel costs.

Basis of Payment. Steel cost adjustments may be positive or negative but will only be made when there is a difference between the  $MPI_L$  and  $MPI_M$  in excess of five percent, as calculated by:

$$\text{Percent Difference} = \{(MPI_L - MPI_M) \div MPI_L\} \times 100$$

Steel cost adjustments will be calculated by the Engineer and will be paid or deducted when all other contract requirements for the items of work are satisfied. Adjustments will only be made for fluctuations in the cost of the steel as described herein. No adjustment will be made for changes in the cost of manufacturing, fabrication, shipping, storage, etc.

The adjustments shall not apply during contract time subject to liquidated damages for completion of the entire contract.



**Attachment**

Item	Unit Mass (Weight)
Metal Piling (excluding temporary sheet piling)	
Furnishing Metal Pile Shells 12 in. (305 mm), 0.179 in. (3.80 mm) wall thickness)	23 lb/ft (34 kg/m)
Furnishing Metal Pile Shells 12 in. (305 mm), 0.250 in. (6.35 mm) wall thickness)	32 lb/ft (48 kg/m)
Furnishing Metal Pile Shells 14 in. (356 mm), 0.250 in. (6.35 mm) wall thickness)	37 lb/ft (55 kg/m)
Other piling	See plans
Structural Steel	See plans for weights (masses)
Reinforcing Steel	See plans for weights (masses)
Dowel Bars and Tie Bars	6 lb (3 kg) each
Mesh Reinforcement	63 lb/100 sq ft (310 kg/sq m)
Guardrail	
Steel Plate Beam Guardrail, Type A w/steel posts	20 lb/ft (30 kg/m)
Steel Plate Beam Guardrail, Type B w/steel posts	30 lb/ft (45 kg/m)
Steel Plate Beam Guardrail, Types A and B w/wood posts	8 lb/ft (12 kg/m)
Steel Plate Beam Guardrail, Type 2	305 lb (140 kg) each
Steel Plate Beam Guardrail, Type 6	1260 lb (570 kg) each
Traffic Barrier Terminal, Type 1 Special (Tangent)	730 lb (330 kg) each
Traffic Barrier Terminal, Type 1 Special (Flared)	410 lb (185 kg) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms	
Traffic Signal Post	11 lb/ft (16 kg/m)
Light Pole, Tenon Mount and Twin Mount, 30 - 40 ft (9 - 12 m)	14 lb/ft (21 kg/m)
Light Pole, Tenon Mount and Twin Mount, 45 - 55 ft (13.5 - 16.5 m)	21 lb/ft (31 kg/m)
Light Pole w/Mast Arm, 30 - 50 ft (9 - 15.2 m)	13 lb/ft (19 kg/m)
Light Pole w/Mast Arm, 55 - 60 ft (16.5 - 18 m)	19 lb/ft (28 kg/m)
Light Tower w/Luminaire Mount, 80 - 110 ft (24 - 33.5 m)	31 lb/ft (46 kg/m)
Light Tower w/Luminaire Mount, 120 - 140 ft (36.5 - 42.5 m)	65 lb/ft (97 kg/m)
Light Tower w/Luminaire Mount, 150 - 160 ft (45.5 - 48.5 m)	80 lb/ft (119 kg/m)
Metal Railings (excluding wire fence)	
Steel Railing, Type SM	64 lb/ft (95 kg/m)
Steel Railing, Type S-1	39 lb/ft (58 kg/m)
Steel Railing, Type T-1	53 lb/ft (79 kg/m)
Steel Bridge Rail	52 lb/ft (77 kg/m)
Frames and Grates	
Frame	250 lb (115 kg)
Lids and Grates	150 lb (70 kg)

## RETURN WITH BID

### ILLINOIS DEPARTMENT OF TRANSPORTATION

### OPTION FOR STEEL COST ADJUSTMENT

The bidder shall submit this completed form with his/her bid. Failure to submit the form or properly complete contract number, company name, and sign and date the form shall make this contract exempt of steel cost adjustments for all items of steel. Failure to indicate "Yes" for any item of work will make that item of steel exempt from steel cost adjustment. After award, this form, when submitted shall become part of the contract.

**Contract No.:** \_\_\_\_\_

**Company Name:** \_\_\_\_\_

**Contractor's Option:**

Is your company opting to include this special provision as part of the contract plans for the following items of work?

- |  |     |                          |
|--|-----|--------------------------|
| Metal Piling   | Yes | <input type="checkbox"/> |
| Structural Steel   | Yes | <input type="checkbox"/> |
| Reinforcing Steel  | Yes | <input type="checkbox"/> |
| Dowel Bars, Tie Bars and Mesh Reinforcement                | Yes | <input type="checkbox"/> |
| Guardrail  | Yes | <input type="checkbox"/> |
| Steel Traffic Signal and Light Poles, Towers and Mast Arms | Yes | <input type="checkbox"/> |
| Metal Railings (excluding wire fence)                      | Yes | <input type="checkbox"/> |
| Frames and Grates  | Yes | <input type="checkbox"/> |

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

## ILLINOIS DEPARTMENT OF LABOR

### PREVAILING WAGES FOR COOK COUNTY EFFECTIVE MAY 2010

The Prevailing rates of wages are included in the Contract proposals which are subject to Check Sheet #5 of the Supplemental Specifications and Recurring Special Provisions. The rates have been ascertained and certified by the Illinois Department of Labor for the locality in which the work is to be performed and for each craft or type of work or mechanic needed to execute the work of the Contract. As required by Prevailing Wage Act (820 ILCS 130/0.01, et seq.) and Check Sheet #5 of the Contract, not less than the rates of wages ascertained by the Illinois Department of Labor and as revised during the performance of a Contract shall be paid to all laborers, workers and mechanics performing work under the Contract. Post the scale of wages in a prominent and easily accessible place at the site of work.

If the Illinois Department of Labor revises the prevailing rates of wages to be paid as listed in the specification of rates, the contractor shall post the revised rates of wages and shall pay not less than the revised rates of wages. Current wage rate information shall be obtained by visiting the Illinois Department of Labor web site at <http://www.state.il.us/agency/idol/> or by calling 312-793-2814. It is the responsibility of the contractor to review the rates applicable to the work of the contract at regular intervals in order to insure the timely payment of current rates. Provision of this information to the contractor by means of the Illinois Department of Labor web site satisfies the notification of revisions by the Department to the contractor pursuant to the Act, and the contractor agrees that no additional notice is required. The contractor shall notify each of its subcontractors of the revised rates of wages.

# Cook County Prevailing Wage for May 2010

Trade Name	RG	TYP	C	Base	FRMAN	*M-F>8	OSA	OSH	H/W	Pensn	Vac	Trng
=====	==	===	=	=====	=====	=====	===	===	=====	=====	=====	=====
ASBESTOS ABT-GEN		ALL		35.200	35.700	1.5	1.5	2.0	9.130	8.370	0.000	0.400
ASBESTOS ABT-MEC		BLD		31.540	0.000	1.5	1.5	2.0	9.670	9.610	0.000	0.520
BOILERMAKER		BLD		43.020	46.890	2.0	2.0	2.0	6.720	9.890	0.000	0.350
BRICK MASON		BLD		39.030	42.930	1.5	1.5	2.0	8.800	10.67	0.000	0.740
CARPENTER		ALL		40.770	42.770	1.5	1.5	2.0	9.840	9.790	0.000	0.490
CEMENT MASON		ALL		41.850	43.850	1.5	1.5	2.0	8.600	9.810	0.000	0.220
CERAMIC TILE FNSHER		BLD		33.600	0.000	2.0	1.5	2.0	6.950	8.020	0.000	0.540
COMM. ELECT.		BLD		36.440	38.940	1.5	1.5	2.0	7.650	7.750	0.000	0.700
ELECTRIC PWR EQMT OP		ALL		39.850	46.430	1.5	1.5	2.0	9.870	12.40	0.000	0.300
ELECTRIC PWR GRNDMAN		ALL		31.080	46.430	1.5	1.5	2.0	7.700	9.680	0.000	0.240
ELECTRIC PWR LINEMAN		ALL		39.850	46.430	1.5	1.5	2.0	9.870	12.40	0.000	0.300
ELECTRICIAN		ALL		40.400	43.000	1.5	1.5	2.0	11.33	9.420	0.000	0.750
ELEVATOR CONSTRUCTOR		BLD		46.160	51.930	2.0	2.0	2.0	10.03	9.460	2.770	0.000
FENCE ERECTOR		ALL		30.700	32.200	1.5	1.5	2.0	7.950	8.430	0.000	0.500
GLAZIER		BLD		37.000	38.500	1.5	1.5	2.0	7.340	12.05	0.000	0.740
HT/FROST INSULATOR		BLD		42.050	44.550	1.5	1.5	2.0	9.670	10.81	0.000	0.520
IRON WORKER		ALL		40.750	42.750	2.0	2.0	2.0	11.00	15.99	0.000	0.300
LABORER		ALL		35.200	35.950	1.5	1.5	2.0	9.130	8.370	0.000	0.400
LATHER		ALL		40.770	42.770	1.5	1.5	2.0	9.840	9.790	0.000	0.490
MACHINIST		BLD		42.770	44.770	1.5	1.5	2.0	7.750	8.690	0.650	0.000
MARBLE FINISHERS		ALL		29.100	0.000	1.5	1.5	2.0	8.800	10.67	0.000	0.740
MARBLE MASON		BLD		39.030	42.930	1.5	1.5	2.0	8.800	10.67	0.000	0.740
MATERIAL TESTER I		ALL		25.200	0.000	1.5	1.5	2.0	9.130	8.370	0.000	0.400
MATERIALS TESTER II		ALL		30.200	0.000	1.5	1.5	2.0	9.130	8.370	0.000	0.400
MILLWRIGHT		ALL		40.770	42.770	1.5	1.5	2.0	9.840	9.790	0.000	0.490
OPERATING ENGINEER		BLD 1		45.100	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 2		43.800	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 3		41.250	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 4		39.500	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 5		48.850	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 6		46.100	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		BLD 7		48.100	49.100	2.0	2.0	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		FLT 1		51.300	51.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		FLT 2		49.800	51.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		FLT 3		44.350	51.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		FLT 4		36.850	51.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 1		43.300	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 2		42.750	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 3		40.700	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 4		39.300	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 5		38.100	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 6		46.300	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
OPERATING ENGINEER		HWY 7		44.300	47.300	1.5	1.5	2.0	11.70	8.050	1.900	1.150
ORNAMNTL IRON WORKER		ALL		40.200	42.450	2.0	2.0	2.0	8.700	14.04	0.000	0.500
PAINTER		ALL		38.000	42.750	1.5	1.5	1.5	8.350	9.400	0.000	0.670
PAINTER SIGNS		BLD		31.740	35.640	1.5	1.5	1.5	2.600	2.540	0.000	0.000
PILEDRIIVER		ALL		40.770	42.770	1.5	1.5	2.0	9.840	9.790	0.000	0.490
PIPEFITTER		BLD		43.150	46.150	1.5	1.5	2.0	7.660	9.550	0.000	1.570
PLASTERER		BLD		38.550	40.860	1.5	1.5	2.0	9.000	9.690	0.000	0.450
PLUMBER		BLD		44.000	46.000	1.5	1.5	2.0	9.860	7.090	0.000	1.030
ROOFER		BLD		37.000	40.000	1.5	1.5	2.0	7.500	6.020	0.000	0.330
SHEETMETAL WORKER		BLD		40.460	43.700	1.5	1.5	2.0	9.580	12.35	0.000	0.610
SIGN HANGER		BLD		28.210	29.060	1.5	1.5	2.0	4.450	2.880	0.000	0.000
SPRINKLER FITTER		BLD		40.500	42.500	1.5	1.5	2.0	8.500	6.850	0.000	0.500
STEEL ERECTOR		ALL		40.750	42.750	2.0	2.0	2.0	10.95	15.99	0.000	0.300
STONE MASON		BLD		39.030	42.930	1.5	1.5	2.0	8.800	10.67	0.000	0.740
TERRAZZO FINISHER		BLD		35.150	0.000	1.5	1.5	2.0	6.950	10.57	0.000	0.380
TERRAZZO MASON		BLD		39.010	42.010	1.5	1.5	2.0	6.950	11.91	0.000	0.510

TILE MASON		BLD		40.490	44.490	2.0	1.5	2.0	6.950	9.730	0.000	0.610
TRAFFIC SAFETY WRKR		HWY		24.300	25.900	1.5	1.5	2.0	3.780	1.875	0.000	0.000
TRUCK DRIVER	E	ALL	1	30.700	31.350	1.5	1.5	2.0	6.750	5.450	0.000	0.150
TRUCK DRIVER	E	ALL	2	30.950	31.350	1.5	1.5	2.0	6.750	5.450	0.000	0.150
TRUCK DRIVER	E	ALL	3	31.150	31.350	1.5	1.5	2.0	6.750	5.450	0.000	0.150
TRUCK DRIVER	E	ALL	4	31.350	31.350	1.5	1.5	2.0	6.750	5.450	0.000	0.150
TRUCK DRIVER	W	ALL	1	32.550	33.100	1.5	1.5	2.0	6.500	4.350	0.000	0.000
TRUCK DRIVER	W	ALL	2	32.700	33.100	1.5	1.5	2.0	6.500	4.350	0.000	0.000
TRUCK DRIVER	W	ALL	3	32.900	33.100	1.5	1.5	2.0	6.500	4.350	0.000	0.000
TRUCK DRIVER	W	ALL	4	33.100	33.100	1.5	1.5	2.0	6.500	4.350	0.000	0.000
TUCKPOINTER		BLD		39.200	40.200	1.5	1.5	2.0	7.830	10.25	0.000	0.770

Legend:

M-F>8 (Overtime is required for any hour greater than 8 worked each day, Monday through Friday.)

OSA (Overtime is required for every hour worked on Saturday)

OSH (Overtime is required for every hour worked on Sunday and Holidays)

H/W (Health & Welfare Insurance)

Pensn (Pension)

Vac (Vacation)

Trng (Training)

## Explanations

### COOK COUNTY

TRUCK DRIVERS (WEST) - That part of the county West of Barrington Road.

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial/Decoration Day, Fourth of July, Labor Day, Veterans Day, Thanksgiving Day, Christmas Day. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration such as the day after Thanksgiving for Veterans Day. If in doubt, please check with IDOL.

### EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at some close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

### CERAMIC TILE FINISHER

The grouting, cleaning, and polishing of all classes of tile, whether for interior or exterior purposes, all burned, glazed or unglazed products; all composition materials, granite tiles, warning detectable tiles, cement tiles, epoxy composite materials, pavers, glass, mosaics, fiberglass, and all substitute materials, for tile made in tile-like units; all mixtures in tile like form of cement, metals, and other materials that are for and intended for use as a finished floor surface, stair treads, promenade roofs, walks, walls, ceilings, swimming pools, and all other places where tile is to form a finished interior or exterior. The mixing of all setting mortars including but not limited to thin-set mortars, epoxies, wall mud, and any other sand and cement mixtures or adhesives when used in the preparation, installation, repair, or maintenance of tile and/or similar materials. The handling and unloading of all sand, cement, lime, tile, fixtures, equipment, adhesives, or any other materials to be used in the preparation, installation, repair, or maintenance of tile and/or similar materials. Ceramic Tile Finishers shall fill all joints and voids regardless of method on all tile work, particularly and especially after installation of said tile work. Application of any and all protective coverings to all types of tile installations including, but not be limited to, all soap compounds, paper products, tapes, and all polyethylene coverings, plywood, masonite, cardboard, and any new type of products that may be used to protect tile installations, Blastrac equipment, and all floor scarifying equipment used in preparing floors to receive tile. The clean up and removal of all waste and materials. All demolition of existing tile floors and walls to be re-tiled.

#### COMMUNICATIONS ELECTRICIAN

Installation, operation, inspection, maintenance, repair and service of radio, television, recording, voice sound vision production and reproduction, telephone and telephone interconnect, facsimile, data apparatus, coaxial, fibre optic and wireless equipment, appliances and systems used for the transmission and reception of signals of any nature, business, domestic, commercial, education, entertainment, and residential purposes, including but not limited to, communication and telephone, electronic and sound equipment, fibre optic and data communication systems, and the performance of any task directly related to such installation or service whether at new or existing sites, such tasks to include the placing of wire and cable and electrical power conduit or other raceway work within the equipment room and pulling wire and/or cable through conduit and the installation of any incidental conduit, such that the employees covered hereby can complete any job in full.

#### MARBLE FINISHER

Loading and unloading trucks, distribution of all materials (all stone, sand, etc.), stocking of floors with material, performing all rigging for heavy work, the handling of all material that may be needed for the installation of such materials, building of scaffolding, polishing if needed, patching, waxing of material if damaged, pointing up, caulking, grouting and cleaning of marble, holding water on diamond or Carborundum blade or saw for setters cutting, use of tub saw or any other saw needed for preparation of material, drilling of holes for wires that anchor material set by setters, mixing up of molding plaster for installation of material, mixing up thin set for the installation of material, mixing up of sand to cement for the installation of material and such other work as may be required in helping a Marble Setter in the handling of all material in the erection or installation of interior marble, slate, travertine, art marble, serpentine, alberene stone, blue stone,

granite and other stones (meaning as to stone any foreign or domestic materials as are specified and used in building interiors and exteriors and customarily known as stone in the trade), carrara, sanionyx, vitrolite and similar opaque glass and the laying of all marble tile, terrazzo tile, slate tile and precast tile, steps, risers treads, base, or any other materials that may be used as substitutes for any of the aforementioned materials and which are used on interior and exterior which are installed in a similar manner.

MATERIAL TESTER I: Hand coring and drilling for testing of materials; field inspection of uncured concrete and asphalt.

MATERIAL TESTER II: Field inspection of welds, structural steel, fireproofing, masonry, soil, facade, reinforcing steel, formwork, cured concrete, and concrete and asphalt batch plants; adjusting proportions of bituminous mixtures.

#### OPERATING ENGINEER - BUILDING

Class 1. Asphalt Plant; Asphalt Spreader; Autograde; Backhoes with Caisson Attachment; Batch Plant; Benoto (requires Two Engineers); Boiler and Throttle Valve; Caisson Rigs; Central Redi-Mix Plant; Combination Back Hoe Front End-loader Machine; Compressor and Throttle Valve; Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Conveyor (Truck Mounted); Concrete Paver Over 27E cu. ft; Concrete Paver 27E cu. ft. and Under; Concrete Placer; Concrete Placing Boom; Concrete Pump (Truck Mounted); Concrete Tower; Cranes, All; Cranes, Hammerhead; Cranes, (GCI and similar Type); Creter Crane; Crusher, Stone, etc.; Derricks, All; Derricks, Traveling; Formless Curb and Gutter Machine; Grader, Elevating; Grouting Machines; Highlift Shovels or Front Endloader 2-1/4 yd. and over; Hoists, Elevators, outside type rack and pinion and similar machines; Hoists, One, Two and Three Drum; Hoists, Two Tugger One Floor; Hydraulic Backhoes; Hydraulic Boom Trucks; Hydro Vac (and similar equipment); Locomotives, All; Motor Patrol; Lubrication Technician; Manipulators; Pile Drivers and Skid Rig; Post Hole Digger; Pre-Stress Machine; Pump Cretes Dual Ram; Pump Cretes: Squeeze Cretes-Screw Type Pumps; Gypsum Bulker and Pump; Raised and Blind Hole Drill; Roto Mill Grinder; Scoops - Tractor Drawn; Slip-Form Paver; Straddle Buggies; Tournapull; Tractor with Boom and Side Boom; Trenching Machines.

Class 2. Boilers; Broom, All Power Propelled; Bulldozers; Concrete Mixer (Two Bag and Over); Conveyor, Portable; Forklift Trucks; Highlift Shovels or Front Endloaders under 2-1/4 yd.; Hoists, Automatic; Hoists, Inside Elevators; Hoists, Sewer Dragging Machine; Hoists, Tugger Single Drum; Rock Drill (Self-Propelled); Rock Drill (Truck Mounted); Rollers, All; Steam Generators; Tractors, All; Tractor Drawn Vibratory Roller; Winch Trucks with "A" Frame.

Class 3. Air Compressor; Combination Small Equipment Operator; Generators; Heaters, Mechanical; Hoists, Inside Elevators; Hydraulic Power Units (Pile Driving, Extracting, and Drilling); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Low Boys; Pumps, Well Points; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches; Bobcats (up to and including ¾ cu yd.) .

Class 4. Bobcats and/or other Skid Steer Loaders (other than bobcats up to and including ¾ cu yd.); Oilers; and Brick Forklift.

Class 5. Assistant Craft Foreman.

Class 6. Gradall .

## Class 7. Mechanics.

### OPERATING ENGINEERS - HIGHWAY CONSTRUCTION

Class 1. Asphalt Plant; Asphalt Heater and Planer Combination; Asphalt Heater Scarfire; Asphalt Spreader; Autograder/GOMACO or other similar type machines: ABG Paver; Backhoes with Caisson Attachment; Ballast Regulator; Belt Loader; Caisson Rigs; Car Dumper; Central Redi-Mix Plant; Combination Backhoe Front Endloader Machine, (1 cu. yd. Backhoe Bucket or over or with attachments); Concrete Breaker (Truck Mounted); Concrete Conveyor; Concrete Paver over 27E cu. ft.; Concrete Placer; Concrete Tube Float; Cranes, all attachments; Cranes, Tower Cranes of all types: Creter Crane: Crusher, Stone, etc.; Derricks, All; Derrick Boats; Derricks, Traveling; Dowell Machine with Air Compressor; Dredges; Formless Curb and Gutter Machine; Grader, Elevating; Grader, Motor Grader, Motor Patrol, Auto Patrol, Form Grader, Pull Grader, Subgrader; Guard Rail Post Driver Truck Mounted; Hoists, One, Two and Three Drum; Hydraulic Backhoes; Backhoes with shear attachments; Lubrication Technician; Manipulators; Mucking Machine; Pile Drivers and Skid Rig; Pre-Stress Machine; Pump Cretes Dual Ram; Rock Drill - Crawler or Skid Rig; Rock Drill - Truck Mounted; Rock/Track Tamper; Roto Mill Grinder; Slip-Form Paver; Soil Test Drill Rig (Truck Mounted); Straddle Buggies; Hydraulic Telescoping Form (Tunnel); Tractor Drawn Belt Loader (with attached pusher - two engineers); Tractor with Boom; Tractaire with Attachments; Trenching Machine; Truck Mounted Concrete Pump with Boom; Raised or Blind Hole Drills (Tunnel Shaft); Underground Boring and/or Mining Machines 5 ft. in diameter and over tunnel, etc; Underground Boring and/or Mining Machines under 5 ft. in diameter; Wheel Excavator; Widener (APSCO).

Class 2. Batch Plant; Bituminous Mixer; Boiler and Throttle Valve; Bulldozers; Car Loader Trailing Conveyors; Combination Backhoe Front Endloader Machine (Less than 1 cu. yd. Backhoe Bucket or over or with attachments); Compressor and Throttle Valve; Compressor, Common Receiver (3); Concrete Breaker or Hydro Hammer; Concrete Grinding Machine; Concrete Mixer or Paver 7S Series to and including 27 cu. ft.; Concrete Spreader; Concrete Curing Machine, Burlap Machine, Belting Machine and Sealing Machine; Concrete Wheel Saw; Conveyor Muck Cars (Haglund or Similar Type); Drills, All; Finishing Machine - Concrete; Highlift Shovels or Front Endloader; Hoist - Sewer Dragging Machine; Hydraulic Boom Trucks (All Attachments); Hydro-Blaster; All Locomotives, Dinky; Off-Road Hauling Units (including articulating)/2 ton capacity or more; Non Self-Loading Ejection Dump; Pump Cretes: Squeeze Cretes - Screw Type Pumps, Gypsum Bulker and Pump; Roller, Asphalt; Rotary Snow Plows; Rototiller, Seaman, etc., self-propelled; Scoops - Tractor Drawn; Self-Propelled Compactor; Spreader - Chip - Stone, etc.; Scraper; Scraper - Prime Mover in Tandem (Regardless of Size); Tank Car Heater; Tractors, Push, Pulling Sheeps Foot, Disc, Compactor, etc.; Tug Boats.

Class 3. Boilers; Brooms, All Power Propelled; Cement Supply Tender; Compressor, Common Receiver (2); Concrete Mixer (Two Bag and Over); Conveyor, Portable; Farm-Type Tractors Used for Mowing, Seeding, etc.; Fireman on Boilers; Forklift Trucks; Grouting Machine; Hoists, Automatic; Hoists, All Elevators; Hoists, Tugger Single Drum; Jeep Diggers; Low Boys; Pipe Jacking Machines; Post-Hole Digger; Power Saw, Concrete Power Driven; Pug Mills; Rollers, other than Asphalt; Seed and Straw Blower; Steam Generators; Stump Machine; Winch Trucks with "A" Frame; Work Boats; Tamper-Form-Motor Driven.



Class 4. Air Compressor; Combination - Small Equipment Operator; Directional Boring Machine; Generators; Heaters, Mechanical; Hydraulic Power Unit (Pile Driving, Extracting, or Drilling); Hydro- Blaster; Light Plants, All (1 through 5); Pumps, over 3" (1 to 3 not to exceed a total of 300 ft.); Pumps, Well Points; Tractaire; Welding Machines (2 through 5); Winches, 4 Small Electric Drill Winches.

Class 5. Bobcats (all); Brick Forklifts; Oilers.

Class 6. Field Mechanics and Field Welders

Class 7. Gradall and machines of like nature.

#### OPERATING ENGINEER - FLOATING

Class 1. Craft Foreman; Diver/Wet Tender; and Engineer (hydraulic dredge).

Class 2. Crane/Backhoe Operator; 70 Ton or over Tug Operator; Mechanic/Welder; Assistant Engineer (Hydraulic Dredge); Leverman (Hydraulic Dredge); Diver Tender; Friction and Lattice Boom Cranes.

Class 3. Deck Equipment Operator, Machineryman; Maintenance of Crane (over 50 ton capacity); Tug/Launch Operator; Loader/Dozer and like equipment on Barge; and Deck Machinery, etc.

Class 4. Deck Equipment Operator, Machineryman/Fireman (4 Equipment Units or More); Off Road Trucks (2 ton capacity or more); Deck Hand, Tug Engineer, Crane Maintenance 50 Ton Capacity and Under or Backhoe Weighing 115,000 pounds or less; and Assistant Tug Operator.

#### TERRAZZO FINISHER

The handling of sand, cement, marble chips, and all other materials that may be used by the Mosaic Terrazzo Mechanic, and the mixing, grinding, grouting, cleaning and sealing of all Marble, Mosaic, and Terrazzo work, floors, base, stairs, and wainscoting by hand or machine, and in addition, assisting and aiding Marble, Masonic, and Terrazzo Mechanics.

#### TRAFFIC SAFETY

Work associated with barricades, horses and drums used to reduce lane usage on highway work, the installation and removal of temporary lane markings, and the installation and removal of temporary road signs.

#### TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION - EAST & WEST

Class 1. Two or three Axle Trucks. A-frame Truck when used for transportation purposes; Air Compressors and Welding Machines, including those pulled by cars, pick-up trucks and tractors; Ambulances; Batch Gate Lockers; Batch Hopperman; Car and Truck Washers; Carry-alls; Fork Lifts and Hoisters; Helpers; Mechanics Helpers and Greasers; Oil Distributors 2-man operation; Pavement Breakers; Pole Trailer, up to 40 feet; Power Mower Tractors; Self-propelled Chip Spreader; Skipman; Slurry Trucks, 2-man operation; Slurry Truck Conveyor Operation, 2 or 3 man; TEamsters Unskilled dumpman; and Truck Drivers hauling warning lights, barricades, and portable toilets on the job site.

Class 2. Four axle trucks; Dump Crets and Adgetors under 7 yards; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnapulls or Turnatrailers when pulling other than self-loading equipment or

similar equipment under 16 cubic yards; Mixer Trucks under 7 yards; Ready-mix Plant Hopper Operator, and Winch Trucks, 2 Axles.

Class 3. Five axle trucks; Dump Crets and Adgetors 7 yards and over; Dumpsters, Track Trucks, Euclids, Hug Bottom Dump Turnatrailers or turnapulls when pulling other than self-loading equipment or similar equipment over 16 cubic yards; Explosives and/or Fission Material Trucks; Mixer Trucks 7 yards or over; Mobile Cranes while in transit; Oil Distributors, 1-man operation; Pole Trailer, over 40 feet; Pole and Expandable Trailers hauling material over 50 feet long; Slurry trucks, 1-man operation; Winch trucks, 3 axles or more; Mechanic--Truck Welder and Truck Painter.

Class 4. Six axle trucks; Dual-purpose vehicles, such as mounted crane trucks with hoist and accessories; Foreman; Master Mechanic; Self-loading equipment like P.B. and trucks with scoops on the front.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

#### LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.