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 that 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 downloading and/or ordering CD-ROM's and are 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, signed and notarized, "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 a **Proposal Denial and/or Authorization Form**, approved by the Central Bureau of Construction, that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Proposal Denial and/or Authorization Form** 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 bidder check IDOT's website http://www.dot.il.gov/desenv/delett.html before submitting final bid information.

IDOT is not responsible for any e-mail related failures.

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

Technical Questions about downloading these files may be directed to Tim Garman (217)524-1642 or garmantr@dot.il.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?

Questions Regarding	**Call**
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
Electronic plans and proposals	(217)524-1642

ADDENDUMS AND REVISIONS TO THE PROPOSAL FORMS

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

RETURN WITH BID

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Proposal Submitted By
Name
Address
City

Letting November 18, 2005

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. 76645
ST. CLAIR County
Section 82-(1,2)T-17
District 8 Construction Funds
Route FAI 70

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)

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.

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 "Request for Proposal Forms and Plans" 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 **Proposal Denial and/or Authorization Form**, approved by the Central Bureau of Construction, that indicates which items have been approved For Bidding. If **Authorization to Bid** cannot be approved, the **Proposal Denial and/or Authorization Form** will indicate the reason for denial. If a contractor has requested to bid but has not received a **Proposal Denial and/or Authorization Form**, 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.

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?

Questions Regarding	Call
Prequalification and/or Authorization to Bid	217/782-3413
Preparation and submittal of bids	217/782-7806
Mailing of CD-ROMS	217/782-7806

RETURN WITH BID

Illinois Department of Transportation

PROPOSAL

TO THE DEPARTMENT OF TRANSPORTATION

1. Proposal of _____

   _____

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

   Contract No. 76645
   ST. CLAIR County
   Section 82-(1,2)T-17
   Route FAI 70
   District 8 Construction Funds

Rehabilitation of the Bowman Avenue Pump Station located at Exchange Avenue and Seventh Street (Bowman Yard) in East St. Louis.

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.

3. **ASSURANCE OF EXAMINATION AND INSPECTION/WAIVER.** The undersigned further declares that he/she has carefully examined the proposal, plans, specifications, 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:

Amount of Bid			Proposal Guaranty	Amount of Bid			Proposal Guaranty
Up to		$5,000	$150	$2,000,000	to	$3,000,000	$100,000
$5,000	to	$10,000	$300	$3,000,000	to	$5,000,000	$150,000
$10,000	to	$50,000	$1,000	$5,000,000	to	$7,500,000	$250,000
$50,000	to	$100,000	$3,000	$7,500,000	to	$10,000,000	$400,000
$100,000	to	$150,000	$5,000	$10,000,000	to	$15,000,000	$500,000
$150,000	to	$250,000	$7,500	$15,000,000	to	$20,000,000	$600,000
$250,000	to	$500,000	$12,500	$20,000,000	to	$25,000,000	$700,000
$500,000	to	$1,000,000	$25,000	$25,000,000	to	$30,000,000	$800,000
$1,000,000	to	$1,500,000	$50,000	$30,000,000	to	$35,000,000	$900,000
$1,500,000	to	$2,000,000	$75,000	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.

BD 354 (Rev. 11/2001)

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. **CERTIFICATE OF AUTHORITY.** The undersigned bidder, if a business organized under the laws of another State, assures the Department that it will furnish a copy of its certificate of authority to do business in the State of Illinois with the return of the executed contract and bond. Failure to furnish the certificate within the time provided for execution of an awarded contract may be cause for cancellation of the award and forfeiture of the proposal guaranty to the State.

ILLINOIS DEPARTMENT OF TRANSPORTATION
SCHEDULE OF PRICES
CONTRACT NUMBER - 76645

State Job # - C-98-026-03
PPS NBR - 8-88570-0500
County Name - ST CLAIR- -
Code - 163 - -
District - 8 - -
Section Number - 82-(1,2)T-17

Project Number

Route
FAI 70

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
XX002909	CLASS SI CONC	CU YD	285.000				
X0301028	PUMP STA SCADA EQUIP	L SUM	1.000				
X0325156	REM & DISP LEAD PAINT	SQ FT	2,580.000				
X0325157	CATH PROT PD HEADERS	L SUM	1.000				
X0325158	COMP SPARE S-PUMP ASM	EACH	1.000				
X0325159	PCB TRANS OIL ANALYS	EACH	5.000				
X0325160	PCB TRANS OIL DISP	GALLON	300.000				
X0325161	TRANSFORMER OIL DISP	GALLON	300.000				
X0325162	CH LK CANT SL GT 8X20	EACH	1.000				
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				
X8040305	ELECT SERV CONNECT	L SUM	1.000				
Z0008224	DRIL SHAFT/SOIL 24	FOOT	28.000				
50102400	CONC REM	CU YD	25.000				

ILLINOIS DEPARTMENT OF TRANSPORTATION
SCHEDULE OF PRICES
CONTRACT NUMBER - 76645

State Job # - C-98-026-03
PPS NBR - 8-88570-0500
County Name - ST CLAIR- -
Code - 163 - -
District - 8 - -
Section Number - 82-(1,2)T-17

Project Number

Route
FAI 70

Item Number	Pay Item Description	Unit of Measure	Quantity	x	Unit Price	=	Total Price
50200100	STRUCTURE EXCAVATION	CU YD	500.000				
50500405	F & E STRUCT STEEL	POUND	45,000.000				
50800105	REINFORCEMENT BARS	POUND	20,002.000				
50800205	REINF BARS, EPOXY CTD	POUND	23,722.000				
66400570	CH LK FENCE 8 SPL	FOOT	300.000				
66409400	CH LK GATES 8X12 DBL	EACH	1.000				
66411200	CH LK FEN-PRI SLAT 10	FOOT	600.000				
66900200	NON SPL WASTE DISPOSL	CU YD	130.000				
66900450	SPL WASTE PLNS/REPORT	L SUM	1.000				
66900530	SOIL DISPOSAL ANALY	EACH	1.000				
67000400	ENGR FIELD OFFICE A	CAL MO	24.000				
67100100	MOBILIZATION	L SUM	1.000				

CONTRACT NUMBER **76645**

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. By execution of the Proposal Signature Sheet, the bidder indicates that each of the mandated assurances has 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 termination of the contract and the suspension or debarment of the bidder.

II. ASSURANCES

A. 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. The Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous assurance, and the surety providing the performance bond shall be responsible for the completion of the contract.

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 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. The bidder assures the Department that the award and execution of the contract would not cause a violation of Section 50-10.

C. 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 $150,700.00. Sixty percent of the salary is $90,420.00.

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.

D. 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.

E. 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.

F. Revolving Door Prohibition

1. The Illinois Procurement Code provides:

Section 50-30. Revolving door prohibition. Chief procurement officers, associate procurement officers, State purchasing officers, 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.

G. 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.

H. 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

I. 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

A. 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. The Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous certification, and the surety providing the performance bond shall be responsible for completion of the contract.

B. 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 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, 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 shall contain a certification by the contractor that the contractor is not barred from being awarded a contract or subcontract under this Section. A contractor who makes a false statement, material to the certification, commits a Class 3 felony.

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

C. 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.

D. 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.

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.

E. 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.

F. 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.

G. Debt Delinquency

1. The Illinois Procurement Code provides:

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

The contractor or bidder certifies that it, or any affiliate, is not barred from being awarded a contract under 30 ILCS 500. Section 50-11 prohibits a person from entering into a contract with a State agency 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 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 contractor further acknowledges that the contracting State agency may declare the contract void if this certification is false or if the contractor, or any affiliate, is determined to be delinquent in the payment of any debt to the State during the term of the contract.

H. Sarbanes-Oxley Act of 2002

1. The Illinois Procurement Code provides:

Section 50-60(c).

The contractor 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 for a period of five years prior to the date of the bid or contract. The contractor acknowledges that the contracting agency shall declare the contract void if this certification is false.

I. ADDENDA

The contractor or bidder certifies that all relevant addenda have been incorporated in to this contract. Failure to do so may cause the bid to be declared unacceptable.

J. Section 42 of the Environmental Protection Act

The contractor certifies in accordance with 30 ILCS 500/50-12 that the bidder or contractor is not barred from being awarded a contract under this Section which prohibits the bidding on or entering into contracts with the State of Illinois or a State agency 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 contractor acknowledges that the contracting agency may declare the contract void if this certification is false.

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.**

_____

_____

_____

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

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 Department may terminate the contract if it is later determined that the bidder rendered a false or erroneous disclosure, 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.

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: For bidders that have previously submitted the information requested in Form A

The Department has retained the Form A disclosures submitted by all bidders responding to these requirements for the April 24, 1998 or any subsequent letting conducted by the Department. The bidder has the option of submitting the information again or the bidder may sign the following certification statement indicating that the information previously submitted by the bidder is, as of the date of signature, current and accurate. The Certification must be signed and dated by a person who is authorized to execute contracts for the bidding company. Before signing this certification, the bidder should carefully review its prior submissions to ensure the Certification is correct. If the Bidder signs the Certification, the Bidder should proceed to Form B instructions.

CERTIFICATION STATEMENT

I have determined that the Form A disclosure information previously submitted is current and accurate, and all forms are hereby incorporated by reference in this bid. Any necessary additional forms or amendments to previously submitted forms are attached to this bid.

_____
(Bidding Company)

_____ _____
Name of Authorized Representative (type or print) Title of Authorized Representative (type or print)

_____ _____
Signature of Authorized Representative Date

Form A: For bidders who have NOT previously submitted the information requested in Form A

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 the second page of 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 $90,420.00? YES ___ NO___
3. Does anyone in your organization receive more than $90,420.00 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 $90,420.00? 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 on page 2 of Form A must be signed and dated by a person that is authorized to execute contracts for your company.

Form B: Identifying Other Contracts & Procurement Related Information Disclosure Form B must be completed for each bid submitted by the bidding entity. It must be signed by an individual who is authorized to execute contracts for the bidding entity. *Note: Signing the NOT APPLICABLE STATEMENT on Form A does not allow the bidder to ignore Form B. Form B must be completed, signed 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 signature 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.

D. Bidders Submitting More Than One Bid

Bidders submitting multiple bids may submit one set of forms consisting of all required Form A disclosures and one Form B for use with all bids. Please indicate in the space provided below the bid item that contains the original disclosure forms and the bid items which incorporate the forms by reference.

- The bid submitted for letting item _____ contains the Form A disclosures or Certification Statement and the Form B disclosures. The following letting items incorporate the said forms by reference:

_____

_____

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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. 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 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 $90,420.00 (60% of the Governor's salary as of 7/1/01). **(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 $90,420.00, (60% of the Governor's salary as of 7/1/01) provide the name the State agency for which you are employed and your annual salary. _____
_____

3. If you are currently appointed to or employed by any agency of the State of Illinois, and your annual salary exceeds $90,420.00, (60% of the Governor's salary as of 7/1/01) 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 $90,420.00, (60% of the Governor's salary as of 7/1/01) 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 __

(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 $90,420.00, (60 % of the Governor's salary as of 7/1/01) 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 $90,420.00, (60% of the salary of the Governor as of 7/1/01) 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 $90,420.00, (60% of the Governor's salary as of 7/1/01) 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 __

(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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(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.

Completed by: _____
Name of Authorized Representative (type or print)

Completed by: _____
Title of Authorized Representative (type or print)

Completed by: _____ _____
Signature of Individual or Authorized Representative Date

NOT APPLICABLE STATEMENT

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.

_____
Name of Authorized Representative (type or print)

_____
Title of Authorized Representative (type or print)

_____ _____
Signature of Authorized Representative Date

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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 SIGNED

_____
Name of Authorized Representative (type or print)

_____
Title of Authorized Representative (type or print)

_____ _____
Signature of Authorized Representative Date

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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

Illinois Department of Transportation

Contract No. 76645
ST. CLAIR County
Section 82-(1,2)T-17
Route FAI 70
District 8 Construction Funds

PART I. IDENTIFICATION

Dept. Human Rights #_____ Duration of Project: _____

Name of Bidder: _____

PART II. WORKFORCE PROJECTION

A. The undersigned bidder has analyzed minority group and female populations, unemployment rates and availability of workers for the location in which this contract work is to be performed, and for the locations from which the bidder recruits employees, and hereby submits the following workforce projection including a projection for minority and female employee utilization in all job categories in the workforce to be allocated to this contract:

TABLE A

TOTAL Workforce Projection for Contract													TABLE B: CURRENT EMPLOYEES TO BE ASSIGNED TO CONTRACT			
			MINORITY EMPLOYEES						TRAINEES							
JOB CATEGORIES	TOTAL EMPLOYEES		BLACK		HISPANIC		*OTHER MINOR.		APPREN-TICES		ON THE JOB TRAINEES		TOTAL EMPLOYEES		MINORITY EMPLOYEES	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OFFICIALS (MANAGERS)																
SUPERVISORS																
FOREMEN																
CLERICAL																
EQUIPMENT OPERATORS																
MECHANICS																
TRUCK DRIVERS																
IRONWORKERS																
CARPENTERS																
CEMENT MASONS																
ELECTRICIANS																
PIPEFITTERS, PLUMBERS																
PAINTERS																
LABORERS, SEMI-SKILLED																
LABORERS, UNSKILLED																
TOTAL																

TABLE C

TOTAL Training Projection for Contract								
EMPLOYEES IN TRAINING	TOTAL EMPLOYEES		BLACK		HISPANIC		*OTHER MINOR.	
	M	F	M	F	M	F	M	F
APPRENTICES								
ON THE JOB TRAINEES								

*Other minorities are defined as Asians (A) or Native Americans (N).

Please specify race of each employee shown in Other Minorities column.

Note: See instructions on the next page

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IL 494-0454

RETURN WITH BID

Contract No. 76645
ST. CLAIR County
Section 82-(1,2)T-17
Route FAI 70
District 8 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 only 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. 76645
ST. CLAIR County
Section 82-(1,2)T-17
Route FAI 70
District 8 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.

Firm Name _____

(IF AN INDIVIDUAL)

Signature of Owner _____

Business Address _____

_____

Firm Name _____

By _____

(IF A CO-PARTNERSHIP)

Business Address _____

_____

Name and Address of All Members of the Firm:

_____ _____

_____ _____

Corporate Name _____

By _____

Signature of Authorized Representative

_____

Typed or printed name and title of Authorized Representative

(IF A CORPORATION)

Attest _____

Signature

(IF A JOINT VENTURE, USE THIS SECTION FOR THE MANAGING PARTY AND THE SECOND PARTY SHOULD SIGN BELOW)

Business Address _____

_____

Corporate Name _____

By _____

Signature of Authorized Representative

_____

Typed or printed name and title of Authorized Representative

(IF A JOINT VENTURE)

Attest _____

Signature

Business Address _____

_____

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

RETURN WITH BID

Illinois Department of Transportation

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

_____
(Company Name)

By: _____
(Signature & Title)

SURETY

_____
(Company Name)

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 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

Illinois Department of Transportation

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

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. 76645
ST. CLAIR County
Section 82-(1,2)T-17
Route FAI 70
District 8 Construction Funds

Illinois Department of Transportation

Illinois Department of Transportation

NOTICE TO BIDDERS

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., November 18, 2005. 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. 76645
   ST. CLAIR County
   Section 82-(1,2)T-17
   Route FAI 70
   District 8 Construction Funds

Rehabilitation of the Bowman Avenue Pump Station located at Exchange Avenue and Seventh Street (Bowman Yard) in East St. Louis.

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

Timothy W. Martin, Secretary

INDEX
FOR
SUPPLEMENTAL SPECIFICATIONS AND RECURRING SPECIAL PROVISIONS
Adopted March 1, 2005

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

ERRATA Standard Specifications for Road and Bridge Construction (Adopted 1-1-02) (Revised 3-1-05)

SUPPLEMENTAL SPECIFICATIONS

RECURRING SPECIAL PROVISIONS

The following RECURRING SPECIAL PROVISIONS indicated by an "X" are applicable to this contract and are included by reference:

TABLE OF CONTENTS

STATE OF ILLINOIS

SPECIAL PROVISIONS

The following Special Provisions supplement the "Standard Specifications for Road and Bridge Construction," adopted January 1, 2002 (Hereinafter referred to as the Standard Specifications; and the "Supplemental Specifications and Recurring Special Provisions" indicated on the "Check Sheet" included herein which apply to and govern the rehabilitation of existing Bowman Avenue Pump Station , Section 82-(1,2) T-17 located in St. Clair 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 Department of Transportation Bowman Avenue Pump Station located within the Department of Transportation Property Bowman Shed area bounded by Exchange Avenue on the north, Collinsville Road on the west, Bowman Avenue on the south and I-55 expressway on the east in East St. Louis, St. Clair County.

DESCRIPTION OF IMPROVEMENT

This improvement shall consist of the rehabilitation of the existing pump station including but not limited to partial demolition and material removal, concrete work, reinforcement bars, 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 furnishing and installing complete new pumping units, replacement of heating and ventilating equipment, pump discharge piping and electrical work consisting of removal of existing and replacement of with new 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 new 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 specified in the Contract Document and as approved by the Engineer.

Construction staging area will be located as shown on G3 drawing. Construction access gate will be located at south east corner of Bowman Shed at Exchange Avenue adjacent to the north of the Exchange Avenue bride over I55/70. The entire existing fence along I55/70(south Bowman shed boundary) will be replaced with a 10 feet high chain link fence, 3 stands barb wire and privacy slates along full length of back fence (vertical vinyl or alum slates in chain link) from Exchange Avenue to the Proposed Bowman Avenue. Interior and temporary fences will be 8' high without any barbwire. A permanent gate near the transformers for access from that end of the permanent enclosure to minimize fenced area as required by DEPARTMENT. A 20 feet wide strip from the proposed construction access gate along the existing fence line to the proposed staging area could be used as a construction access based on the field measurement. Note that the access strip will reduce usable staging area for storage and trailer. Access to Bowman Yard must not be blocked. Contractor will not be allowed to store an additional trailer or equipment in the Yard overnight.

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 constriction 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 DEPARTMENT and shall be subject to approval by the DEPARTMENT.

PRE-BID SITE INSPECTION OF PUMP STATION

The Bowman Avenue Pump Station will be open for Contractor's inspection on Fridays, October 28 and November 4, 2005 between 9:00 AM to 12:00 PM local time. A representative of the DEPARTMENT will be on hand during this DEPARMENT time period. In the event the date or time is not suitable, an alternative inspection date and time can be arranged with Mr. Dave Walker of DEPARTMENT Bureau of Electrical Operations, at (618) 346-3274.

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. This work shall consist of preparing, revising and updating a detailed progress schedule based upon the Critical Path Method (CPM). This work shall also consist of performing time impact analysis of the progress schedule based upon the various revisions and updates as they occur. The required software shall be Primavera SureTrak 3.0 Project Manager, published by Primavera systems, Inc. The schedule format shall contain the following: Project Name, Contract Number, Company Name, Planning Unit (calendar/working days), Start Date, Completion Date, and Number/Version (original or updated schedule number). Updates to the schedule shall be submitted according to Article 108.02 except that at a minimum, updated schedule shall be submitted at the 25, 50 and 75 percent completion points of the Contract.

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 Progress Schedule.

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 Progress Schedule.

MONTHLY LABOR SUMMARY AND ACTIVITY REPORTING SYSTEM

Effective: 1-1-1995 Revised June 2001

I. Monthly Labor Summary Report, Form SBE 148

The prime contractor and each first and second tier sub-contractor, (hereinafter referred to as “subcontractor”) shall submit a certified Monthly Labor Summary Report directly to the District Engineer.

This report is in lieu of submittal of the Monthly Workforce Analysis Report, Form SBE 956.

This report must be received in District Eight no later than the tenth day of the next month.

This Report shall be submitted by the prime contractor and each subcontractor, for each consecutive month, from the start, to the completion of their work on the contract.

The data source for this Report will be a summation of all personnel and hours worked on each subject contract for the month based on weekly payrolls for that month.

The Monthly Labor Summary Report is required to be submitted in one of the following formats:

a.). For contractors having IDOT contracts valued in the aggregate at $250,000 or less, the report may be typed or clearly handwritten using Form SBE 148 for submittal to the District Engineer for District Eight.

b.) For contractors having IDOT contracts valued in the aggregate at more than $250,000, the report must be submitted in a specific “Fixed Length Comma Delimited ASCII Text File Format”. The subject file format is detailed on the next page. Submittal of this file may be by 3.5 inch disk, modem, or by e-mail.

II. Monthly Contract Activity Report, Form SBE 248

The prime contractor and each subcontractor shall submit a monthly report directly to the District Engineer reflecting their contract activity on all Illinois Department of Transportation contracts they have in force in District Eight.

This report shall be submitted for each consecutive month, from the start, to the completion of all contracts in District Eight.

The report must be received in the District Office no later than the tenth day of the next month.

Monthly Labor Summary and Activity Reporting System Codes and Formats

Indicated below for your reference are the Employee Codes and File Formats required for this system.

I.) Monthly Labor Summary Report, Form SBE 148

The following employee codes are to be used to identify each individual on the Summary Report:

1. **Gender:** **M** - Male **F** - Female

2. **Ethnic Group**: **1** - White **2** - Black **3** - Hispanic
4 - American Indian/Alaskan Native **5** - Asian/Pacific Islander

3. **Work Classification**: **OF** - Official **SU** - Supervisor **FO** - Foremen
CL - Clerical **CA** - Carpenter **EO** – Operator **ME** - Mechanic
TD - Truck Driver **IW** - Ironworker **PA** - Painter **OT** - Other
EL - Electrician **PP** - Pipefitter **TE** – Technical **LA** – Laborer
CM - Cement Mason

4. **Employee Status**: **O** - Owner Operator **J** - Journeyman
C - Company **A** – Apprentice **T** - Trainee

Specific "Fixed Length Comma Delimited ASCII File Format"

Order	Field Name	Type	Size
1	Contractor Number	A	4
2	Contractor Reference Number	A	6
3	Contract Number	A	5
4	Period (07/28/2000)	D	10
5	SSN (111-11-1111)	A	11
6	Name	A	40
7	Gender	A	1
8	Ethnic Group	A	1
9	Work Classification	A	1
10	Employee Status	A	1
11	Total Hours (0000060.00)	N	10

File Name Conventions: (Contractor Number + Report Month/Year).Txt
i.e. 20001298.Txt

II.) Monthly Contract Activity Report, Form SBE 248

The following activity codes are to be used to identify the contractor's contract status each month on the Monthly Activity Report, Form SBE 248:

A. Contract Status: 1 - Not Started 2 - Active 3 - No Work
4 - Suspended 5 - Complete

Failure to comply with this special provision may result in the withholding of payments to the contractor, and/or cancellation, termination, or suspension of the contract in whole or part.

Compliance with this Special Provision shall be considered incidental to the cost of the contract and no additional compensation will be allowed for any costs incurred.

All prime and subcontractors having contracts in the aggregate exceeding $250,000 must provide a "Fixed Length Comma Delimited ASCII File" for approval prior to the start of construction.

This Special Provision must be included in each subcontract agreement.

The Department of Transportation is requesting disclosure of information necessary to accomplish the statutory purpose as outlined under 23CFR part 230 and 41CFR part 60.4 and the Illinois Human Rights Act. Disclosure of this information is REQUIRED. Failure to comply with this special provision may result in the withholding of payments to the contractor, and/or cancellation, termination, or suspension of the contract in whole or part.

Compliance with this Special Provision shall be considered incidental to the cost of the contract and no additional compensation will be allowed for any costs incurred.

This Special Provision must be included in each subcontract agreement.

OFFICE COPY MACHINE

Effective: January 1, 1987 *Revised: October 15, 1996*

The copier specified in Article 670.02 shall meet the following specifications:

(1) Edge-to-edge copying.

(2) Up to 275 mm x 425 mm (11 in x 17 in) size for copy-size capabilities.

(3) A detachable platen cover in order to copy portions of large-bound documents.

(4) A cabinet stand for the copier.

TELEPHONE ANSWERING MACHINE

Effective: January 11, 1990 *Revised: June 7, 1996*

The telephone answering machine specified in Article 670.02 shall meet the following minimum specifications:

(1) Time/Day Indication - A computerized voice records the date and time that each message is received.

(2) Beeperless Remote - Any remote touch-tone phone can be used to review all messages by the use of an access code.

(3) Dual-Cassette System - Pre-recorded and received messages are managed on separate cassettes.

(4) Conversation Record - The operator can record any phone call.

(5) Remote Turn-On - Any remote touch-tone phone can be used to turn on the answering machine by the use of an access code.

(6) Tape-Full Message - The Caller is advised if the message tape is too loaded to record the call.

(7) Battery Back-Up - The settings and messages are protected from power failures.

(8) Two-Line Capacity - Projects that have a second phone line through the provision of a 670.05 Engineer's Field Laboratory shall provide a single phone answering machine that services both lines.

Prior to the purchase of this item, the Contractor shall submit specifications for the proposed machine to the Engineer for his approval.

TRAFFIC CONTROL PLAN

Effective: July 12, 1993 *Revised: May 12, 1997*

Traffic control shall be in accordance with the applicable sections of the "Standard Specifications for Road and Bridge Construction", the applicable guidelines contained in the "National Manual on Uniform Traffic Control Devices for Streets and Highways", Illinois Supplement to the National Manual of Uniform Traffic Control Devices, these Special Provisions, and any special details and Highway Standards contained herein and in the plans.

Special attention is called to Articles 107.09 and 107.14 of the "Standard Specifications for Road and Bridge Construction and the following Highway Standards relating to traffic control:

701301

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 1A - SUMMARY OF WORK

1. 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 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 grout as indicated on the Drawings and as specified in Section 3B, Grout.

(e) All unit masonry work consisting of concrete block work and brickwork as indicated on the Drawings and as specified in Section 4A, Unit Masonry.

(f) All metal work as indicated on the Drawings and as specified in Division 5, Metals.

(g) All carpentry work as indicated on the Drawings and as specified in Section 6A, Rough Carpentry.

(h) All board insulation work as indicated on the Drawings and as specified in Section 7A, Board Insulation.

(i) All granular insulation in cells of concrete masonry walls work as indicated on the Drawings and as specified in Section 7B, Loose Fill Insulation.

(j) All roofing work as indicated on the Drawings and as specified in Section 7C, Elastomeric Sheet Roofing- Fully Adhered/Ballasted Cover.

(k) All sheet metal work at roofing as indicated on the Drawings and as specified in Section 7D, Sheet Metal Flashing and Trim.

(l) All sealant work as indicated on the Drawings and as specified in Section 7E, Joint Sealers.

(m) All doors and hardware as indicated on the Drawings and as specified in Division 8, Doors and Windows.

(n) All painting as indicated on the Drawings and as specified in Section 9A, Painting.

(o) The station identification plate, shop desk, bulletin board, staff gauges, first aid kit, fire extinguishers, pump dolly and clock as indicated on the Drawings and as specified in Section 10A, Specialties.

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)	Concrete Removal	Section 501
(b)	Excavation for Structures	Section 502
(c)	Class SI Concrete:	Section 503
(d)	Furnishing and Erecting Structural Steel	Section 505
(e)	Reinforcement Bars:	Section 508
(f)	Engineer's Field Office, Type A	Section 670

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, Division 15, 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 floor opening guards, 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, supply units, duct work and all appurtenances.

(e) Ventilation system including, but not limited to, exhaust fans with motorized louver/damper combination, supply units, duct work, louvers, controls and all appurtenances.

(f) Removal and disposal of existing double door valves

(g) Double door check valves

(h) Miscellaneous mechanical items consisting of cable support and stilling well.

(i) All overhead crane system, monorail system, hoist and trolley work as indicated on the Drawings and as specified in Section 14A, Overhead Crane Monorail system, Hoist and Trolley.

(j) All demolition work as described in Section 2B.

(k) Provide a complete spare sump pump assembly.

1.2.3 Complete spare sump pump assembly shall be paid under pay item Complete Spare Sump 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 Ameren UE Requirements.

(d) Motor control center.

(e) Disconnect switches and motor starters.

(f) Control panel and SCADA panel.

(g) Lighting fixtures, lighting panel board, lighting transformer and wiring devices.

(h) Power, lighting, control and signal wires and cables.

(i) Conduit and raceway system.

(j) Electric heaters, complete.

(k) Generator system.

(l) Ultrasonic level, transducer and float type level sensing control system.

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

(n) Branch wiring and conduit for main pumps, sump pumps, unit heaters, ventilation system, SCADA system and other electrical equipment as shown on the Drawings.

(o) Cathodic protection system for pump discharge headers.

(p) Testing.

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

1.3.4 SCADA system shall be paid under pay item Pump Station SCADA Equipment.

1.3.5 Cathodic protection system shall be paid under pay item Cathodic Protection for Pump Discharge Headers.

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 Bowman Avenue Pump Station 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.

1.4.3 The major construction items include, but not limited to, are as follows:

(a) Removal of existing three (3) storm water pumping units SWP-2, 4 & 6, one (1) submersible sump pump SSP-1 and One(1) submersible dewatering pump DP-1.

(b) Installation of the proposed storm water pumping units SWP-2, 4 & 6, sump pumping unit SSP-1 and two (2) dewatering pumping units DP-1 & 2 and all appurtenances.

(c) Partial removal of existing ventilation system and installation of the proposed HVAC system.

(d) Removal and replacement of existing monorail system. Installation of the proposed hoist and trolley system including structural framing.

(e) Disconnection and removal of electric service system, generator and control system.

(f) Installation of the proposed electric service system including pump control, motor control center, generator and appurtenances.

(g) Site security and architectural improvements.

(h) Miscellaneous items as shown and/or specified.

(i) Maintain continuous operations of the existing pump station during rehabilitation.

(j) Miscellaneous items as shown, as required and or as specified.

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 in a manner such that the roadways served by the pump station are adequately protected from flooding by storm water and ground water during construction. The Contractor shall also be responsible for the security of pump station during construction. Maintenance of pump station shall be as directed by DEPARTMENT staff. DEPARTMENT will provide a designated staff to coordinate maintenance of pump station during construction.

1.5.2 Prior to the starting of work, the Contractor shall notify the Engineer and arrange for a pre-construction inspection. At the pre-construction inspection, the facility and its equipment shall be examined and defective or missing items shall be repaired by the District 8 Electrical Operations 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 45 minutes 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 DEPARTMENT engineer.

(a) 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 DEPARTMENT to perform the necessary alarm response.

1.5.4 Routine Monthly Maintenance Requirements:

Ongoing maintenance activities are required to maintain the existing pumping station for proper roadway and groundwater drainage. Routine maintenance inspections of all equipment (existing or new installation) shall be conducted by the Contractor.

(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 DEPARTMENT to perform the necessary routing maintenance.

1.5.5 All routine monthly maintenance requirements listed below and within apply to the existing pumping station and all new facilities installed under this contract and specified herein.

GENERATOR

( ) Check Fuel in Generator Tank
( ) Check Alarm Indicator Lights
( ) Check Engine oil level/antifreeze
( ) Check engine block heater operation
( ) Check transfer switch
( ) Check heater/ventilation operation
( ) Equalize charge D.C. control system batteries
( ) Check Battery levels
( ) Load Test generator

PUMPS, MOTORS, & STARTERS

Check the following pumps for the following items

SSP1	CHECK FOR THE FOLLOWING
SSP2	( ) PUMP OPERATION
SWP1	( ) PUMP VIBRATION
SWP2	( ) DISCHARGE LEAKAGE
SWP3	
SWP4	
SWP5	
SWP6	

Motor Room – CENTRAL LUBE SYSTEM

( ) CHECK PUMP BOWL ASSEMBLY GREASE
( ) CHECK AND LUBRICATE STORM WATER PUMPS AND CHECK VALVE FUNCTIONS ( ) SSP 2 ( ) SSP4 ( ) SSP6

( ) Fill Grease Reservoir
( ) Drain the water in the air compressor/check flow meter on the bubble system

VENTILATION SYSTEM

( ) CHECK AIR SUPPLY FAN OPERATING AND IN HAND MODE ***SF4***
( ) CHECK SUMP EXHAUST FAN OPERATING AND IN HAND MODE ***EF1***
( ) LUBRICATE BOTH FANS
( ) CHECK MOTOR ROOM SUPPLY FAN & LOUVER OPERATION

HAND MODE	OFF MODE	AUTO MODE BY THERMOSTAT
( ) SF1 RUNNING	( ) SF1 NOT RUNNING	( ) SF1 RUNNING
( ) SF2 RUNNING	( ) SF2 NOT RUNNING	( ) SF2 RUNNING
( ) SF3 RUNNING	( ) SF3 NOT RUNNING	( ) SF3 RUNNING
( ) V1 OPENED	( ) V1 CLOSED	( ) V1 OPENED
( ) V2 OPENED	( ) V2 CLOSED	( ) V2 OPENED

** LEAVE MOTOR ROOM SUPPLY FANS IN AUTO MODE & LEAVE THERMOSTAT SET @ 80 **

FIRE PROTECTION SYSTEM

( ) CHECK ALL VALVES OPEN

( ) CHECK WATER LEVEL IN STORAGE TANK

( ) CHECK WATER SUPPLY LINE FLOW

GENERAL ITEMS

( ) CHECK TRASH RACK IF NEEDED CLEAN

1.5.6 Should it become necessary to perform maintenance work beyond the scope of the Contract, the Contractor shall be reimbursed the exact amount of the pay cost. Extra work shall be paid as outlined in the Standard Specifications for Road and Bridge Construction.

1.5.7 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. Removal of any pump station equipment and well shut down require at least 48 hours advance notice and approval. Deep wells can only be turned off for a maximum of 12 hours daily. Operation of pump station and deep well shut down shall be as directed by DEPARTMENT staff. DEPARTMENT will provide a designated staff to coordinate operation of pump station. Impending storm or forecast may result in the Engineer denying or rescheduling request for shut down, even if prior approval was given.

1.6.2 Continuous operating integrity shall require coordination of construction activities. Prior to starting work, the Contractor shall submit a detailed sequenced plan of work, for review and approval by the Engineer. Every Monday morning the Contractor must meet with the Resident Engineer and Bowman Maintenance Yard Operators Field Engineer, at the site, to review the work for the week and coordinate the Contractor’s work with the day-to-day Maintenance Yard operation. The Operators Field Engineer is Mr. Joseph D. Monroe, P.E. at 618-346-3279.

1.6.3 Continuous operation may require that some of the existing electrical equipment be disconnected, relocated and reconnected as temporary systems.

1.6.4 Continuous operation will require that new pumps and piping be installed sequentially. Only one pump may be removed from service at a time. Once a pump is removed the Contractor must continue to work on installation to the completion of new pump and operational. A minimum of 68,700 gpm pumping capacity shall be maintained during entire construction period. If necessary, temporary pumping shall be installed without additional cost to DEPARTMENT under special circumstance. In addition, the wet pit shall be thoroughly cleaned to the satisfaction of the Engineer for three times, first prior to the installation of the new pump and second and third before the contract final acceptance. The current wet well has a deposit of silt and sand on both sides of the wet well. Any work to be done in the wet well must be coordinated with Operations staff. Contact Mr. Pete Sawyer (618) 346-3292.

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 and security of Pump Station and Drainage Facilities During Construction

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

1.7.2 Locations of existing pump station and 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 pump station and 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 pump station 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.

1.7.4 Contractor is responsible for security of pump station during construction. DEPARTMENT will not patrol construction fence area. Anything inside temporary construction fence is Contractor’s responsibility. DEPARTMENT authorized personnel will have access to the pump station at any times. Contractor shall provide extra keys for DEPARTMENT personnel (3 or 4). All entrances, roof hatches, etc. at the pump station must be secured at the end of the day.

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. All iron and steel products which are incorporated into the work shall be domestically manufactured, or produced, or fabricated. Contractor shall provide documents certifying domestic source. Also all coating (epoxy, galvanizing, painting) shall be domestically applied.

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: (4 copies of each submittal are required)

(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.

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. Four additional copies shall be marked with the date of approval and forwarded to the ENGINEER for use in field and for DEPARTMENT'S O & M Manual and 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) Three submittal copies, in addition to the number the Contractor requires returned, including those required for Operation and Maintenance Manual shall be submitted to the Engineer. An additional two submittal copies shall be submitted to the Design Engineer:

Alvord, Burdick & Howson, LLC
20 N. Wacker Drive, Suite 1401
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 Data

(a) Operation and Maintenance Data shall be submitted in accordance with Subsection 1.12, Operation and Maintenance Data, 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 Sub-contractor and the General Contractor shall review and stamp the submittal. Submittals which are not approved or approved-as-noted by the Contractor shall not be submitted to the Engineer. The Contractor shall not give an approved-as-noted status to submittals having incompleteness or major corrective notations as this will only delay the ultimate approval process.

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

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 <u>PROVIDED IT COMPLIES WITH CONTRACT DOCUMENTS</u>. 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 Four copies of completed Record Drawings for the pump station 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 Data

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

1.12.2 Prior to the Work Reaching 75 Percent Completion, two copies of the data 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. Submit final revised 3 copies within 14 days after field testing and start up of the pump station. 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 data 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 page 1A-19) for each item of equipment.

(b) A section of an equipment preventive maintenance data summary (see sample form at gage 1A-20) for each item of equipment. A 5 year maintenance schedule for all installed equipment shall also contain in the manual.

(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) 5 year maintenance schedule for all equipment furnished and installed.

(h) The record of the initial performance of the equipment from the Field Testing.

(i) All O&M Data 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 data 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 data shall be cross-referenced to the manufacturers' bound manuals.

1.12.6 O & M Equipment Data Summary and Preventive Maintenance Summary shall be as follows:

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

BOWMAN AVENUE PUMP STATION

Operation and Maintenance Data

Equipment Data Summary (See Section 1A, 1.12, 3(a))

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

BOWMAN AVENUE PUMP STATION

Operation and Maintenance Data

Preventive Maintenance Summary (See Section 1A, 1.12, 3(b))

Equipment Name: Location: O&M Data Reference

Manufacturer:

Address:

Telephone:

Model No: Serial No:

Maintenance Task	Lubricant/Part	*D	W	M	Q	SA	A

NOTES:

*D-Daily W-Weekly M-Monthly Q-Quarterly SA-Semi-Annual A-Annual

1.12.7 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.

1.13.4 The Contractor will not be allowed to store an additional trailer or equipment in the Yard over night.

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 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. All entrances, doors, roof hatches at the pump station must be secured at the end of the day. DEPARTMENT will not patrol the construction area. Anything inside temporary construction fence shall be Contractor's responsibility. DEPARTMENT authorized personnel will have access to the pump station at any times. The Contractor shall provide extra keys (3 or 4) for DEPARTMENT personnel.

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, hand holes, 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. Access to the Bowman Yard must not be blocked any time during construction.

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 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 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 therefore.

1.16.3 DEPARTMENT and his 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 DEPARTMENT or his 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 DEPARTMENT or his 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 DEPARTMENT or his 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 DEPARTMENT accepts the Work.

1.16.7 If at anytime prior to the expiration of any applicable warranties or guarantees, equipment is rejected by 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 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 DEPARTMENT obtains, from other sources, equipment to take the place of that rejected. DEPARTMENT hereby agrees to obtain other equipment within a reasonable time and the CONTRACTOR agrees that 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 DEPARTMENT or his authorized Representatives or inspection bureaus without cost to the CONTRACTOR However, if the test required are beyond DEPARTMENT capability, the test shall be conducted by DEPARTMENT approved testing service and paid for by 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 tests shall be conducted by DEPARTMENT approved testing service and paid for by the Contractor.

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 DEPARTMENT or by DEPARTMENT approved testing service for compliance.

1.16.20 DEPARTMENT shall be bear the costs of any job site inspection.

1.16.21 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 DEPARTMENT. All obligations under the terms and conditions of the Contract shall be fulfilled even though DEPARTMENT or his Authorized Representatives fail to ascertain noncompliance or notify the CONTRACTOR of noncompliance.

1.16.29 A final inspection and Field Testing of all work completed and equipment furnished shall be required before acceptance by DEPARTMENT. This final Field Testing must include an operational demonstration to verify complete compliance with all contract requirements. This inspection and testing must be requested by the contractor a minimum of seven calendar days prior to the proposed date. All test equipment, materials, and labor necessary to conduct the inspection shall be furnished by the contractor at his expense. Final Field Testing shall be conducted over consecutive calendar days. A record of the initial performance of the equipment shall be kept for placement in the Operation and Maintenance Data. Four copies of completed record drawings for the pump station shall be submitted after final Field Testing. The Field Testing shall comply with all requirements as outlined in DEPARTMENT Drainage Manual.

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. For structural modifications not shown on the plans, the Contractor shall hire a licensed Structural Engineer in the STATE of Illinois to analyze Contractor's proposed modifications and seal drawings. Then DEPARTMENT will review for approval.

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. For structural modifications not shown on the plans, see 1.17.1 of this Section.

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 *American Association of STATE Highways and Transportation Officials*

ANSI *American National Standards Institute*

ASME *American Society of Mechanical Engineers*

ASTM *American Society for Testing and Materials*

AWG *American Wire Gauge*

ICEA *Insulated Power Cable Engineers Association*

IEEE *Institute of Electrical and Electronic Engineers*

IES *Illuminating Engineering Society of North America*

NEC *National Electrical Code*

NEMA *National Electrical Manufacturer's Association*

NESC *National Electrical Safety Code*

UL *Underwriter's Laboratories*

ACI *American Concrete Institute*

FM *Factory Mutual*

SSPC *Steel Structures Painting Council*

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 January 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) GUIDE BRIDGE SPECIAL PROVISIONS, a publication of the Department of Transportation Bureau of Bridge and Structures for drilled shafts.

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 the Pre-Construction Meeting and shall provide information as requested to substantiate the prices included in the Schedule of Values.

1.20.3 The Schedule of Values must be approved by the Engineer and District 8, 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 and Final Acceptance

1.21.1 Functional testing of equipment prior to pump station Start-up:

(a) After certification of proper installation by the Manufacturer's representative, equipment shall undergo testing, as outlined in the Special Provisions. In addition to this individual unit testing, the specific equipment system shall be tested in its entirety. This testing may disclose a punch list of issues which must be resolved before Stat-up can begin.

1.21.2 Performance testing during pump station Start-up:

(a) When the work at the pump station is complete, the Contractor shall begin Start-up operations. During start-up, the complete facility shall be taken through various scenarios of operation, including normal starting/stopping of the pumps, generator, ventilation systems and emergency operation. This testing shall also be conducted during a simulated storm water event.

(b) During this period, equipment performance shall be evaluated as well as individual system performance.

(c) In addition, each system shall be tested to demonstrate its compatibility with interrelated systems. The overall operation of the entire station shall be evaluated, adjustments made and settings recorded for inclusion in the Final Operation and Maintenance Data.

(d) A punch list of operational problems, identified during this testing, shall be prepared and submitted to the Engineer for review. Problems with equipment, systems and/or problems with the interaction between the various systems shall be rectified by the Contractor, at no cost, to the satisfaction of the Engineer. This testing shall be repeated until the Engineer determines satisfactory results have been obtained.

(e) When the punch list of operating issues has been resolved, a 90-day period of continuous station operation shall begin. Upon completion of this period, to the satisfactory of the Engineer, Final Acceptance of the facility shall be granted.

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

(a) Demonstration of pump control system
(b) Gas detection calibration kit shall be always stored on site
(c) Demonstration of transfer switch operation and maintenance
(d) Demonstration of generator system operation
(e) Check alarm operation SCADA system
(f) Demonstration of cathodic protection system

1.21.4 The contractor shall be prepared to demonstrate operation and maintenance procedures for all equipment installed.

2. PRODUCTS:

Not Used

3. EXECUTION:

Not Used

END OF THIS SECTION

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 1B - MEASUREMENT AND PAYMENT:

1. GENERAL:

1.1 Description

1.1.1 The work under this Contract for the rehabilitation of Bowman Avenue Pump Station 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 will be as measured and paid for as described herein.

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

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

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

1.1.5 REINFORMENT BARS will be paid for at the Contract unit price per pound as specified in Section 3A, Cast-In-Place Concrete

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

1.1.7 CHAIN LINK FENCE WITH PRIVACY SLATES, 10’ will be paid for at the Contract unit price per lineal foot as specified in Section 2A, Site Work.

1.1.8 CHANI LINK GATES, 8’x12’ DOUBLE will be paid for at the Contract unit price each as specified in Section 2A, Site Work.

1.1.9 CHAIN LINK CANTILEVER SLIDE GATE, 8’X20’ will be paid for at the contract unit price each as specified in Section 2A, site Work.

1.1.10 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.

1.1.11 MOBILIZATION will be paid for at the Contract lump sum price and shall be in accordance with the requirements of Supplement Specifications and Recurring Special Provisions.

1.1.12 PUMP STATION SCADA EQUIPMENT 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.

1.1.13 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 all temporary construction access work including fence, gates, road, pavement, light poles, restoration, etc. 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 Section 10A, Specialties (Miscellaneous General Work).

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

1.1.15 PUMP STATION MECHANICAL WORK will be paid for at the Contract lump sum price 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.

1.1.16 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 $160,000.00. The Contractor will be reimbursed the exact amount of the charges by the utility.

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

1.1.18 DRILLED SHAFT IN SOIL 24” will be paid for at the Contract unit price per Lineal foot as specified in Section 2A, Site Work.

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

1.1.20 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.

1.1.21 COMPLETE SPARE SUMP PUMP ASSEMBLY will be paid for at the Contract unit price each as specified in the applicable requirements of Division 1, General Requirements, and Division 15, Mechanical.

1.1.22 CATHODIC PROTECTION FOR PUMP DISCHARGE HEADERS, will be paid for at the Contract lump sum price as specified in the applicable requirements of Division 1, General Requirements, and Section 16E, Cathodic Protection For Pump Discharge Headers.

1.1.23 NON-SPECIAL WASTE DISPOSAL will be paid for at the Contract unit price per cubic yards.

1.1.24 SPECIAL WASTE PLANS AND REPORTS will be paid for at the Contract lump sum price per each.

1.1.25 PCB TRANSFORMER OIL DISPOSAL or TRANSFORMER OIL DISPOSAL depending on the transformer oil analysis will be paid for at the Contract unit price per gallon.

1.1. 26 PCB TRANSFORMER OIL ANALYSIS will be paid for at the Contract unit price per each. This price shall include transporting the sample from the job site to the laboratory.

1.1.27 SOIL DISPOSAL ANALYSIS will be paid for at the Contract lump sum price Per each.

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) Excavation and backfill
(b) Removal of existing fence and gates
(c) Install fence and gates (swing gates and slide gate)
(d) Temporary construction access provision, fence, gate and bituminous cold mix.
(e) Drilled shaft in soil for foundation
(f) Storm sewer system
(g) PCB transformer oil analysis and disposal
(h) Transformer oil disposal
(i) Special waste plans and reports
(j) Non-special waste disposal
(k) Soil disposal analysis

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 Structure excavation will be paid for at the Contract unit price per cubic yard for STRUCTURE EXCAVATION.

1.5.2 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.

1.5.3 This work will 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.

1.5.4 The Contract unit price for CHAIN LINK FENCE 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.

1.5.5 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.

1.5.6 Excavation and backfill and the existing fence and gates removal and disposal shall be included for payment under the Item, PUMP STATION GENERAL WORK.

1.5.7 Temporary construction access provision, fence, gate and bituminous cold mix as required and shown on Dwg. G3 shall be also included for payment under the Item, PUMP STATION GENERAL WORK.

1.5.8 Drilled shaft in soil for foundation shall be included for payment under the Item, DRILLED SHAFT IN SOIL 24”.

1.5.9 Storm sewer system consists of storm sewer pipe, catch basin, frame and stone riprap shall be included for payment under the Item, PUMP STATION GENERAL WORK.

1.5.10 PCB TRANSFORMER OIL ANALYSIS using EPA Method 8082 will be paid for at the contract unit price per EACH. This price shall include transporting the sample from the job site to the laboratory.

1.5.11 Disposal of PCB transformer oils shall be paid for at the contract unit price per gallon for PCB TRANSFORMER OIL DISPOSAL or TRASFORMER OIL DISPOSAL depending on the transformer oil analysis.

1.5.12 Special waste plans and reports shall be paid for at the contract lump sum price for the Item, SPECIAL WASTE PLANS AND REPORTS.

1.5.13 Soil disposal analysis shall be paid for at the contract unit price per each for SOIL DISPOSAL ANALYSIS.

1.5.14 Non-special waste disposal shall be paid for at the contract unit price per cubic yard for NON-SPECIAL WASTE DISPOSAL.

2. PRODUCTS:

2.1 Chain Link Fence Materials

2.1.1 Posts and fence are specified according to Section 664 of the Standard Specifications. Horizontal braces shall be all pipe type A per DEPARTMENT Standard 664001-01. Swing gate posts shall be 4” with 8.65 lb/ft steel pipe. 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 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 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 The 10’ high fence shall consist of a 9’ high chain link fence with 2” mesh colored PVC privacy slates plus 1’ of three stands of barb wire. The privacy slates shall be vertical or diagonal and the color shall be green or as selected by the DEPARTMENT.

2.2 Cantilever Sliding Gate and Swing Gate

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 Cantilever:

ASTM F1184, Type II, heavy duty, top rail gate incorporating a track for top roller and with framing, supports, bracing, hardware and accessories as required for a complete and operational assembly. Brace frame to prevent sagging and apply fabric to entire gate. Provide bar latch and two padlocks to enable both inside or outside padlock to open latch.

2.2.3 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.

2.2.4 Fabrication

Fabricate perimeter frames of gate from metal and finish to match fence framework. 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.

2.2.5 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.

2.2.6 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.

2.2.7 Locking Device

Locking device shall be as shown on the drawing.

2.3 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 DEPARTMENT.

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 Surface course grading and backfill for structure shall be granular backfill conforming to CA-6 or CA-10 of Section 1004 of the Standard specifications.

2.4.5 Excess excavated materials shall be disposed of off site.

2.4.6 Backfill shall be constructed in lifts not to exceed 6 inches when compacted.

2.4.7 Maintain optimum moisture content of backfill material to attain required backfill density.

2.4.8 Aggregate shall be compacted to not less than 90% of Standard laboratory density.

2.4.9 Backfill simultaneously on each side of unsupported foundation walls.

2.4.10 Drilled shaft in soil shall be in accordance with the DEPARTMENT Bureau of Bridges & Structures Guide Bridge Special Provisions, and the drilled shaft section o the general specifications, Part V, Structures.

2.5 Storm Sewer System

2.5.1 Storm sewer pipe shall be 12” diameter RCCP, Class IV in accordance with Section 1040 of the Standard Specifications.

2.5.2 Pre-cast concrete section for catch basin shall conform to the ASTM C76, Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Table IV, Wall B.

2.5.3 Stone riprap shall be Gradation No. 4 per Article 1005.02 of the Standard Specifications.

2. 6 Non-Special Waste Working Conditions

2.6.1 This work shall be according to Article 669 of the Standard Specifications for Road and Bridge Construction adopted January 1, 2002 and the following:

2.6.2 Qualifications. The term environmental firm shall mean an environmental firm with at least five (5) documented leaking underground storage tank (LUST) cleanups or that is pre-qualified in hazardous waste by the Department. Documentation includes but not limited to verifying remediation and special waste operations for sites contaminated with gasoline, diesel, or waste oil in accordance with all Federal, State, or local regulatory requirements and shall be provided to the Engineer for approval. The environmental firm selected shall not be a former or current consultant or have any ties with any of the properties contained within and/or adjacent to this construction project.

2.6.3 General. Implementation of this Special Provision will likely require the Contractor to subcontract for the execution of certain activities. It will be the Contractor's responsibility to assess the working conditions and adjust anticipated production rates accordingly.

2.6.4 The Contractor shall manage all contaminated materials as non-special waste as previously identified. This work shall include monitoring and potential sampling, analytical testing, and management of material contaminated by regulated substances. **The generator number for Bowman Avenue Pump Station is 1630455076 (ILD098483351).**

2.6.5 The Contractor shall excavate and dispose of any soil classified as a non-special waste as directed by this project or the Engineer. Any excavation or disposal beyond what is required by this project or the Engineer shall be at the Contractor’s expense. The preliminary site investigation (PSI) report, available through the District’s Environmental Studies Unit, estimated the excavation quantity of non-special waste at the following location. The information available at the time of plan preparation determined the limits of the contamination and the quantities estimated were based on soil excavation for construction purposes only. The lateral distance is measured from centerline and the farthest distance is the offset distance or construction limit which ever is less. The Environmental Firm shall continuously monitor for worker protection and the Contractor shall manage and dispose of all soils excavated within the following areas as classified below. Any soil samples or analysis without the approval of the Engineer shall be at the Contractor’s expense.

2.6.6 All excavated soils from the Bowman Pump Station – non-special waste. Contaminants of concern sampling parameters: PNAs, PCBs, and TCLP Lead.

2.6.7 Some of the soils identified above requiring management as a non-special waste can be managed on-site as fill. Although the soil concentrations exceed a residential property's Tier 1 soil remediation objective for the ingestion exposure pathway, they can be utilized on-site as fill because the roadway is not considered a residential property. All storm sewer excavated soils can be placed back into the excavated trench as backfill unless trench backfill is specified. If the soils cannot be utilized on-site as fill then they must be managed off-site as a non-special waste. The following areas can be managed on-site as fill.

2.6.8 All excavated soils from the Bowman Pump Station – non-special waste. Contaminants of concern sampling parameters: PNAs, PCBs, and TCLP Lead.

2.6.9 Each transformer shall be drained of its oil and the oil from each transformer shall be analyzed for PCBs prior to disposal to determine the correct waste characterization. Mixing of the transformer oils will not be allowed until analytical results determine that the transformer oils are of similar in chemical makeup and have the same waste characterization.

2.6.10 PCBs transformer oil disposal will be measured for payment in gallons.

3. EXECUTION:

3.1 Existing Fence Removal and Installing New Fence

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

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

3.1.3 10' chain link fence shall be provided with three strands of barbed wire and attached tilt.

3.2 Storm Sewer System

3.2.1 Strom sewer, catch basin and stone riprap shall be installed and constructed in accordance with Section 550, 551, 602 and 281 of 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.

1.1.3 The existing transformers to be removed may contain PCB. Special disposal is required for the three single phase transformer to remove PCB's in insulating oil. The transformer will be tested before disposal to determine the level of PCBs under Special Provision Section 2A, Article 2.6 Non-Special Waste Working conditions for PCB Oil Analysis.

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 will 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 will 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.

(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.

(f) Refer to Section 2A for PCB transformer oil analysis and disposal, Special waste plans and reports, soil disposal analysis and non-special waste disposal pay items.

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 Fairbanks Morse 5,500 gpm sump pump SSP-1.

(b) The existing KSB 2,000 gpm dewatering pump.

(c) The existing Healy Ruff control panel cabinet.

(d) The existing three (3) phase breaker in the generator building.

(e) All existing breakers in the control room and motor room.

(f) The existing supply fans SF 1 and 3 in the motor room.

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 (DM 1, 2, 3 & 4) and shall include, but not be limited to, the following:

(a) Pipe railing
(b) Masonry at existing exterior and interior walls
(c) Roof hatches
(d) Miscellaneous metals and structural steel
(e) Louvers and dampers
(f) Miscellaneous mechanical and piping
(g) Fence and gates including concrete bases
(h) Electrical transformer supporting structures, concrete base and curb
(i) Electrical substation supporting structure
(j) Electrical engine/generator housing structure and concrete pier support.
(k) Engine/generator oil fuel supply piping
(l) Existing light poles to be removed.

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 at perimeter, unless cored or otherwise indicated on the Drawings (DM1, 2, 3, 4 & E3).

(b) Corners of saw-cut openings shall not be over cut.

(c) Concrete removal shall be of complete removal concrete structure and include reinforcing steel and other materials encountered. Concrete removal shall include demolition of concrete driveway and steps.

(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 (DM1, 2, 3 & 4) and shall include but not limited to, the followings:

(a) Disconnection and removal of unit heaters, thermostats, supply fans, combustible gas detector sensors, roof ventilators, dampers, automatic shutters and pump lubrication system.

(b) Provide wall and floor openings and patching of wall openings.

(c) Removal of three (3) storm water pumping units, one sump pumping unit and one dewatering pumping unit, piping and appurtenances.

(d) Removal of fire pumping unit, accessories and appurtenances.

3.1.4 All demolition work to be included under the Item PUMP STATION, ELECTRICAL WORK shall be as indicated on the Drawings (DM3, E3, 4, 5 & 6) and shall include, but not limited to, the following:

(a) Electrical transformers, cable, conduit and appurtenances. The electrical transformers may contain PCB. Refer to Special Provisions, Section 2A, Article 2.6 Non-Special Waste Working Conditions.

(b) Electrical substation, cable, conduit and appurtenances.

(c) Electrical engine/generator, cables, conduit and appurtenances.

(d) Motor control center equipment, cable, and conduit.

(e) Pump control bubbler system and appurtenances.

(f) Lighting system.

(g) HVAC power supplies.

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. Holes shall be filled with grout and exposed edges finish to match adjacent surfaces for a neat appearance.

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 DEPARTMENT.

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

(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 salvaged items shall be removed carefully and not damaged and protected until they are picked up by the DEPARTMENT.

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.

3.2.3 All material excavated must be removed from the Yard at the end of the work day.

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, 2002, 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 will be measured as specified in Article 503.21 of the Standard Specifications.

1.4.2 Payment

(a) The work specified under this Section will be paid for at the contract unit price per cubic yard for CLASS SI CONCRETE.

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, unless otherwise noted on drawings. Reinforcement not indicated to be epoxy coated on the electrical/generator building shall be plain 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-318-89 (Building Code Requirements for Reinforced Concrete).

2.3 Cast-In-Place Concrete

2.3.1 General

(a) Unless otherwise indicated, all regular concrete and skin coat 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 SI)
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) Place masonry seismic anchorage and dove tail anchor slots in beams, walls and columns as specified in Masonry Section 4A, detailed on drawings and as required.

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

(f) 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.

(g) 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) 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) With the exception of floors, all interior and exterior surfaces that will be exposed to view after completion of the work shall be given a rubbed 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 receive a slightly roughened fiber bristle broom furnish immediately after receiving a smooth steel troweled finish. All edges of finished surfaces shall be rounded or leveled with edging tools. Brooming shall be in direction perpendicular to main traffic route. New 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 equipment bases.

1.1.2 Grout for handrails and railings

1.1.3 Grout for pipe and conduit penetrations.

1.1.4 Grout for anchor bolts.

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.

1.2.4 Section 5C - Handrails and Railings.

1.2.5 Section 5D - Grating and Floor Plates.

1.2.6 Section 14A - Monorail System, Hoist, and Trolley.

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^{o}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 will be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

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.

2.2.2 Five Star Epoxy Grout by U.S. Grout Corporation.

2.2.3 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.

3.2.5 Equipment Bases

(a) After shimming and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with grout. Use non-metallic cementitious grout unless another type of grout is recommended by equipment manufacturer.

(b) Non-shrink, non-metallic epoxy grout may be used with Engineer's specific review.

3.3 Schedule

3.3.1 Non-Shrink, Non-Metallic Cementitious Grout: anchor bolts, equipment bases, pipe supports, pipe and conduit penetration, slide gate frame, pipe thrust support structures, and masonry pilasters.

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, dowels, wall ties, flashing, and appurtenant work required to complete the masonry walls and partitions as shown on the Drawings and as specified herein. Refer to Division 1 for additional requirements. All concrete masonry wall wythes shall be fully grouted.

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, including, but not limited to, final opening sizes required, correct location of openings, etc.

1.1.3 This work shall include the setting and incorporating into the masonry of all bolts, anchors, inserts, nailers, metal attachments, subframes, frames, etc. as indicated on the Drawings, as specified herein, as furnished by others, and as located by others.

1.1.4 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 - Carpentry

1.2.5 Section 7A - Board Insulation

1.2.6 Section 7B - Loose Fill Insulation

1.2.7 Section 7D - Sheet Metal Flashing and Trim

1.2.8 Section 7E - Joint Sealers

1.2.9 Section 8A - Aluminum Doors and Frames

1.2.10 Section 8B – Overhead coiling Door

1.2.11 Section 8C - Door Hardware

1.2.12 Section 8D – Steel Doors and Frames

1.2.13 Section 10A - Specialties

1.2.14 Divisions 11, 12, 13 & 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) “Building Code Requirements for Concrete Masonry Structures ACI-530-05/ASCE 5-05"; American Concrete Institute.

(b) "Specifications for Masonry Structures (ACI-530.1-05/ASCE 6-05).

(c) "The International Building Code 2003"; International Code Council

Mortar:

(a) ASTM C5: Quicklime for Structural Purposes

(b) ASTM C144: Aggregate for Masonry Mortar

(c) ASTM C150: Portland Cement

(d) ASTM C207: Hydrated Lime for Masonry Purposes

(e) ASTM C270: Mortar for Unit Masonry

(f) ASTM 404: Aggregates for Masonry Grout

(g) ASTM C476: Grout for Masonry

(h) ASTM C780: Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

(i) ASTM C1019: Method of Sampling and Testing Grout

Unit Masonry:

(a) ASTM A123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

(b) ASTM A525: Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process.

(c) ASTM B370: Copper Sheet and Strip for Building Construction.

(d) ASTM C90: Hollow Load Bearing Concrete Masonry Units

(e) ASTM C145: Solid Load Bearing Concrete Masonry Units.

(f) ASTM C216: Facing Brick (Solid Masonry Units Made From Clay or Shale)

1.4 Submittals

1.4.1 Samples of brick (to match existing yellow brick used) shall be submitted. As a minimum, samples shall include 3 brick units.

1.4.2 Material submittals shall include manufacturer's certification of compliance for the type and grade of masonry units supplied.

1.4.3 Include design mix, indicate proportion or property method used, required environmental conditions, and admixture limitations.

1.4.4 Submit test reports on mortar indicating conformance with ASTM C270.

1.4.5 Submit test reports on grout indicating conformance with ASTM C476 and C1019.

1.4.6 Submit manufacturers 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 will be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Brick units

2.1.1 Manufacturers:

(a) Belden
(b) Darlington
(c) Hanley
(d) 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 yellow brick must match the existing brick. Contractor shall submit the sample brick for Engineer's approval.

2.2 Concrete Block

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 Hollow load bearing concrete block units shall conform to ASTM C 90, Grade N, Type 1, normal weight.

2.2.3 Solid load bearing concrete block units shall conform to ASTM C 145, 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 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 Mortar

2.3.1 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.

2.3.2 Pre-Mix Mortar:

Ready mix mortar may be used on this project per the following mortar type listed below:

(a) 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.

2.3.3 Mortar Mixes:

(a) 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.

(a) Pointing Mortar: Mortar shall be Type N and shall conform to ASTM C270, using the Property Method.

(b) 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.

(c) Mortar shall be freshly prepared and uniformly mixed and shall be of spreadable, workable consistency.

(d) 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.

(e) The mortar ingredients shall be mixed in a batch mixer for not less than three minutes.

(f) The use of fire clay, rock dust, dirt and other deleterious materials is prohibited.

2.4 Grout

2.4.1 Grout shall conform to ASTM C 476 and shall have a minimum strength of 3,000 psi at 28 days.

2.4.2 Grout shall have proportions of 1 part Portland cement 0.10 parts hydrated lime and 3 parts sand by volume.

2.4.3 Bond Beams: Lintels: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.4.4 Engineered Masonry: 3000 psi strength at 28 days, 7-8 inches slump, mixed in accordance with ASTM C476 Course Grout.

2.5 Cement

Cement shall be Type 1 Portland cement conforming to ASTM C 150. Plastic cement shall not be used.

2.6 Lime

Hydrated lime shall conform to ASTM C 207.

2.7 Aggregates

2.7.1 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.

2.7.2 Aggregate for mortar shall conform to ASTM C 144.

2.7.3 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, uncoated, 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, Anchor Ties, 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 **3/16"** cross ties.

2.10.2 Manufacturer – Subject to compliance with requirements, provide horizontal joint reinforcement from one of the following, or an approved equal:

(a) Wire Bond
(b) Hohmann & Barnard
(c) Dur-O-Wall, Inc.
(d) Homan Products, Inc.

2.10.3 Horizontal Joint Reinforcement and Metal Accessories shall be as follows:

(a) Seismic Reinforcing: The width of the horizontal reinforcing shall be less than the actual thickness of the wall or partition in which it is to be placed. The reinforcing wire shall be a truss type configuration consisting of 2 side rods with diagonal cross wire forming the truss. Wire brick bond ties/anchors provided for veneer anchorage with additional longitudinal wire reinforcing along brick veneer mortar bed. Provide at 16"o.c. maximum vertical spacing. Provide 3/16" diameter side rods and cross rods, hot dip galvanized. Provide Wire-Bond Series 900 Truss Type with Wire Bond Clip or approved equal from recommended manufacturers listed in Part 2.10.2 above.

(b) Seismic Reinforcing: corners and intersections: Corners shall be reinforced with truss type configuration for masonry corners and "T "intersections: Provide 3/16" diameter side rods and cross rods, hot dip galvanized. Intersection between walls and partitions shall be reinforced horizontally with interlocking 3/16" side rods and cross rods to reinforce the "T" or corner joint. Provide wire reinforcing at 16-inch centers maximum vertically, in the same course as the wall reinforcing. Provide Wire Bond Series Truss Type reinforcing for these special wall intersections or approved equal from recommended manufacturers listed in Part 2.10.2 above.

(c) Seismic reinforcing for solid and hollow interior masonry walls: The width of the horizontal reinforcing shall be less than the actual thickness of the wall or partition in which it is to be placed. The reinforcing wire shall be a truss type configuration consisting of 2 side rods with diagonal cross wire forming the truss. Provide at 16"o.c. maximum vertical spacing. Provide 3/16" diameter side rods and cross rods, hot dip galvanized. Provide Wire-Bond 300Series Truss Type for single wythe walls or approved equal from recommended manufacturers listed in Part 2.10.2 above.

(d) Dovetail anchors: Provide hot dip galvanized dovetail channel anchor slots at spaced at 16" o.c. maximum horizontally. Coordinate with Section 3A Concrete and related trades for placement. Provide hot dip galvanized dovetail rectangular ties with 3/16" side rods for veneer masonry anchorage. Anchors shall be spaced maximum 16"

o.c. vertically and 16" o.c. horizontally as required. Provide Wire-Bond anchors or approved equal from recommended manufacturers listed in Part 2.10.2 above.

2.10.4 Anchor Ties

(a) Seismic and lateral load anchor ties at top of masonry wall to underside of support structure shall be able to resist 300 #/LF.

(b) Seismic and lateral load anchor ties at jamb side of masonry wall to adjacent support structures shall be able to resist 300 #/ LF.

2.11 Flashings

2.11.1 Refer to Section 7D 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. (These locations occur at base of masonry veneer wall at top of openings, i.e. doors, lintels, etc.)

2.12.3 Cleaning Solutions: Non-acidic, not harmful to masonry work or adjacent materials per the following:

(a) Cleaners for red and light colored brick not subject to metallic staining with mortar not subject to bleaching.

(1) Sure Klean No. 600 Detergent; PrSoCo. Inc.
(2) Approved equal.

(b) Cleaners for brick subject to metallic staining:

(1) Sure Klean Vana Trol; ProSoCo. Inc.
(2) 202V VanaStrop; Deitrich Technologies, Inc.
(3) Approved equal.

2.12.4 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 3/16 inch steel wire, hot-dip galvanized after fabrication. Provide Wire-bond or approved equal.

3. EXECUTION:

3.1 General

3.1.1 Masonry work shall not be started when the horizontal and vertical alignment of the foundation is out of plumb or line one inch or more.

3.1.2 The top surface of the concrete foundation shall be clean and free of laitance and the aggregate exposed before starting the masonry.

3.1.3 All masonry shall be laid true, level and plumb in accordance with the Drawings.

3.1.4 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.

3.1.5 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.

3.1.6 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.

3.1.7 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.

3.1.8 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.

3.1.9 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.

3.1.10 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 matter 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.

3.1.11 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.

3.1.12 All surfaces, including sills, ledges, finished concrete, etc., shall be protected from mortar droppings or other damage during construction.

3.1.13 Horizontal steel reinforcing bars shall be laid on the webs of bond beam units and at other locations as required per seismic code and as indicated.

3.1.14 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.

3.1.15 Install horizontal joint reinforcement 16 inches o.c. vertically and as indicated on Drawings. **Exception**: 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. Install veneer wall ties as indicated by manufacturer.

3.1.16 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.

3.1.17 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.

3.1.18 Grouting at bond beams over openings shall be done in one continuous operation.

3.1.19 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 and reinforced with vertical reinforcing steel.

3.1.20 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.

3.1.21 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.

3.1.22 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 each floor, and at sills and heads of openings, to maintain the level of the walls. Partitions shall extend from the floor to the bottom of the floor or roof construction above, unless otherwise indicated. Walls and partitions shall be structurally bonded or anchored to each other and to concrete walls, beams and columns. Non load-bearing partitions and interior walls shall be securely anchored to the construction above and in a manner that provides lateral stability.

3.1.23 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.

3.1.24 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.

3.1.25 Concrete masonry units shall be cut and fit for placement of monorail and support beam. Coordinate with other sections of work to provide correct size, shape, and location.

3.1.26 Seismic anchorage at base and top of CMU block walls. All reinforced cores shall be anchored at top and bottom with reinforcing steel bars (dowels) of equal size and spacing to the CMU core reinforcing.

(a) Base anchorage: Placement of **base** dowels to be coordinated with concrete trade and related trades as required for proper location and spacing requirements. (Option, base dowels may be drilled and epoxy anchored into concrete base, with 6” minimum embedment.)

(b) Top anchorage: Use minimum 12” long dowels with 4” epoxy embedment into concrete structure. Tie dowel to CMU reinforcing. Fully grout masonry cores.

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 (except at north wall of new electrical building) to receive cavity insulation and air/vapor barrier sheet/adhesive.

3.2.3 Install cavity insulation, vapor barrier, and other accessories as required.

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 bond beams and 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:

(a) Openings up to 42 inches wide: Place two (2) No. 5 bars 1 inch from bottom web.

(b) Openings from 42 inches up to 78 inches wide: Place two (2) No. 5 bars 1 inch from bottom web.

(c) Openings over 78 inches wide: Reinforce openings as detailed.

3.3.4 Grouted Components (general)

(a) Reinforce bond beam (where required and as indicated on drawings) with two (2) No. 5 bars, placed continuous bottom reinforcement.

(b) Reinforce other grouted components as shown on Contract Drawings.

(c) Lap splices minimum 40 bar diameters.

(d) Support and secure reinforcing bars from displacement. Maintain position within 2 inch of dimensioned position.

(e) Place and consolidate grout fill without displacing reinforcing.

(f) At bearing locations, fill masonry cores with grout for a minimum 16 inches either side of opening.

3.3.5 Control Joints:

(a) Do not continue horizontal joint reinforcement through control joints.

(b) Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer=s instructions.

(c) Size control joint in accordance with Section 7E for sealant performance.

3.3.6 Built-In Work

(a) As work progresses, build in steel frames at door openings, anchor bolts, embed bearing plates, lintels and other items furnished by other Sections.

(b) Build in items plumb and level.

(c) 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.

(d) Do not build in organic materials subject to deterioration.

3.3.7 Tolerances

(a) Maximum variation from unit to adjacent unit: 1/32 inch.

(b) Maximum variation from plane of wall: 1/4 inch in 10 feet, and 2 inch in 20 feet or more.

(c) Maximum variation from plumb: 1/4 inch per story non-cumulative; 2 inch in two stories or more.

(d) Maximum variation from level coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 2 inch in 30 feet.

(e) Maximum variation of joint thickness: 1/8 inch in 3 feet.

(f) Maximum variation from cross sectional thickness of walls: 1/4 inch.

3.3.8 Cutting and Fitting

(a) Cut and fit for chases, pipes, conduit, sleeves and other components. Coordinate with other Sections of work to provide correct size, shape, and location.

(b) 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 Clean-Up

3.4.1 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.

3.4.2 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.

3.4.3 After mortar is thoroughly set and cured, remove large mortar particles by hand with wooden paddles and non-metallic scrape holes or chisels.

3.4.4 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 Overhead crane frame.

1.1.3 Monorail hoist beam extension.

1.1.4 Wet well platform.

1.1.5 Base plates.

1.1.6 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 5D – Grating & Floor Plates.

1.2.6 Section 9A – Painting.

1.2.7 Section 14A – Overhead Crane, Monorail System, Hoist, and Trolley.

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 B6 – Zinc (slab zinc).

1.3.12 AWS A2.0 - Standard Welding Symbols.

1.3.13 AWS D1.1 - Structural Welding Code.

1.3.14 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 Unless otherwise noted, the work specified under this Section and as required will be paid for at the Contract unit price per pound for FURNISHING AND ERECTING STRUCTURAL STEEL.

1.9.2 Door strips and sheet metal for the overhead crane frame system shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Materials

2.1.1 Structural Steel Members: ASTM A992 or M270 Grade 50 for W-shapes
ASTM A36 for other than W-shapes.

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: One coat of No. 66-1211 HI-BUILD Epoxylene; 2 mils thick as manufactured by Tnemec or approved equal.

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.

2.5 Overhead Crane Frame

2.5.1 Coordinate hoist beam, beam splice details, connection details and crane stop locations with hoist manufacturer for verification of compatibility with hoist system.

2.5.2 All overhead crane frame members including beams, columns, bracing, plates and rods shall be hot dip galvanized, after fabrication.

2.5.2 Structural steel for beams shall be ASTM A992 or M270 Grade 50 steel.

2.5.3 Door strips and sheet metal for the overhead crane frame shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

(a) Door strips:
- (1) Strips shall be made of PVC with thickness suitable for outdoor use.
- (2) Strip connection shall be suitable for hoist frame.
- (3) Door strips shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK

(b) Sheet metal:
- (1) Sheeting shall have minimum section modulus as shown on plans with minimum yield strength of 33 ksi.
- (2) All sheeting shall be galvanized in accordance with AASHTO M111 and ASTM 385. Minimum coating class shall be G90 as defined in ASTM A653 in accordance with ASTM A924.
- (3) Sheeting shall have appropriate end lap over roof stringers for proper anchorage and be anchored to supporting members by either welding or mechanical fasteners.
- (4) The crane frame shop drawing shall clearly show location of all sheets.
- (5) Sheet metal shall be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK

2.6 Monorail Hoist Beam Extension

2.6.1 Coordinate monorail hoist beam, beam splice details, connection details and crane stop locations with existing hoist system and crane manufacturer for verification of compatibility with hoist system.

2.6.2 Crane stop shall be installed to limit hoist travel on extended beam to that shown on the drawings.

2.6.3 Monorail hoist beam and supporting members shall be hot dip galvanized, after fabrication.

2.7 Wet Well Platform

2.7.1 All wet well platform members shall be hot dip galvanized, after fabrication.

2.7.2 Grating and railing work shall be paid under other sections.

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, ladders and fall prevention systems, stairs, access hatches, roof scuttles, guard rails, chains, bumper posts and bollards and aluminum fabrications.

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 - Handrails and Railings.
1.2.5 Section 5E - Bolts, Anchor Bolts, Expansion Anchors and Concrete Inserts.
1.2.6 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 AWS A2.0 - Standard Welding Symbols.

1.3.12 AWS D1.1 - Structural Welding Code.

1.3.13 AISI - Standard for Stainless Steel.

1.3.14 SSPC - Steel Structures Painting Council.

1.3.15 ANSI A14.3: Safety requirements for fixed ladders.

1.3.16 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 will be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Materials

2.1.1 Steel Sections: ASTM A36.

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 Roof scuttles

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 Roof scuttle shall be single door leaf with frame opening sizes as shown on the drawings. Covers shall be 11 gauge aluminum with 3" beaded flange, neatly welded. Cover insulation shall be 1" thick glass fiber, fully covered and protected by a metal liner of 18 gauge aluminum. Curb shall be 12" height and of 11 gauge aluminum. Curb shall be formed with a 3 2" 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.

2.4.5 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 shal 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.

2.4.6 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.

2.4.7 Special requirements: Roof scuttles are intended to be operated from outside only. Covers must allow clear access for removing and installing the 28" diameter tube pumps by a mobile crane. Roof scuttles shall have padlock hasps for padlocking from outside only. With cover open, hatch shall have a minimum clear opening of 30", except at the very ends, with no projections from cover or curb hardware over the opening.

2.4.8 Acceptable Manufacturers

(a) Bilco Company

(b) Karp Associates, Inc.

(c) Naturalite Skylight Systems

(d) 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: 6.35 mm (1/4 inch) per story, non-cumulative.

3.3.2 Maximum Offset From True Alignment: 6.35 mm (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 Bumper Posts and Guard Rails: As detailed; hot-dip galvanized.

3.4.6 Bollards: Steel pipe, concrete filled, crowned cap, as detailed; hot-dip galvanized.

3.4.7 Ledge and Shelf Angles, Channels and Plates, Not Attached to Structural Framing, for support of masonry: hot-dip galvanized.

3.4.8 Lintels: Hot-Dip galvanized, as detailed.

3.4.9 Miscellaneous brackets, supports and frames: hot-dip galvanized.

3.4.10 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.

3.4.11 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.

3.4.12 Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.

3.4.13 Access hatches as specified.

END OF THIS SECTION

DIVISION 5 -METALS

SECTION 5C - HANDRAILS AND RAILINGS

1. GENERAL:

1.1 Section Includes

1.1.1 Steel handrails, balusters, and fittings.

1.1.2 Handrails and railings shall conform to applicable Section 1006 of the Standard Specifications.

1.2 Products Furnished but not Installed Under this Section

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

1.2.2 Section 4A - Unit Masonry.

1.3 Related Section

1.3.1 Section 9A – Painting.

1.4 References

1.4.1 ASTM A53 Grade B – Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.

1.4.2 ASTM A123 – Zinc-Coating (Hot-Dip) on Iron and Steel Products.

1.4.3 ASTM A153 – Zinc Coating (Hot Dip) on Iron and Steel Hardware.

1.4.4 ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.4.5 ASTM A501 – Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

1.4.6 SSPC – Steel Structures Painting Council.

1.5 Standard Railing and Handrail Design Requirements:

1.5.1 Railing assembly, wall rails, and attachments shall resist a force of 200 pounds in any direction at any point without damage or permanent set.

1.5.2 Railings and handrails shall satisfy all requirements of Occupational Safety and Health Administration, US Department of Labor Chapter XVII, Title 29 Part 1910.

1.6 Submittals

1.6.1 Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.7 Field Measurements

1.7.1 Verify that field measurements are as indicated on shop drawings.

1.8 Basis of Payment

1.8.1 The work will be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Standard Steel Railing System

2.1.1 Rails and Posts: 1-1/2 inch diameter schedule 40 steel pipe 1.9 inch O.D. and 0.145 inch minimum nominal wall thickness; welded joints. Center to center post spacing shall be 4 foot maximum. Pipe shall be carbon steel type ASTM A53 Grade B, ASTM A501, or ASTM A500 Grade B.

2.1.2 Standard Railing: A standard railing shall consist of top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal, from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.

2.1.3 Standard Toe board: A standard toe board shall be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than 1/4 inch clearance above floor level.

2.1.4 Handrail: A handrail shall consist of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail. The handrail shall be rounded or other section that will furnish an adequate handhold for anyone grasping it to avoid falling. The ends of the handrail should be turned in to the supporting wall or otherwise arranged so as not to constitute a projection hazard. The height of handrails shall be not more than 38 inches or less than 34 inches from the upper surface of handrail to surface of tread in line with face of riser or to surface of ramp.

2.1.5 Fittings: Elbows, T-shapes, wall brackets, escutcheons; machined steel.

2.1.6 Mounting: Brackets and flanges, with steel inserts for casting in concrete and embedding into masonry, or flanges and through bolts for securing to grating system.

2.1.7 Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

2.1.8 Splice Connectors: Steel concealed spigots.

2.1.9 Galvanizing: 2.0 oz/sq. ft. zinc coating, minimum, in accordance with ASTM A123 for products and ASTM A153 for hardware. All handrail and railing components shall be hot-dip galvanized after fabrication.

2.2 Fabrication

2.2.1 Fit and shop assemble components in largest practical sizes, for delivery to site.

2.2.3 Fabricate components with joints tightly fitted and secured.

2.2.4 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

2.2.5 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.2.6 Continuously seal joined pieces by continuous welds.

2.2.7 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.

2.2.8 Accurately form components to each other and to building structure.

3. EXECUTION:

3.1 Examination

3.1.1 Verify that field conditions are acceptable and are ready to receive work.

3.2 Preparation

3.2.1 Supply items required to be cast into concrete and embedded in masonry with setting templates, to appropriate Sections.

3.3 Installation

3.3.1 Install components plumb and level, accurately fitted, free from distortion or defects.

3.3.2 Provide anchors, plates and angles required for connecting railings to structure. Anchor railing to structure.

3.3.3 Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.3.4 All handrails and railings shall be provided with a clearance of not less than 11/2 inches between the handrail or railing and any other object.

3.4 Erection Tolerances

3.4.1 Maximum Offset From True Alignment: 1/8 inch.

END OF THIS SECTION

DIVISION 5 - METALS

SECTION 5D - RATING AND FLOOR PLATES

1. GENERAL:

1.1 Section Includes

1.1.1 Metal gratings

1.1.2 Floor Plates

1.1.3 Formed openings

1.1.4 Furnish grating frames for installation.

1.2 Related Sections

1.2.1 Section 3A - Cast-in-place Concrete

1.2.2 Section 5B - Metal Fabrications

1.2.3 Section 5C - Handrails and Railings

1.3 References

1.3.1 ASTM A36 - Structural Steel

1.3.2 ANSI/ASTM A123 - Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

1.3.3 ASTM A153 - Zinc Coating (Hot-Dipped Galvanized) on Iron and Steel Hardware.

1.3.4 ANSI/NAAMM A202.1 - Metal Bar Grating Manual

1.3.5 ASTM A386 - Zinc Coating (Hot-Dipped Galvanized) on Assembled Steel Products

1.3.6 ASTM A525 - General Requirements for Steel Sheet, Zinc- coated (Galvanized) by the Hot-Dip Process

1.3.7 ASTM A569 - Steel, Carbon, Hot-rolled Sheet and Strip, Commercial Quality

1.3.8 ASTM A588 - High Strength Low Alloy Structural Steel

1.3.9 ASTM B-221 - Aluminum & Aluminum Alloy Extruded Bars, Rods, Wire Shapes and Tubes

1.4 Metal Gratings and Floor Plates System Description

1.4.1 Live Load: 300 lbs/sq. ft. minimum, and 1,500 lbs point load Deflection Under Live Load:

(a) Bar grating, floor plates, etc.: 1/360 span maximum.

1.4.2 Size grating and plates to maximum deflection limits by single support design. Provide stiffener angles on underside of floor plates.

1.4.3 Maximum fiber stress shall not exceed 50% of yield stress.

1.4.4 Unless otherwise Specified or noted on Drawings, the minimum size bearing bar and spacing for bar gratings shall be 1-3/4 inches x 3/16 inch spaced 1-3/16 inches on center. Where a difference bearing bar depth is indicated on drawings, bars shall be a minimum of 3/16 inch thick at maximum 1-3/16" spacing.

1.5 Quality Assurance

1.6.1 Design grates and plates under direct supervision of professional engineer experienced in design of building structures, registered in the project's State.

1.6.2 Grating and floor plates shall conform to applicable Section 1006, METALS, of the Standard Specifications.

1.6 Submittals

1.7.1 Indicate details of grates, plates, supports, span and deflection table, openings, and perimeter construction details and tolerances.

1.7.2 Submit samples.

1.7.3 Submit manufacturer's installation instructions.

1.8 Basis of Payment

1.8.1 Payment for the work specified under this Section and as required will be included in the Contract lump sum price for PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Acceptable Manufacturers

2.1.1 Bar Grating

(a) Reliance.
(b) Blaw-Knox.
(c) IKG Borden.

2.1.2 Substitutions: Under provisions of Division 1.

2.2 Materials

2.2.1 Sheet Steel: ASTM A36; carbon steel with diamond pattern.

2.2.2 Formed Steel: ASTM A36 of shapes indicated.

2.2.3 Provide protection for contact of dissimilar metals.

2.3 Fasteners

2.3.1 Fasteners: Stainless steel.

2.3.2 Type: Recessed welded plate for bar type gratings, or stainless steel G-clip grating fasteners as manufactured by Grating Fasteners, Inc.

2.4 Fabrication

2.4.1 Fabricate grates and plates of sizes indicated. Unless otherwise required, grating panels shall be removable and sized to weigh less than 200 pounds.

2.4.2 Provide steel angle support framing for openings. Fabricate frames to Section 5B and as Specified herein.

2.4.3 Bar Gratings

(a) Bearing Bar: 1-3/4 x 3/16 inch, minimum, spaced 1-3/16 inches on center or as indicated on Drawings or otherwise Specified.

(b) Cross Bar: 1/4 x 1/4 inches twisted size, spaced 4" on center or as indicated on Drawings.

(c) Anchorages: Welded recessed plate, stainless steel bolts or stainless steel grating fastener clips.

(d) Banding: Perimeter of all gratings and cutouts shall be banded with bar same size as bearing bar.

2.5 Finishes

2.5.1 Galvanizing: Hot dipped after fabrication to ASTM A123, A386, A153 and A525.

2.5.2 Non-slip Surfacing: Aluminum oxide where indicated.

2.5.3 Aluminum: Where indicated on plans, provide aluminum grating to ASTM B-221 alloy 6063.

3. EXECUTION:

3.1 Inspection

3.1.1 Verify that opening sizes and dimensional variations are acceptable to suit grating and plating tolerances.

3.1.2 Verify that supports and anchors are correctly positioned.

3.2 Installation

3.2.1 Install grates and floor plates in accordance with manufacturer's instructions.

3.2.2 Mechanically cut galvanized finished surfaces. Do not use flame cutting tools. Cold galvanize all cut edges.

3.2.3 Secure grating with mechanical fasteners to prevent movement. Grating sections shall be removable unless otherwise required.

3.3 Tolerances

3.3.1 Conform to ANSI/NAAMM A202.1.

3.3.2 Maximum Space Between Abutting Sections: 1/4 inch.

3.3.3 Maximum Variation From Top Surface Plane of Abutting Sections: 1/16 inch.

END OF THIS SECTION

DIVISION 5 - METALS

SECTION 5E - 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) Grating and floor plate.

(e) Electrical, plumbing and HVAC work.

(f) Concrete patching.

(g) Pump base.

(h) 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 5C - Handrails and Railings.
1.2.5 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 Licensed Structural Engineer in the State of Illinois.

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 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) 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 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.

2.3.4 Other types: If shown on the drawings or specified under other Sections.

2.3.5 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.

2.3.6 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

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.

3.3 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 Wood nailers

1.1.2 Blocking and cant strips

1.13 All other miscellaneous carpentry as required

1.1.4 Temporary protection

1.2 Related Sections

1.2.1 Section 4A - Unit Masonry System
1.2.2 Section 7A - Board Insulation.
1.2.3 Section 7B - Loose Fill Insulation.
1.2.4 Section 7C - Elastomeric Sheet Roofing-Fully Adhered/Ballasted Cover

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.

(1) Northeastern Lumber Manufacturers Association, Inc. (NELMA)
(2) Southern Pine Inspection Bureau (SPIB)
(3) West Coast Lumber Inspection Bureau (WCLIB)
(4) Western Wood Products Association ((WWPA)
(5) 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.

(1) S-Dry: Maximum 19 percent moisture content
(2) MC-5 or KD: Maximum 15 percent moisture content
(3) 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 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 Chromated copper arsenate shall conform to Fed. Spec. TT-W-550F,Type I or Type II.

2.4 Blocking, nailers and other items, whether or not covered by other materials, shall be pressure treated with water-borne chromated copper arsenate. Concentration for water-borne chromated copper arsenate shall not be less than 0.23 lbs. per cu. ft. The pressure treatment for preservatives shall conform to Fed. Spec. TT-W-571i.

2.5 Wood members in connection with roofing and flashing shall be pressure treated with water-borne chromated copper arsenate as specified above and in accordance with applicable APWA Specifications.

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 AND MOISTURE PROTECTION

SECTION 7A - BOARD INSULATION

1. GENERAL:

1.1 Section Includes

1.1.1 Foundations: 2" min. thick board insulation for footing/foundation perimeter.

1.1.2 Cavity Wall: 1" thick board insulation for cavity wall.

1.2 Related Section

1.2.1 Division 3 - Concrete.

1.2.2 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, 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 ½" 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 and Foundation 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.

3.2.5 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 7 - THERMAL AND MOISTURE PROTECTION

SECTION 7B - LOOSE FILL INSULATION

1. GENERAL:

1.1 Section Includes

1.1.1 Granular insulation in cells of concrete masonry unit walls.

1.2 Related Section

1.2.1 Section 4A - Unit Masonry System.

1.3 References

1.3.1 ASTM C516 – Vermiculite Loose Fill Insulation

1.3.2 ASTM C549 – Perlite Loose Fill Insulation

1.3.3 ASTM E84 – Test Method for Surface Burning Characteristics of Building 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 loose fill insulation when temperature or weather conditions are detrimental to successful installation in accordance with manufacturers instructions.

1.8 Coordination

1.8.1 Coordinate the work with installation of masonry wall for placement of materials.

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 PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Acceptable Insulation Materials for Concrete Masonry Unit Hollow Cores.

2.1.1 Granular Insulation: ASTM C516, vermiculite Type II, water repellent, fire resistant, flame/smoke contribution in accordance with ASTM E84.

2.1.2 Granular Insulation: ASTM C549, perlite Type IV, water repellent, fire resistant, limited dust generation, flame/smoke contribution in accordance with ASTM E84.

3. EXECUTION:

3.1 Examination

3.1.1 Verify substrate and adjacent materials and insulation boards are dry and ready to receive.

3.1.2 Verify spaces are free of mortar droppings and debris to allow free flow of insulation.

3.2 Installation

3.2.1 Install insulation in accordance with manufacturer=s instructions.

3.2.2 Place after masonry wall has sufficiently dried and attained optimum moisture content. Place prior to covering cores with bond beams or lintels.

3.2.3 Place as wall is erected. Completely fill spaces.

3.2.4 Place in lifts. Do not exceed pouring height of 6 feet or as recommended by manufacturer (whichever is less).

3.3 Protection of Finished Work

3.3.1 Protect finished work under provisions of Division 1.

3.3.2 Place temporary signs in rooms or areas which face insulated walls warning workers to use caution to prevent loss of loose fill insulation if cutting into walls.

END OF THIS SECTION

DIVISION 7 - THERMAL MOISTURE PROTECTION

SECTION 7C - ELASTOMERIC SHEET ROOFING – FULLY ADHERED/BALLASTED COVER

1. GENERAL:

1.1 Work Scope:

A. Remove existing roofing system and install new elastomeric sheet roofing and appurtenances for the existing pump house roof.

B. Install a new elastomeric sheet roofing and appurtenances for Electrical Control/Generator building and new stairway enclosure.

1.2 Section Includes

1.2.1 Fully adhered elastomeric 60 mil sheet membrane roofing over insulation
1.2.2 Roof insulation
1.2.3 Flexible flashings and base flashings around all openings and roof edge terminations as required by all trades
1.2.4 Ballast cover for ultraviolet protection
1.2.5 Membrane terminations

1.3 Related Sections

1.3.1 Section 3A - Cast-in-Place Concrete
1.3.2 Section 4A – Unit Masonry
1.3.3 Section 6A - Rough Carpentry
1.3.4 Section 7D - Sheet Metal Flashing and Trim.

1.4 References

<u>Insulation Board</u>

1.4.1 ASTM C208 - Cellulosic Fiber Insulating Board.

1.4.2 ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board

1.4.3 ASTM C272 - Water Absorption of Core Materials for Structural Sandwich Constructions

1.4.4 ASTM C612 - Mineral Fiber Block and Board Thermal Insulation

1.4.6 ASTM C1621 - Compressive Properties of Rigid Cellular Plastics

1.4.7 ASTM D1622 - Apparent Density of Rigid Cellular Plastics.

1.4.8 ASTM D2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging

1.4.9 ASTM D2842 - Water Absorption of Rigid Cellular Plastics Roofing Membrane

1.4.1 ASTM D412 - Rubber Properties in Tension

1.4.2 ASTM D746 - Brittleness Temperatures of plastics and Elastomers by Impact.

1.4.3 ASTM D624 – Rubber Property-Tear Resistance.

1.4.4 ASTM D822 – Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products.

1.4.5 ASTM D1004 – Initial Tear Resistance of Plastic Film and Sheeting.

1.4.6 ASTM D2240 – Rubber Property – Durometer Hardness.

1.4.7 ASTM E96 – Water Vapor Transmission of Materials

1.4.8 NRCA (National Roofing Contractors Association) - Roofing and Waterproofing Manual.

1.4.9 ULI - Fire Hazard Classifications.

1.5 System Description

1.5.1 Elastomeric sheet membrane roof assembly to conform to UL requirements for a Class A rated assembly, and I-90 requirements for wind uplift resistance.

1.6 Submittals

1.6.1 Submittals: Procedures for submittals as specified in Division 1.

1.6.2 Shop Drawings:

(a) Roof Plan (use 1/4" = 1'-0"): Submit general roof plan showing tapered insulation plan, which includes all valleys, ridges, slopes, saddles, crickets, scuppers, roof drains, and general drainage pattern based on tapered insulation.

(b) Detail Drawings (use 1-1/2" = 1'-0"): Submit shop drawings detailing base flashings, roof edge termination flashings, reglets, membrane terminations, roof drains, roof scuppers, roof projection flashings, roof hatch flashings.

1.6.3 Samples: Submit samples for the following items:

(a) EPDM Membrane: 8"X10", 3 pieces
(b) Ballast rock: 2 pounds
(c) Termination bars: 2 pieces
(d) Rigid insulation board: 8"X10", 3 pieces

1.6.4 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).

1.6.5 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.

1.6.6 Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6.7 Manufacturer's Field Reports: Submit under provisions of Division 1.

1.6.8 Reports: Indicate procedures followed, ambient temperatures, and wind velocity during application.

1.7 Quality Assurance

1.7.1 Perform Work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

1.8 Qualifications

1.8.1 Manufacturer: Company specializing in manufacturing the products specified in this section with ten years documented experience.

1.8.2 Applicator: Company specializing in performing the work of this section with ten years documented experience and approved by system manufacturer.

1.9 Regulatory Requirements

1.9.1 Conform to applicable code for roof assembly fire hazard requirements.

1.9.2 ULI: Class A Fire Hazard Classification.

1.10 Delivery, Storage, and Handling

1.10.1 Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

1.10.2 Store products in weather protected environment, clear of ground and moisture.

1.10.3 Stand roll materials on end.

1.11 Environmental Requirements

1.11.1 Do not apply roofing membrane during inclement weather or when air temperature is below 40 degrees F and in accordance with manufacturer=s instructions.

1.11.2 Do not apply roofing membrane to damp or frozen deck surface.

1.11.3 Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

1.12 Coordination

1.12.1 Coordinate the work with installing associated flashing as the work of this section proceeds.

1.13 Warranty

1.13.1 Provide 20 year warranty under provisions of Division 1.

1.13.2 Warranty: Cover damage to building resulting from failure to prevent penetration of water.

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 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

2.1.2 Substitutions: Under provisions of Division 1.

2.2 Membrane System

2.2.1 Fully adhered 0.60 (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

2.3.2 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 Ballast Cover

2.6.1 Aggregate: Sound, hard, washed, round and smooth stone; light color; 3/4 inch minimum, 1-1/2 inch maximum size. Fines (aggregate less than 3/4 inch), dirt, or organic materials are not acceptable and constitute cause for rejection.

2.7 Accessories

2.7.1 Sealants: As recommended by membrane manufacturer.

2.7.2 Reglet Strip Devices: Stainless steel or Aluminum or as recommended by Manufacturer.

2.8 Manufacturers - Roofing Insulation Materials

2.8.1 Firestone Building Products Co:

2.8.2 Atlas Roofing Corporation

2.8.3 Apache ISO Products, LLC

2.8.4 Substitutions: Under provisions of Division 1.

2.9 Insulation Materials

2.9.1 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: Square or ship lapped.

(f) Board Thickness: As shown on Drawings, and as required to achieve a minimum R-value of 19.0.

Overlay board(s):

(a) 1/2" 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 1/2" 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:

(a) 1/8" x 1 2" copper or aluminum bar with 45 degree sealant pocket where space permits.

(b) 1/8" x 1" copper or aluminum bar under counterflashing or other restricted areas.

2.11.6 Metal Flashings: Coordinate with Division 7D Sheet Metal Flashing and Trim

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 in accordance with manufacturer's recommendations.

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 Ballast Installation

3.5.1 Ballast: Aggregate, applied dry at 1000#/square or in accordance with manufacturer's instructions, evenly distributed with full surface coverage, as an ultraviolet and surface protection for the roofing membrane.

3.6 Flashing and Accessories

3.6.1 Apply membrane base flashing to seal membrane to vertical elements.

3.6.2 Coordinate installation of roof scuppers, roof drains, roof hatches, mechanical and electrical equipment, and all other roof top items and related flashing.

3.6.3 Seal flashing and flanges of items penetrating membrane.

3.7 Field Quality Control

3.7.1 Field inspection will be performed under provisions of Division 1.

3.7.2 Correct identified defects or irregularities.

3.7.3 Request site attendance of roofing and insulation materials manufacturers during installation of the Work.

3.7.4 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.

3.8 Cleaning

3.8.1 Remove and legally dispose of all debris from the job site.

3.8.2 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.

3.8.3 Repair or replace defaced or disfigured finishes caused by work of this Section.

3.9 Protection

3.9.1 Protect building surfaces against damage from roofing work.

3.9.2 Where traffic must continue over finished roof membrane, protect surfaces.

END OF THIS SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 7D - SHEET METAL FLASHING AND TRIM

1. GENERAL:

1.1 Section Includes

1.1.1 Stainless Steel coping, sill, lintel, base, through wall and cap flashings.

1.1.2 Stainless Steel counterflashing

1.1.3 Stainless Steel Fascias.

1.1.4 Stainless Steel through wall scuppers, conductor head and downspouts.

1.1.5 Precast concrete splash pads for downspouts.

1.2 Products Furnished but not Installed Under this Section

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

1.3 Related Sections

1.3.1 Section 3A - Cast-In-Place Concrete
1.3.2 Section 4A - Unit Masonry System.
1.3.3 Section 5B - Metal Fabrications.
1.3.4 Section 7C - Elastomeric Sheet Roofing
1.3.5 Section 7E - Joint Sealers.
1.3.6 Section 15A - General Mechanical Provisions.

1.4 References

1.4.1 AISI (American Iron and Steel Institute) - Stainless Steel Uses in Architecture.

1.4.2 ASTM A167 - Stainless and Heat-Resisting Chromium- Nickel Steel Plate

1.4.3 ASTM B32 - Solder Metal.

1.4.4 FS O-F-506 - Flux, Soldering, Paste and Liquid.

1.4.5 FS QQ-S-571 - Solder, Tin Alloy.

1.4.6 NAAMM - Metal Finishes Handbook.

1.4.7 NRCA (National Roofing Contractors Association) - Roofing Manual.

1.4.8 SMACNA - Architectural Sheet Metal Manual.

1.4.9 ASTM A240 - Heat-resisting, Chromium & Chromium-Nickel Stainless Steel Plate, Sheet, and Strip.

1.5 Submittals

1.5.1 Submit under provisions of Division 1.

1.5.2 Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.

1.5.3 Samples: Submit two samples 300 mm (12") long of each type of metal flashing illustrating typical material, and finish.

1.6 Qualifications

1.6.1 Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years minimum experience.

1.7 Delivery, Storage and Handling

1.7.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.7.2 Stack preformed material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.7.3 Prevent contact with materials during storage which may cause discoloration, staining, or damage.

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

2.1.1 Stainless Steel Flashing Trim and Coping: Through wall, base, lintel, sil , cap and coping; brake formed to required profiles.

2.1.2 Stainless steel through wall scuppers, conductor heads and downspouts.

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

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.

2.4 Fabrication

2.4.1 Form sections true to shape, accurate in size, square, and free from distortion or defects.

2.4.2 Fabricate cleats, hold-down clips, and starter strips of same material as sheet, minimum 50 mm (2 inches) wide, interlockable with sheet.

2.4.3 Form pieces in longest practical lengths.

2.4.4 Hem exposed edges on underside 13 mm (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 406 mm (16 inch) long legs; solder for rigidity, seal with sealant.

2.4.8 Fabricate vertical faces with bottom edge formed outward 6.3 mm (1/4 inch) and hemmed 45^{o} to form drip.

2.4.9 Fabricate flashing to allow toe to extend 50 mm (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.

3.4 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 7E - 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 7C – Elastomeric Sheet Roofing

1.2.4 Section 7D - Sheet Metal Flashing and Trim: Sealants used in conjunction with metal flashings.

1.2.5 Section 8A - Aluminum Doors and Frames.

1.2.6 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 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.

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, light panels.

1.2 Related Section

1.2.1 Section 4A – Unit Masonry

1.2.2 Section 5B – Metal Fabrications

1.2.3 Section 8C – Door Hardware

1.2.4 Section 15A – General Mechanical Provisions for louvers and dampers.

1.3 References

1.3.1 ANSI/ASTM A36 – Structural Steel.

1.3.2 ANSI/ASTM B209 – Aluminum and Aluminum – Alloy Sheet and Plate.

1.3.3 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: Indicate frame configuration, anchor types and spacings, door elevations, internal reinforcement, closure method, and finish.

1.4.3 Product Data: Indicate door configurations and location of cut-outs for hardware reinforcement.

1.4.4 Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4.5 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 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: 44.5 mm (1-3/4 inches) thick, full flush, tubular aluminum jamb rails, tubular grid sections with 3.2 mm (0.125 inch) thickness face with vertical rib (fluted) design.

2.3.2 Frames: 3.2 mm (0.125 inch) minimum wall thickness, extruded aluminum.

2.4 Door 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.

2.5.2 Insulated 1" window with (2) 1/4" safety glass, 1/2" air gap, sealed glazing panel and tamperproof glazing stops.

2.5.3 Louvers and dampers, coordinate with Division 10 and Mechanical Division specifications and drawings.

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 Coordinate fabrication of doors with windows. Provide fully tempered safety glass, and wired safety glass along with glazing stops and accessories where required on drawings. Provide wired safety glass on fire rated doors where indicated on drawings. Provide double pane insulated fully tempered safety glass for exterior doors where indicated on drawings.

2.6.4 Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline and weatherproof.

2.6.5 Fabricate frames and doors with hardware reinforcement. Reinforcements to be aluminum alloy 6061-T6, minimum 6.3 mm (0.25 inch) thickness.

2.6.6 Prepare components to receive anchor devices. Fabricate anchorage items.

2.6.7 Arrange fasteners, attachments, and jointing to ensure concealment from view.

2.6.8 Prepare frame for silencers. Provide three single rubber silencers for single doors and two single silencers on frame head at double doors.

2.6.9 Fabricate frames with 50 mm (2 inch) head member.

2.7 Finish

2.7.1 Extruded Aluminum Surfaces: Clear Anodized Finish. Provide sample of door and frame in final finish for color and finish approval.

2.7.2 Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 0.6 Kg/m^2 (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. Anchorage shall be as determined by manufacturer; and shall meet the seismic anchorage requirements per local code.

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 8C for installation requirements.

3.3 Tolerances

3.3.1 Maximum Diagonal Distortion: 1.6 mm (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.

3.4.4 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.

3.5 Schedule

3.5.1 See Drawing A7.

END OF THIS SECTION

DIVISION 8 – DOORS AND WINDOW

SECTION 8B – ALUMINUM OVERHEAD COILING DOOR

1. GENERAL

1.1 Section Includes

1.1.1 Standard, insulated, aluminum overhead coiling door, operating hardware, manual operation.

(a) OH1: 8'-0"Wx8'-0"H Exterior Overhead Door

1.2 Related Sections

1.2.1 Section 8C - Door Hardware

1.2.2 Section 9A – Painting

1.2.3 Section 7E – Joint Sealers

1.3 References

1.3.1 ASTM A526/A526M - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Commercial Quality.

1.3.2 ASTM B221/A221M - Aluminum & Aluminum-Alloy Extruded Bars, Rods, Wire, Shape, and Tubes.

1.4 System Description

1.4.1 Manually operated unit.

1.4.2 Coiling Door: Surface mounted.

1.5 Design Requirements

1.5.1 Design door assembly to withstand wind/suction load of 20 psf, without undue deflection or damage to door assembly components.

1.5.2 Insulation Value: R of 6.33

1.6 Submittals

1.6.1 Procedures for Submittals under Division 1.

1.6.2 Provide general construction, component connections and details under Division 1.

1.6.3 Submit Shop Drawings under Division 1 and to indicate pertinent dimensioning, anchorage methods, hardware location, and installation details.

1.6.4 Submit two door slats, 12 inches in size illustrating shape, color and finish texture.

1.6.5 Manufacturer's Installation Instructions: Indicate installation sequence and procedures and adjustment and alignment procedures.

1.7 Operation and Maintenance Data

1.7.1 Section 1A - Contract Closeout: Procedures for submittals.

1.7.2 Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.8 Regulatory Requirements

1.8.1 Provide certificate of compliance from authority having jurisdiction indicating approval of door and operating hardware assembly.

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 PUMP STATION GENERAL WORK.

2. PRODUCTS

2.1 Manufacturers

2.1.1 Cornell Iron Works, Inc.

Model: Series QS24 Service Doors.

2.2.2 Overhead Door Corp.

Model: 615 Series Service Doors.

2.2.3 Substitutions: Under provisions of Section 1A.

2.2 Materials

2.2.1 Exterior Curtain: Conforming to the following:

(a) Slats: Interlocking, minimum 18 B & S gauge aluminum; sandwich slat construction with insulated core of foamed-in-place urethane insulation.

(b) Nominal Slat Size: 3 inches wide x required length.

(c) Slat Ends: Alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement.

(d) Curtain Bottom: Fitted with aluminum hollow extrusion to provide reinforcement and positive contact with floor in closed position.

2.2.2 Interior Curtain: Conforming to the following:

(a) Slats: Interlocking, minimum 16 B & S gage Aluminum.

(b) Nominal Slat Size: 3 inches wide x required length.

(c) Slat Ends: Alternate slats fitted with endlocks to act as wearing surface in guides and to prevent lateral movement.

(d) Curtain Bottom: Fitted with angles to provide reinforcement and positive contact with floor in closed position.

2.2.3 Guides: Formed steel angles for required sizes and configurations. (Hot Dip Galvanized)

2.2.4 Roller Shaft Counterbalance:

Steel pipe and helical steel spring system capable of producing torque sufficient to assure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension.

2.2.5 Hood Enclosure

- Exterior Doors: Cover: 0.040 inch aluminum sheet with reinforced top and bottom edges. Provide minimum intermediate support brackets as required to prevent excessive sag, and to maintain rigidity and shape. Finish: Clear Anodized Finish.

2.2.6 Hardware

(a) Cylinder: Cylinder master keyed in accordance with Section 8C.

(b) Weatherstripping
- Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure.

2.3 Finishes

2.3.1 Exterior Curtain Slats: Clear Anodized Finish.

2.3.2 Interior Curtain Slats: Clear Anodized Finish.

2.3.3 Hood Enclosure: Clear Anodized Finish.

2.3.4 Steel Guides, bottom bar and all exposed steel, and galvanized steel: Prime and finished painted in a powder coated color to match clear anodized finish.

3. EXECUTION

3.1 Examination

Verify that opening sizes, tolerances, and conditions are acceptable.

3.2 Installation

3.2.1 Install door unit assemblies as follows:

(a) Install overhead coiling door with manual operator in accordance with manufacturer's instructions.

3.2.2 Overhead door shall be faced mounted type assemblies.

3.2.3 Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

3.2.3 Securely and rigidly brace components suspended from structure.

3.2.4 Fit and align assembly, including hardware; level and plumb, to provide smooth operation.

3.2.5 Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 7E.

3.2.6 Install perimeter trim and closures.

3.3 Erection Tolerances

3.3.1 Maintain dimensional tolerances and alignment with adjacent work.

3.3.2 Maximum Variation from Plumb: 1/16 inch.

3.3.3 Maximum Variation from Level: 1/16 inch.

3.3.4 Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 Adjusting

3.4.1 Adjust door, hardware and operating assemblies for smooth and noiseless operation.

3.5 Cleaning

3.5.1 Clean door and components.

3.5.2 Remove labels and visible markings.

END OF SECTION

DIVISION 8 - DOORS AND WINDOWS

SECTION 8C - DOOR HARDWARE

1. GENERAL:

1.1 Section Includes

1.1.1 Hardware for interior and exterior doors, and fire-rated 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.

1.2.2 Section 8D – Steel 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.

1.3.4 Section 8D – Steel 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 NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

1.4.6 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, lock set, latchset, closers, thresholds, flushbolts, weatherstripping, and other hardware items, 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.

(b) NFPA 101.

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 Regulatory Requirements

1.10.1 Conform to applicable code for requirements applicable to fire rated doors and frames.

1.11 Delivery, Storage, and Handling

1.11.1 Deliver, store, protect, and handle products to site under provisions of Division 1.

1.11.2 Package hardware items individually; label and identify package with door opening code to match hardware schedule.

1.11.3 Deliver keys to DEPARTMENT by security shipment direct from hardware supplier.

1.11.4 Protect hardware from theft by cataloging and storing in secure area.

1.12 Coordination

1.12.1 Coordinate work with other directly affected Sections involving manufacturer or fabrication of internal reinforcement for door hardware.

1.13 Warranty

1.13.1 Provide five year warranty under provisions of Division 1.

1.13.2 Warranty: Include coverage of door closures.

1.14 Maintenance Materials

1.14.1 Provide maintenance materials under provisions of Division 1.

1.14.2 Provide special wrenches and tools applicable to each different or special hardware component.

1.14.3 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.15 Basis of Payment

1.15.1 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

2.1.1 Hinges: Hager, Stanley, and H Soss.

2.1.2 Mortise Lockset: Corbin Russwin, Schlage, and Sargent.

2.1.3 Mortise Latchset: Corbin Russwin, Schlage, and Sargent.

2.1.4 Closers: Corbin Russwin, LCN, and Norton.

2.1.5 Bolts: Corbin Russwin, Glynn-Johnson, Stanley

2.1.6 Weatherstripping: National Guard Products, Zero.

2.1.7 Thresholds: National Guard Products.

2.1.8 Astragals(Panic Hardware Type): National Guard Products.

2.1.9 Door Sweeps: National Guard Products.

2.1.10 Substitutions: Under provisions of Division 1.

2.2 Keying

2.2.1 Supply 4 keys for each lock.

2.2.2 Keys shall match DEPARTMENT'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 Schedule

3.5.1 Hinges: Stainless steel, heavy weight, five knuckle, four ball bearing with non-rising pin, button tip and ring, non-removable stainless steel pin on exterior doors, US32D finish, Hager Model BB1199.

(a) Door size to 8'-0" x 4'-0":
2 pr. 4.5" x 4.5".

(b) Door size over 8'-0" x 4'-0":
2-1/2 pr. 6" x 6", or as required by door manufacturer.

3.5.2 Mortise Lockset: Wrought bronze, visible parts US32D finish, non-ferrous internal parts, with minimum 3/4" throw on latch bolt, 1" throw on deadbolt. Cylinder shall be as specified by DEPARTMENT. Latch bolt by grip either side. Dead bolt by key outside or by thumbturn lever inside, inside grip simultaneously retracts latchbolt and deadbolt (Entrance Type) Corbin Russwin ML2000 series, Model No. ML2065.

3.5.3 Mortise Latchset: Wrought bronze, visible parts US32D finish, non-ferrous internal parts, with minimum 3/4" throw on latch bolt. No locking device shall be provided for the handles (Passage Set Type) Corbin Russwin ML2000 Series, Model No. ML2010.

3.5.4 Closers: Heavy duty parallel arms with adjustable closing speed, with hold-open for outswinging exterior doors. Corbin Russwin Series DC2000, Model No. DC2210 A2 M72(standard cover) 626(satin chrome plated) .

3.5.5 Flush Bolts: US32D(satin stainless steel finish), full mortised extension flush bolts with dust proof strike, located at inactive leaf of all pairs of doors. Corbin Russwin Model 2849 with No. 70-1/2M Strike.

3.5.6 Thresholds: Clear anodized aluminum finish , with chemically treated stainless steel screws, set in full bed of sealant. National Guard Products, Model No. 896 with bumper gasket.

3.5.7 Weatherstripping: Head and jamb gasket, aluminum with clear anodized aluminum finish and neoprene insert. National Guard Products, Model 700N.

3.5.8 Astragals: Stainless steel surface mounted, meeting stile gasketing with silicone seal. National Guard Products Model No. 178SA.

3.5.9 Door Sweep: Nylon brush gasketing, National Guard Products Model 600 Series, Clear aluminum finish.

3.6 Hardware Schedule per Door

Refer to A Drawings for hardware schedule per door.

END OF THIS SECTION

DIVISION 8 - DOORS AND WINDOWS

SECTION 8D - STEEL DOORS AND FRAMES

1. GENERAL:

1.1 Section Includes

1.1.1 Interior fire-rated steel flush door, with louver/damper, light panel and frame.

1.2 Related Section

1.2.1 Section 4A - Unit Masonry

1.2.2 Section 5B - Metal Fabrications

1.2.3 Section 8C - Door Hardware

1.2.4 Section 15A - General Mechanical Provisions

1.3 References

1.3.1 ANSI/ASTM A36 - Structural Steel.

1.3.2 ANSI/ASTM A526 - Steel sheet, Zinc Coated (galvanized) by Hot-Dip Process, Commercial Quality.

1.3.3 ASTM E152 - Methods of Fire Tests of Door Assemblies.

1.3.4 DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

1.3.5 NFPA 252 - Fire Tests for Door Assemblies.

1.3.6 SDI 105 - Recommended Erection Instructions for Steel Frames.

1.3.7 UL 10B - Fire Tests of Door Assemblies

1.4 Submittals

1.4.1 Submit under provisions of Division 1.

1.4.2 Shop Drawings: Indicate frame configuration, anchor types and spacings, door elevations, internal reinforcement, closure method, and finish.

1.4.3 Product Data: Indicate door configurations and location of cut-outs for hardware reinforcement.

1.4.4 Manufacturer's Installation Instructions: Indicate special installation instructions.

1.4.5 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.

1.5.2 Fire rated door panel and frame construction to conform to NFPA 80 for fire-rated class indicated on Drawings.

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 PUMP STATION GENERAL WORK.

2. PRODUCTS:

2.1 Manufacturers

2.1.1 CECO Corp.

2.1.2 Republic Doors.

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 Interior Doors: 1-3/4 inches thick, full flush, SDI-100 Grade III Model 2, 16 gage thick steel sheet material, galvanized.

2.3.2 Frames and subframes: 16 gage wall thickness, core thickness.

2.4 Door Core

2.4.1 Core: Mineral fiberboard or other insulation for fire-rated door as recommended by manufacturer.

2.5 Accessories

2.5.1 Rubber Silencers: Resilient rubber.

2.5.2 Glazing stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamperproof screws.

2.5.3 Glass and Glazing: Wired 1/4" safety glass for interior fire rated doors.

2.5.4 Louver: provide louver to be installed in door leaf, coordinate type, size with Division 15 mechanical. provide damper as required per Division 15 mechanical.

2.6 Protective Coatings

2.6.1 Bituminous Coating: fibered asphalt emulsion.

2.6.2 Primer: Zinc chromate type. Finish paint in accordance with Section 9A Painting.

2.7 Fabrication

2.7.1 Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.

2.7.2 Fabricate frames and doors with hardware reinforcement plates welded in place. Fabricate doors with reinforcement for window and louver openings. Arrange fasteners, attachments, and jointing to ensure concealment from view.

2.7.3 Reinforce frames wider than 48 inches with rolled formed steel channels fitted tightly into frame head, flush with top.

2.7.4 Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions for double doors on strike side, tow single silencers on frame head at double doors without mullions.

2.7.5 Attach fire rated label to each frame and door unit.

2.7.6 Fabricate frames for masonry wall coursing with 2 inch header.

2.7.7 Coordinate fabrication of doors with louver and damper size and mounting requirements as specified in Division 15 and as indicated on drawings where indicated on drawings for steel doors.

2.7.8 Coordinate fabrication of door leafwith window. Provide wired safety glass along with glazing stops and accessories where required on drawings. Provide wired safety glass on fire rated door.

2.7.9 Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline and weatherproof.

2.8 Finish

2.8.1 Interior Units: 0.60 oz/sq ft galvanized (G60 galvanized coating).

2.8.2 Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A386 to 0.6 Kg/m^2 (2.0 oz/sq ft) primed with iron oxide paint.

2.8.3 Primer: Baked on primer.

2.8.4 Finish: Finish paint with color as selected by Engineer. Refer to Section 9A Painting specifications.

2.8.5 Apply one coat of bituminous paint to 1/16 inch minimum thickness to steel surfaces in contact with cementitious or dissimilar materials. Coating may be shop or field applied, specify accordingly.

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, louver and hardware in accordance with manufacturer's instructions, (Steel Door Institute) SDI-105, and (Door Hardware Institute) DHI recommendations.

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 as applicable.

3.2.4 Use anchorage devices to securely attach frame assembly to structure. Anchorage shall be as determined by manufacturer; and shall meet the seismic anchorage requirements per local code.

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 8C for installation requirements.

3.3 Tolerances

3.3.1 Maximum Diagonal Distortion: 1.6 mm (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 door and frame surfaces.

3.4.4 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.

3.5 Schedule

3.5.1 See A Drawings for schedule.

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.

1.2.4 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 will be paid as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

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.

2.1.3 Unless otherwise indicated, all surfaces without a final finish color shall be painted. In general, colors will be differentiated as follows:

(a) Ceiling
(b) Grade floor
(c) Lower level floors
(d) Lower level concrete walls
(e) Interior metal trim
(f) Exterior metal trim
(g) Exterior piping and appurtenances (such as sluicegate stands and operators)
(h) Natural or anodized aluminum surfaces shall not be painted. Surfaces and equipment which are provided with a factory final finish shall not be painted.

Notes:

1. Wall and floor at wet well shall not be painted. All other lower and upper level floors, walls and ceilings shall be painted.

2. All piping shall be shop finish painted.

2.2 Color Coding

2.2.1 Piping and electrical conduit shall be color coded with general color scheme as specified in this Section. 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 Concrete floors above the wet pit shall have an abrasive coating of 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.

3.1.9 Steel or Hollow Metal Doors and Frames: New doors will be primed ready to receive finish paint. Prep surfaces as recommended by door manufacturer and finish paint with epoxy based paint to color as selected by Engineer. Existing Doors, see Part 3.1.6 for door panel preparation for epoxy priming and finish painting with finish color to be selected by Engineer.

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 DEPARTMENT.

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 painters 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	Field or Shop Finish Coats		
Class of Work	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	B	B*	B	F
Wrapped in Insulation	B	B*		
Exterior, Exposed to Process Wetting and Drying	B	B*	D	D
Concrete Masonry:				
Interior		G	D	D
Concrete		D	D	

Pipe and Duct Insulation:			
Exposed	A	A	
PVC	A	A	
Steel Doors and Frames	A (as req'd)	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.

Symbol	Product Name and Number	Volume Solids %	Dry Film Thickness Micrometers	(Mils) Per Coat
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:

(a) Ceiling steel frame - light gray
(b) Floors – light gray or equivalent
(c) Ceilings - white
(d) CMU and concrete walls - Tannery
(e) Interior steel frame and metal trim - light gray
(f) Exterior metal trim - light gray
(g) Exterior piping and appurtenances - Turbine blue
(h) Interior piping - Turbine blue
(i) Electrical conduits – Match wall or ceiling running against
(j) Bollards – Yellow
(k) Hoist beams – Red
(l) Physical hazards – Yellow
(m) Exterior hoist frame – Light gray

END OF THIS SECTION

DIVISION 9 – FINISHES

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 walls, ceiling and floor of the interior of the pump station.

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 signed by a Certified Hazardous Materials Manager (CHMM) and registered Professional Engineer in the STATE of Illinois.

(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 foot for REMOVAL AND DISPOSAL OF LEAD BASED PAINT.

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 an 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. At a minimum, a PM-10 monitor shall be used and a base line of air quality established pre and post work.

3.1.3 Contractor shall clean up site on a daily basis so that no debris is tracked off the site.

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 NELAC accredited testing lab. Include accreditation of testing lab.

(e) Final Report to be signed and reviewed by a Certified Hazardous Material Manager and registered Professional Engineer in the STATE of Illinois. 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 Existing MCC Room Ceiling: Approximately 180 ft^2

3.3.2 Existing MCC Room Walls: Approximately 770 ft^2

3.3.3 Existing MCC & Motor Room Floor: Approximately 1,630 ft^2

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, shop desk, station identification plate, staff gauges, 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 will be paid for as part of the Contract lump sum price for PUMP STATION GENERAL WORK.

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, 44" long, 3" deep. See Drawing M7 for location.

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 53 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 two first aid kit with brackets for wall mounting as directed. The kit shall be Model No. 640135 as manufactured by Johnson and Johnson or equal.

2.6 Fire Extinguishers

2.6.1 Furnish and install five 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 Design, fabricate and furnish one pump dolly for moving pump at floor El. 408.0 for the spare sump pump.

2.7.2 Dolly shall be designed to following criteria:

(a) Dolly design shall be coordinated with approved pump shop drawings and approved monorail hoist shop drawings.

(b) Dolly shall be custom designed to provide safe, stable handling of low flow pump by one person.

(c) Accommodations for pump handling shall allow for both manual pushing and pulling of dolly.

(d) Dolly shall easily slide under the pumps for loading while pumps are raised to maximum monorail hoist height in the hoist drop area.

(e) Dolly chasis shall be either a pallet dolly, a pallet lift truck or other design approved by Engineer, designed for the weight of sump pump SSP-1 of approximately 5,000 lbs. Chasis shall be provided with custom designed cradle for supporting main and low flow pumps. Cradle support shall be based on pump manufacturer handling and storage recommendations to prevent damage to pumps. Cradle support shall allow for pushing/pulling of dolly and shall be securely attached to dolly. Dolly chasis shall be a galvanized steel plate approximately 34” by 42” in plan, 8.5" maximum height with two rigid 6”x3” and two 6”x3” swivel wheel casters designed for weight of sump pump or other design approved by Engineer.

(f) Submit shop drawings showing complete sequence of pump handling, including clearances, rolling resistance and details of dolly assembly.

2.8 Clock

2.8.1 Clock shall be synchronous motor type, 12" face, 120 V. 60 Hz.

2.9 Breathing Apparatus

2.9.1 Provide a self contained breathing apparatus (SCBA) unit. Self contained breathing apparatus shall be positive pressure and approved to the latest National Institute for Occupational Safety and Health (NIOSH) standards. The apparatus shall be Model INDUST-SCBA unit and manufactured by Toxalert International or approved equal.

2.9.2 Provide a wall mounted cabinet for the breathing apparatus.

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

DIVISIONS 11, 12 AND 13

None Required

DIVISION 14 - CONVEYING SYSTEMS

SECTION 14A - OVERHEAD CRANE, MONORAIL SYSTEM, HOIST, AND TROLLEY

1. GENERAL:

1.1 Section Includes

1.1.1 Monorail hoist extension.
1.1.2 Overhead crane.
1.1.3 Hoists and trolleys.
1.1.4 Operating controls.
1.1.5 Accessories.
1.1.6 1/2 Ton hoist

1.2 Related Sections

1.2.1 Section 5A - Structural Steel.
1.2.2 Section 5E - Bolts, Anchor Bolts, Expansion Anchors, and Concrete Inserts.
1.2.3 Section 9A - Painting.
1.2.4 Division 16 - Electrical.

1.3 References: Equipment shall meet the requirements of the following specifications unless more stringent requirements are otherwise specified:

1.3.1 ANSI B30.2.0 – Safety Standard for Overhead and Gantry Cranes.
1.3.2 ANSI B30.11 – Safety Standard for Underhung Cranes and Monorail Systems.
1.3.3 ANSI B30.16 – Safety Standard for Overhead Hoists.
1.3.4 ANSI B30.17 – Safety Standards for Overhead and Gantry Cranes
1.3.5 ANSI MH27.1 – Specifications for Underhung Cranes and Monorail Systems.
1.3.6 HMI 100 – Standard Specifications for Electric Wire Rope Hoists.
1.3.7 HMI 200 – Standard Specifications for Hand-Operated Chain Hoist.
1.3.8 HMI 400 – Standard Specification for Electric Chain Hoists.
1.3.9 CMAA No.70 – Specifications for Electric Overhead Traveling Cranes.
1.3.10 CMAA No.74 – Specifications for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes
1.3.11 NEC – National Electric Code
1.3.12 NEMA – National Electrical Manufacturers Association.
1.3.13 AWS D1.1 – Code for Welding in Building Construction.

1.4 Monorail Hoist Extension System Description

1.4.1 Crane manufacturer shall modify or replace existing electrification, cable reel and controls as required to allow full travel of the existing hoist and trolley on the extended hoist beam length.

1.4.2 Existing hoist is a 2 ton capacity, Yale electric wire rope hoist, with motorized trolley, standard headroom, H4 duty class. The hoist was installed in about 1982 by Zeller Electric, Inc, St. Louis, Mo.

1.4.3 Monorail hoist beam extension as indicated on the structural plans shall be performed under Division 5.

1.5 Overhead Crane System Description

1.5.1 Overhead crane - The crane system shall consist of an underhung, single girder, floor control, overhead crane designed for 3-ton capacity. Crane and hoist shall be suitable for infrequent service at full loading during regular annual pump servicing. Crane and hoist shall be suitable for outdoor use and storage under varied weather conditions. All equipment shall be designed for minimum Class C (Moderate Service) as specified in ANSI MH27.1 Center to center of rail and lift are as indicated on the structural overhead crane drawings, 17 feet and 72 feet, respectively. The system includes, but is not limited to, the following principal items:

1.5.2 Install runways and rails to frame structure to meet manufacturer's tolerance specifications.

1.5.3 Provide stops at each end of runway with limit switches to terminate operation upon reaching stop.

1.5.4 Motor-driven, underhung, single girder bridge, 3-ton capacity. The bridge travel speed shall be approximately 70 and 25 feet per minute. The bridge shall be motorized. The electrical controls for the bridge shall be included in the control devices.

1.5.5 Underhung single girder crane bridge - The bridge girder travel shall be electrically controlled by a pushbutton pendent control positioned for operation at El.420. Wheel stops shall be positioned at each end of bridge girder.

1.5.6 3-ton motorized chain hoist and motorized trolley shall be operated by the crane bridge pushbutton pendent control positioned for operation at El. 420.0. Hoist shall have two lifting speeds. Slow speed shall be a maximum of 4 to 6 feet per minute and fast speed shall be approximately 15 feet per minute. A chain container shall store full chain length. An appropriate reel shall be provided for pendant. Hoist trolley travel speed shall be approximately 50 and 15 feet per minute. Hoist shall meet the hoist manufacturer's association H4 classification.

1.5.7 A 3-ton capacity trolley with a 3-ton capacity fixed hook shall be rigidly linked to one side of the chain hoist motorized trolley. The trolley shall move along the underhung hoist rail with the motorized hoist trolley. The hook on this trolley is to allow raising and lowering the pumps in increments through alternating between supporting the pump from the hoist and the fixed hook, if such a system is provided by the pump manufacturer.

1.5.8 Electrical supply to the electric crane motor shall be by a 4 conductor figure 8 feedrail and collector system. The feedrails shall be protected by ultraviolet resistant PVC cover, supported by hangers on standoff insulators. The system shall be suitable for operating under rain, snow and icing conditions.

1.5.9 An electric cord reel or festooned tagline shall be supplied to adequately provide power to both hoist and trolley motors. The cord reel shall allow movement of the trolley along the full length of bridge girder and runway rails as shown on Drawings.

1.5.10 Although only the principal items are described herein, it is understood that all items necessary for safe and efficient operation shall be supplied, so that monorail system shall be complete in all respects and ready for operation.

1.5.11 Minimum and maximum hook heights and approach distances shall be as indicated on Drawings.

1.5.12 The Contractor shall furnish all labor, equipment, materials and services required to install the required overhead cranes (including bridges, trolleys, hoists and all required accessories) and monorail systems (including hoists, trolley and all required accessories), as shown and as specified. Work shall be complete in all respects and ready for operation. Although only the principal items are described herein, it is understood that all parts necessary for safe and efficient operation shall be supplied. This shall include all necessary safety devices, stops, brakes and complete electrical hookup, and all additional structural supports necessary to make the system complete and ready for safe operation.

1.6 1/2 Ton Hoist

1.6.1 A 1/2 Ton capacity hand hoist shall be provided for handling the dewatering pump DP-1.

1.6.2 Hoist shall have 12 feet of lift and chain rigged for operation from the EL.370 platform shown on drawings S3 and S4.

1.6.3 Hoist shall have top hook suspension, outdoor housing and a load brake that can hold a capacity load stationary at any position load.

1.6.4 The chain shall be zinc plated alloy steel heat treated for wear and impact resistance.

1.7 Submittals

1.7.1 Shop Drawings: Indicate as a minimum, Plans, elevations, anchor bolt size and layout, and sectional views fully dimensioned to indicate actual clearance along with other pertinent data.

1.7.2 Panel Layout and Schematic Wiring Diagrams: Provide complete wiring diagrams indicating all electrical devices, numbered terminal strips and wiring and complete description of control system.

1.7.3 Catalog data and information shall be submitted for each unit.

1.8 Quality Assurance

1.8.1 All equipment shall be from one manufacturer or supplier.

1.8.2 All materials shall be new and of first class materials and construction.

1.8.3 All monorail system equipment, including trolleys, hoists, switches and electrification devices, shall be installed by a manufacturer approved installer to ensure system completeness, operational integrity and safety.

1.8.4 Hoist manufacturer shall coordinate hoist system requirements with hoist beam supplier and shall verify compatibility and suitability of hoist beams where indicated on Drawings.

1.8.5 Provide a written certification that the equipment has been installed in accordance with the requirements under this Section.

1.9 Operation and Maintenance Data

1.9.1 Submit under provisions of Division 1.

1.9.2 Maintenance Data: Include a parts catalog with complete list of equipment replacement parts and local distributors.

1.9.3 Provide two complete sets of replacement parts, including but not limited to, brake linings and contact kits.

1.9.4 Operation Manuals: Include description of system's method of operation and control, including motor control system and special or non-standard features provided.

1.9.5 Maintenance Manuals: Include instructions for lubrication, adjustment and care of equipment, including detailed technical descriptions of operation, adjustment, and settings of electrical circuits and mechanical equipment.

1.9.6 Provide legible schematic wiring diagrams covering electrical equipment as supplied and installed, including changes made in final work, with symbols listed corresponding to identity or markings on equipment.

1.10 Qualifications

1.10.1 Manufacturer: Company specializing in manufacturing the Products specified with minimum ten years documented experience. The suppliers of equipment under this Section shall be members of the Crane Manufacturer's Association of America, Inc.

1.10.2 Installer: Company specializing in performing the work of this section and approved by monorail equipment manufacturer.

1.11 Regulatory Requirements

1.11.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.12 Field Measurements

1.12.1 Verify that field measurements are as indicated on shop drawings.

1.13 Basis of Payment

1.13.1 Overhead crane system, monorail system, hoist, and trolley will be paid for as part of the Contract lump sum price for PUMP STATION MECHANICAL WORK.

2. PRODUCTS:

2.1 Manufacturers

2.1.1 ACCO/Louden/Wright.
2.1.2 R&M Materials Handling Inc.
2.1.3 Saturn.
2.1.4 North American Industries, Inc.
2.1.4 Substitutions: Under provisions of Section 1A.

2.2 General

2.2.1 Service Classifications: All equipment shall be designed for minimum Class C (Moderate Service) as specified in ANSI MH27.1, and outdoor operation in ambient temperatures (-15 degrees to 40 degrees C). Equipment shall be suitable for outdoor storage and usage under varied atmospheric conditions.

2.2.2 The maximum allowable stresses in materials used for various parts of the equipment are specified herein. However, manufacturer shall be responsible for an adequate design based on factors proven in practice and shall use lower working stresses wherever he deems necessary or desirable.

2.2.3 Adequate factors of safety shall be used throughout the design, especially in the design of parts subject to alternating stresses, vibration, impact, or shock. Under the most severe conditions of static or dynamic loading expected in normal operation, stresses in the materials shall not exceed the values specified below. Maximum shear stresses in ferrous materials shall not exceed 60% of the allowable stresses in tension, except as noted below. The design stresses for components not listed herein shall be selected by manufacturer, but the maximum stresses in tension or compression shall not exceed one-third of the yield strength nor one-fifth of the ultimate tensile strength.

2.2.4 Structural building components as shown on the Drawings are separate from this specification. All other supports, connections, clamps, nuts, washers, etc., are part of this specification.

2.2.5 Track end stops shall be of the welded type and shall be capable of withstanding the impact of a fully loaded crane or carrier traveling at 50% of the full load speed.

2.2.6 All working parts shall be arranged for convenient inspection, lubrication, adjustment, repair, or replacement. The equipment shall be assembled, painted, tested, and adjusted in the shop as far as practicable before shipment.

2.3 Power Supply

2.3.1 All electric power supply equipment shall be suitable for 480-volt, 3-phase, 60-hertz electric service. All hoisting equipment shall be provided with suitable junction boxes for connection of field services and complete with a ground pad. Connections shall be located as shown.

2.4 Motorized Trolley

2.4.1 Trolley wheels shall be designed to operate on the bottom flange of the crane girder, wheels shall be tapered, hardened treads, designed to carry the maximum wheel load under normal conditions without undue wear, with diameter no less than is shown in Table 4.1 of Hoist Manufacturers Institute - Standard Specifications HMI-100-74 for contour wheels with treads no less than 25 mm (1-inch) wide. Wheels shall be machined to match diameters with treads to match the rolling surface of the lower flange of the hoist beam.

2.4.2 Wheel bearings shall be double row precision ball bearings, provided with fittings and seals for pressure lubrication.

(a) Bearings shall be selected to provide a minimum B10 life of 5,000 hours.

2.4.3 The electrical controls for the trolley shall be included in the push-button operation for the hoist.

2.4.4 Routine inspection of gear train shall require no disassembly of major components.

2.5 Electric Hoist

2.5.1 Electric hoist controls shall comply with N.E.C. requirements for the application being considered and shall include control fusing and contacts mechanically and electrically interlocked.

2.5.2 Hoist and appurtenances shall be designed to withstand all stresses imposed under safe operating conditions while handling loads within the rated capacity.

2.5.3 Load bearing parts shall be designed such that the static stress, calculated for rated load, shall not exceed 20% of the ultimate strength of the material.

2.5.4 Furnish suitable push-button pendant control. Push-button arrangement to be supplied with strain relief protection

2.5.5 Hooks shall be supported by anti-friction thrust bearings and permit 360^{o} rotation. Provide latch to bridge opening of the hook.

2.5.6 Hoists shall be equipped with overload limit device to limit loads to rated capacity.

2.5.7 Provide an upper limit switch which will automatically stop the hoist motion when the block reaches its highest position.

2.5.8 The braking system shall be capable under normal operating conditions with rated load to stop and hold the load when controls are released. Two brakes shall be provided; Mechanical load brake and electrical motor brake.

2.5.9 Controlled lowering shall be limited to 120% of rated lowering speed. In the event of complete power failure, the load shall be stopped and held.

2.5.10 All bearings shall be heavy duty, anti-friction type with a minimum B10 life of 5,000 hours.

2.5.11 All gearing shall be forged heat treated alloy steel machined for smooth quiet operation. All gearing shall meet AGMA quality specifications. No cast gears shall be permitted.

2.5.12 Chain hoist

2.6 Electrical Equipment

2.6.1 All electrical equipment and wiring shall comply with the requirements of Division 16 of the Specifications, and shall be suitable for operating under rain, snow and icing conditions.

2.6.2 Power supply shall be 480V, 3 phase, 60 Hz. All electrical interconnections for the monorail system shall be provided by the manufacturer.

2.6.3 Motor voltage shall be 460V, 3 phase, 60 Hz. Controls, lights and heaters shall be operated on 120V, single phase, 60 Hz, derived from the control power transformer in motor starters. Push-button control voltage shall not exceed 120V.

2.6.4 Motors shall be fully enclosed non-ventilated, 60- minute duty, Class F insulation, 85^{o}C temperature rise over 50^{o}C ambient, 1.15 service factor, NEMA hoist-duty. Motors shall be wound-rotor type except those rated less than 7.5 KW (10 HP) and no more than two speeds may be of either wound-rotor type or squirrel-cage type. Each motor shall be braced and insulated to withstand plugging service and heavy shocks and vibrations transmitted to it by the driven machinery. Motor bearings shall be anti-friction type, grease-lubricated with provision for applying and draining grease and for preventing overgreasing. Motor bearings shall have AFBMA B10 life of not less than 10,000 hours.

2.6.5 DC magnet-actuated disc brake shall be provided for rapid stopping of the motor with minimum or zero hook drift.

2.6.6 Motor starters shall be combination circuit breaker, full voltage, reversing, magnetic, NEMA Size 1 minimum, with thermal overload on each phase, fused control power transformers, NEMA 4 enclosure. The starter coil voltage shall not exceed 120V.

2.6.7 All floor-operated functions shall be executed through a common pendent pushbutton station. The pushbutton station shall be heavy duty, oil-tight, with heavy-duty, multi-conductor cable supported mechanically in a satisfactory manner to protect the electrical conductor against strain. The pushbutton station shall be constructed to prevent electrical shock and clearly marked for identification of functions.

2.6.8 Hoist-driven rotating cam or traveling nut type limit switches shall be provided for the upper and lower hook positions, and a block-operated back-up overtravel limit switch which directly interrupts power to the hoist motor shall

be provided for the extreme upper position. Lever-operated end-of-travel limit switches shall be provided for motorized bridge and trolley. All limit switches shall be actuated in one direction only, automatically reset, mounted in NEMA 4 enclosures.

2.7 Finishes

2.7.1 All monorail tracks, runway beams, switches, support steel, rods and clamps shall be hot-dip galvanized and painted in accordance with Section 9A of these Specifications. The top surface of the bottom flange of track may not be painted if the manufacturer specifies that painting may impair wheel motion. Hoists shall be painted with the manufacturer's standard finish, suitable for weather exposure.

3. EXECUTION:

3.1 Examination

3.1.1 Verify location and layout of anchor bolts.

3.1.2 Verify that electrical power is available and of correct characteristics.

3.2 Installation

3.2.1 Install system and components in accordance with ANSI B30.11

3.2.2 The monorail system 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.

3.2.3 Structural members shall not be cut, drilled or otherwise altered without permission of the Engineer.

3.2.4 Structural supports as shown on the Drawings are separate from this specification. All other supports, connections, clamps, nuts, washers, etc., are part of this specification.

3.3 Tests by Regulatory Agencies

3.3.1 Field inspection and testing will be performed under provisions of Division 1.

3.3.2 Perform tests required by ANSI B30.11 and ANSI B30.2.0 in the presence of the Engineer and DEPARTMENT. Each hoist shall be tested through a complete lift and lowering cycle and through complete trolley travel along beam to determine that the equipment will perform the function of hoisting, braking and traveling quietly and smoothly. The hoisting capacity shall be tested as near actual anticipated loads as possible with available loading

facilities such as material or equipment which is readily available within area served. Defects in the equipment indicated by tests shall be promptly corrected.

3.3.3 Schedule tests with two week notice.

3.4 Cleaning

3.4.1 Remove protective coverings from protected surfaces.

3.4.2 Clean surfaces and components ready for inspection.

END OF THIS 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 mechanical 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:

MHSW	P.S. Manual for Highway Storm Water Pumping Station
AASHTO	American Association of STATE Highways and Transportation Officials

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWWA	American Water Works Association
IPCEA	Insulated Power Cable Engineers Association
IES	Illuminating Engineering Society of North America
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriter's Laboratories
HIS	Hydraulic Institute Standard
FM	Factory Mutual
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association

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 minor changes in the locations of the installation without additional cost to the DEPARTMENT.

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 DEPARTMENT 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 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.

(f) Seismic lateral and longitudinal bracing shall be provided at pipe hangers for pipes larger than 3 inches in diameter as shown on the plans. Seismic bracing is not required where the rod hangers are 12 inches or less in length. Hangers shall be at maximum of 7 feet spacing. The bracing and rod stiffener members shall be hot-dip galvanized. Acceptable systems of seismic restraint shall be Unistrut Seismic Bracing System, B-Line Seismic Restraints, Grinnell or VMC Seismic Restraints. Details not shown on the drawings shall be based on the acceptable seismic restraint systems using International Building Code 2000 parameters I_p=1.0, S_{DS}=0.53, Seismic Design Category D, and a minimum seismic design force of F_p = 0.16g.

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

1.10.16 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 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 DEPARTMENT.

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 DEPARTMENT

1.14.1 Certain data, as specified herein, shall be furnished to DEPARTMENT when installation and testing are complete, before final acceptance. Refer to O & M data submittal requirements under provisions of Section 1A.

1.14.2 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 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 Five 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 5 year maintenance schedule 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 Field Testing, Start-up and Final Acceptance

1.15.1 Field testing, start-up and final acceptance shall be in accordance with the requirements of Section 1A of Special Provisions and 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 will be paid as specified under each individual Section.

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:

Load Classification	Maximum Load per Bracket
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 embedded in concrete shall be galvanized steel. 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 will be paid as specified under each individual Section.

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 15F 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, product data and operation and maintenance data under provisions of Sections 1A and 15A.

1.3.2 Submit detailed drawings and data on pipe fittings, valves 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 Piping and appurtenances work will be paid as part of the contract lump sum price for PUMP STATION MECHANICAL WORK.

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

(a) 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 0f 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.

(d) Pipe shall be coated inside and outside with liquid epoxy primer Symbol B as specified in Section 9A and meeting the requirements of AWWA C210.

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 Copper Tubing and Joints

(a) Copper tubing for water service piping shall be Type K, ASTM B88. The fittings shall be wrought copper per ANSI/ASME B16.22 for inside piping. The joints shall be solder, Grade 95TA, ASTM B32 for inside piping. The fittings shall be cast bronze, ASME B16.26 and the joint shall be flared connection for outside piping.

2.1.6 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.

2.1.7 Quality Assurance

(a) Certified welders, having current certificates conforming to the requirements of the ANSI code shall perform all welding on steel pipelines.

2.1.8 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, 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 building, where finish painting 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) 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 Double Door Check Valves

2.2.1 General

(a) This item shall consist of the furnishing of all labor, equipment, tools, materials and the performance of all work necessary to make the double door check valve complete and operable in accordance with the plans, specifications, manufacturer's recommendations and as directed by the Engineer.

(b) The double door check valves shall be installed on the main pump 36” discharge piping.

(c) Double door check valves shall be of compact design, arranged for bolting between the flanges of mating piping and shall be of the threaded full flange type. Double door check valves shall be provided as shown on the Drawings and provided with a lifting hook.

(d) The double door check valve assembly shall be Series 9000 manufactured by the Valve and Primer Corporation, Val-Matic Valve and Manufacturing Corp. or equal. Each check valve manufacturer shall be required to submit evidence, on request, of similar sized check valve installations that have operated successfully.

(e) Supplier shall have at least ten (10) years experience in the manufacture of double door check valve, and shall provide references and a list of installations.

2.2.2 Design Requirement

(a) Double door check valves shall be spring-loaded and of the type held closed by the legs of one or more “heavy duty” torsion springs. Flow from the pump shall cause the doors to open and upon pump shut down, the heavy duty torsion springs shall shut the doors before reverse flow starts, for a non-slam closure. Seating shall be resilient and water tight. Sealing element shall be BUNA-N molded to the valve.

(b) Double door check valves shall be 125-150 lb. Class rating and the size shall be 36-inch diameter (Nominal)

2.2.3 Materials

(a) All material used in the construction of the valve shall be best suited for the application and shall conform to the following requirements:

Component Part	Material
Body	Carbon Steel ASTM A 216 Gr. WCB
Door	Carbon Steel ASTM A 216 Gr. WCB
Door Lug Bearing	Teflon/Phenolic
Spring (Heavy Duty)	Stainless Steel ASTM A313 T316
Hinge Pin	Stainless Steel ASTM A276 T316
Hinge Pin Retainer	Stainless Steel ASTM A276 T316
Stop Pin	Stainless Steel ASTM A276 T316

Lifting Eye Bolt	Steel
Sealing Element	BUNA-N

(b) The double door check valves shall be installed in accordance with the installation manual which shall be furnished by the valve manufacturer. Extreme care should be used in the handling, storage, and installation of this valve to prevent damage and to ensure proper performance.

2.3 Pipe Supports and Anchors

2.3.1 Pipe supports and anchors shall be furnished and installed as shown on the Drawings or as specified in Division 15B.

2.4 Sleeve-Type Couplings

2.4.1 Couplings shall be provided with rolled steel followers, steel sleeves, rubber compound gasket and high strength boltsand nuts.

2.4.2 Use gaskets that are not affected by the fluid service of the pipeline.

2.4.3 Couplings shall have a minimum pressure rating equal to the test pressure of the pipeline.

2.4.4 Middle rings shall be provided without a pipe stop, and at least 3/8-inch thick, 7 inches wide for 10-inch diameter pipe and 10 inches wide for 16-inch through 24-inch diameter pipe, with follower rings of the proper thickness.

2.4.5 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.

2.4.6 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.

2.5 Knife Gate Valves

2.5.1 Valve 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 150 psig cwp.

(b) Shut-off pressure rating shall be 150 psig cwp.

2.5.2 The valve body shall be tested at 1.5 times the rated pressure and the valve 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) Valve body material shall be cast 316 stainless steel.

(b) Gate shall be type 316 stainless steel.

2.5.3 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.

2.5.4 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. The manual actuator shall be standard handwheel actuator.

(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.

2.5.5 The valve 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.

2.5.6 The packing shall be a square braided PTFE impregnated synthetic fiber material.

2.5.7 The valve 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.

2.5.8 Both faces of gate shall have a surface finish of 16 microinch to insure ease of operation and seal performance.

2.5.9 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.

2.5.10 All non-stainless steel metal surfaces shall be painted with a zinc free primer

2.6 Rubber Flapper Swing Check Valve

2.6.1 Rubber Flapper Swing Check Valve shall consist of the following components:

(a) Cast Iron body
(b) Cast Iron body cover
(c) Precision molded steel reinforced solid Buna-N flapper with O-ring design seating edge.
(d) Backflow Device.

2.6.2 Flapper shall be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check valve shall have full pipe size flow area. Seating surface shall be on a 45 degree angle requiring the flapper to travel only 45 degrees from closed to full open position for minimum head loss.

2.6.3 Buna-N Flapper shall have a spring molded internally to permit the flapper to close against a slight head and prevent slamming.

2.6.4 Provide backflow device for allowing reverse flow through the check valve.

2.6.5 Valve shall be designed for 175 psi W.P. and shall be bubble tight for water.

2.7 Air/Vacuum Valves

2.7.1 Air/vacuum valves shall be design to exhaust small quantity of air from the pump column during pumping operations and to allow small quantity of air to enter the pump column during pump shutdown to prevent vacuum from developing.

2.7.2 The body and cover shall be constructed of cast iron. The float shall be constructed of stainless steel and designed to withstand a maximum pressure of 1000 psi. The valve seat shall Buna-N rubber.

2.7.3 Operating pressures shall be from 100 psi to 150 psi.

2.7.4 Inlet and outlet shall be standard pipe thread for 3” diameter and under and flange connection for 4” diameter and larger A mushroom cap shall be installed at the outlet.

2.7.5 Air/vacuum valves shall be manufactured by Valve and Primer Corp., Series 142 or approved equal.

2.7.6 Provide thread cap or blind flange for each air and vacuum valve installed.

2.8 Backflow Preventer

2.8.1 Backflow preventer shall be double check valve assembly and consist of a bronze body with bronze caps. The body shall be a "Y" pattern design incorporating two stainless steel spring loaded, center guided check assemblies. The assembly shall include threaded inlet and outlet, full port ball valve shut-off valves and four ball valve test cocks. All internal parts shall be of corrosion resistant materials. The assembly shall meet the requirements of AWWA C510-92.

2.8.2 Check valve shall be bronze body ASTM B 584-78 with corrosion resistant internal parts and stainless steel springs.

2.8.3 Backflow preventer shall be CLA-VAL Model DC6L or approved equal.

2.9 Yard Hydrant

2.9.1 Yard hydrant shall be compression type with valve and working parts of brass and positive automatic drain. Inlet shall be 1" with minimum 3' of ground cover. Outlet shall 1" brass hose nozzle.

2.9.2 Yard hydrant shall be Total Eclipse No.1 manufactured by Kupferl Foundry Company or approved equal.

2.10 Curb Stop Valve

2.10.1 Curb stop valve shall be constructed of 85-5-5-5 ASTM B62 brass with integral tee head and plug and have a minimum rated working pressure of 175 psi. End connection shall be copper flare. Valve shall be manufactured and tested in accordance with AWWA C800.

2.10.2 Curb stop valve shall be Mueller H-15201 or approved equal.

2.11 Valve Box

2.11.1 Furnish and install cast-iron valve box and cover for buried curb stop valve designed for operation with a valve wrench. Box shall be 2 ¼" shaft with cover marked "WATER".

2.11.2 Valve box shall be Tyler Corp., 6500 Series or approved equal.

2.12 Expansion Joints

2.12.1 Expansion joints shall be concentric reducer expansion joint type for connections to flushing water pump suction and discharge piping as shown on the drawing.

2.12.2 Expansion joints shall be constructed of rubber, fabric, metal reinforcing rings and steel retaining rings and are formed and cured in a heated compression mold using an exclusive high pressure press. The outer cover and interior tube shall be of an elastomer. The multiple plies of reinforcing fabric shall be reinforced with metal rings and molded in place during manufacture to provide a minimum working pressure rating of 200 psi at 70 degree F. Metal backing or retaining rings shall be bounded in place during molding for ease of installation.

2.12.3 End flange and retaining rings shall be Class 125 flanges drilled in accordance with ANSI B16.1.

2.13 Pressures Gauges

2.13.1 Provide four (4) 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 41/2" in diameter, with white faces and black graduations.

2.13.2 Gauges shall be liquid filled (Glycerline or silicone), such as Ashcroft 1279. Discharge gauge shall be 0 to 50 ft.

2.14 Ball Valve

2.14.1 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.

2.14.2 The ball and stem shall be stainless steel (ASTM A276 GR 316). End connections shall be threaded type.

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 1.10.13 of Section 15A for hangers and supports.

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 control low strength material fill as required by the Engineer. The concrete used to repair the structure shall be Class SI 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.

3.13 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 Schedule

3.14.1 Valve Schedule

Facility/Service	Valve Type	Size Inches	Joint Type	Actuator Type	Remarks
Main Pump Discharge	Double Door Check	36	F	NA	
Sump Pump Discharge	Flapper Swing Check	16	F	NA	
Sump Pump Discharge	Knife Gate	16	F	M	
Dewatering Pump Discharge	Flapper Swing Check	10	F	NA	
Flushing Water Pump Suction and Discharge	Knife Gate	4	F	M	
Main, Sump and Dewatering Pumps	Air/Vacuum	6, 3, 1	F or T	NA	

Note:

(1)Abbreviations used in the schedule are as follows:

Joints

F	Flanged
T	Threaded
NA	Not Applicable
M	Manual Actuator

3.14.2 Inside Piping Schedule

Service	Size (Inches)	Pipe Material(1)	Protective Coatings(3) Int.	Ext.	Joints(2)	Remarks
Main Pump Discharge	24, 36	St	P	P	F	
Sump Pump Discharge	16, 24	St	P	P	F	
Dewatering Pump Discharge	6,10	DI	P	P	F	
Flushing Water Piping	4	DI	P	P	F	
Water Line	1 ½, 3	C	--	--	S	

3.14.3 Outside Piping Schedule

Service	Size (Inches)	Pipe Material(1)	Protective Coatings(3) Int.	Ext.	Joints(2)	Remarks
Water Service	¾, 1 ½	C	--	--	Fl	

NOTES:
(1) St Steel
DI Ductile Iron
C Copper Tubing

(2) F Flanged
S Solder
F Flared

(3) P Shop Finish Painted

END OF THIS SECTION

DIVISION 15 – MECHANICAL

SECTION 15D – PUMPING EQUIPMENT

1. GENERAL:

1.1 Description

1.1.1 This section includes requirements for furnishing and installing submersible mixed flow tube pumps, submersible motor pumping unit and all appurtenances necessary for a complete installation.

1.1.2 Pumping units include main pumps, sump pump and dewatering pump as shown on the Drawings and specified.

1.1.3 The main pumps, sump pump and spare sump pump shall be submersible mixed flow tube 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 pumps, sump pump and spare sump 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 The dewatering pump shall be of the vertical, centrifugal, heavy duty, non-clog, close-coupled, submersible type, with bottom suction and side discharge, each driven by submersible electric motor mounted as an integral part of the pump. The pumping unit shall be designed to pump at the capacities specified. The pumping equipment guide rails or cable and base elbow shall be arranged for installation in the spaces shown without appreciable revision of the piping. The pumping units shall be designed for continuous and intermittent duty.

1.1.5 Unless otherwise indicated, all pumps of a specified type shall be identical, the product of the same manufacturer. Refer to Division 15A.

1.1.6 Complete spare sump pump assembly shall be stored at floor EL. 408.0 as indicated on the drawing.

1.1.7 Provide protective monitoring system as required to upgrade to the existing Main Pumps SWP-1, 3 & 5 in order to meet NEC Class I, Division 2 Classification.

1.2 Operating Conditions

1.2.1 The main pumps shall be capable of a draw down to a low water level of EL. 372.0 without cavitation occurring. The sump pump, and spare sump pump shall be capable of a draw down to a low water level of EL.369.50 without cavitation occurring. The dewatering pump shall be capable of a draw down to a low water level of EL. 366.0 without cavitation occurring. Manufacturer's certification of the preceding shall be provided as part of the submittal data.

1.2.2 The main pumps, sump pump, spare sump pump and the dewatering 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:

Requirements

Items	Main Pumps SWP-2,4 & 6	Sump Pump SSP-1 & Spare Sump Pump
Capacity at primary rating point (design point)	13,000 gpm	5,300 gpm
Total head at primary rating point (design point)	46 ft	50ft
Overall efficiency, wire to water, at rating point, minimum, percent	72	65
Capacity at secondary rating point, Minimum	15,000 gpm	7,000 gpm
Total head at secondary rating point, feet	30 ft	25ft
Overall efficiency, wire to water, at secondary head, minimum, percent	60	55
Diameter of sphere that will pass through pump, minimum	2-3/4 inch	2-3/4 inch
Pump discharge column inside diameter	34 inch	24 inch
Pump speed, maximum, rpm	880	1,185
Motor horsepower, minimum	200 hp	120 hp
Motor efficiency at full load, minimum, percent	90	88
Motor power factor at full load, minimum	0.75	0.80
Locked rotor kVa/hp, maximum, NEMA code letter	H	H

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. The NPSH required for any of the above design points shall not exceed 38 ft. of water for main pump and 36 ft. of water for sump pump, when referenced to the lowest point on the pump bellmouth.

1.2.3 The dewatering 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 to the following requirements:

Items	Requirements	
	Dewatering Pump DP 1	Dewatering Pump DP 2
Capacity at primary rating point (design point)	1,000 gpm	500 gpm
Total head at primary rating point (design point)	54 ft	48 ft
Overall efficiency, wire to water, at rating point, minimum, percent	60	50
Shutoff head: Maximum	90 ft	105 ft
Capacity at secondary rating point, Minimum	1,400 gpm	800 gpm
Total head at secondary rating point, feet	35 ft	38 ft
Overall efficiency, wire to water, at secondary head, minimum, percent	50	50
Diameter of sphere that will pass through pump, minimum	3 inch	3 inch
Pump discharge diameter, minimum	6 inch	4 inch
Pump speed, maximum, rpm	1,750	1,750
Motor horsepower, minimum	19 kW (25 hp)	11 kW (15 hp)
Motor efficiency at full load, minimum, percent	85	84
Motor power factor at full load, minimum	0.83	0.80
Locked rotor kVa/hp, maximum, NEMA code letter	H	H

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. The NPSH required for any of the above design points shall not exceed 35 ft. of water, when referenced to the lowest point on the pump bellmouth.

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.

1.2.5 Submersible units shall be capable of sustaining full reverse runaway speed Without damage.

1.2.6 Motors shall be capable of operating pumps at any point on the curve without overloading and without using the service factor.

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 5E - 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 Submit shop drawings, product data and O & M data, including the following, shall be provided as specified under provisions of Section 1A and 15A.

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) 5 year maintenance schedule

(m) 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 DEPARTMENT 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 2, 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 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 DEPARTMENT at all times and shall be delivered to DEPARTMENT upon completion of the work.

(b) Five bound copies of operating and maintenance instructions, diagrams, parts, lists, requirements, 5 year maintenance schedule and other information pertinent to the operation of the various systems and equipment shall be submitted to the Engineer for review in accordance with the requirements of Division 1A.

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 the specified rated head and capacity, the another point shall be the specified secondary rated point and the remaining points at capacities necessary to provide a uniform distribution of data. Capacity shall be expressed in gallons per minute and head shall be expressed in 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 DEPARTMENT to witness such testing. DEPARTMENT shall designate these individuals. The Contractor shall notify DEPARTMENT 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.

(g) The pump tests shall be performed in Illinois. However, if this can=t be done, the Contractor shall hire an approved witness and pay all necessary expenses.

(h) The Contractor shall provide a written certification that the equipment has been installed in accordance with the requirements under this Section.

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 Division1.

1.8 Spare Parts

1.8.1 The following spare parts shall be provided for two sets for main pump, one set for sump pump and two sets for dewatering pumps :

(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.

1.8.3 The Contractor shall not deliver spare parts to site until final inspection and that a typed list shall accompany the spare parts identifying the part with its part number.

1.9 Basis of Payment

1.9.1 The pumping equipment, except for the spare sump pump, will be paid as part of the contract lump sum price for PUMP STATION MECHANICAL WORK. The spare sump pump will be paid for at the Contract unit price for COMPLETE SPARE SUMP PUMP ASSEMBLY.

2. PRODUCTS:

2.1 Main Pump (SWP- 2, 4 & 6), Sump Pump (SSP-1) and Spare Sump Pump Specifics

2.1.1 Pump Construction

(a) 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 or 316 stainless steel. All external surfaces other than stainless steel, shall be protected by a two-component epoxy resin finish.

(b) The impeller shall be open design, bronze ASTM B584 C90300, 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.

(c) 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.

(d) 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.

(e) The pump shaft shall be of ASTM A276 Type 403 or 420 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.

(f) 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.

(g) 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 mount over a shaft protecting sleeve of ASTM A 276 Type 420

stainless steel 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

(a) 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 AF@ insulation capable of resisting temperatures to 155 degree C.

(b) 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.

(c) 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.

(d) 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.

2.1.3 Pump Discharge Piping and Mounting Tube

(a) A matching discharge and pump mounting tube shall be furnished by the pump supplier. The discharge piping and mounting tube shall be permanently installed in the wet well. The design shall be such that the pump units may be installed in the mounting tube 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 tube. No portion of the discharge tube shall bear directly on the floor of the sump. The tube shall be supported as shown on the Drawings.

(b) 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 tube. 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.

(c) The discharge piping and mounting tube 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 and mounting tube shall be coated inside and outside with liquid epoxy primer Symbol B as specified in Section 9A and meeting the requirements of AWWA C210. 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.

(d) 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.

(e) Provide pump proper tube support at pump room floor El. 408.0 and pump stabilizer plates at floor El. 393.67 and El. 380.0 similar to as shown on the drawings. The pump manufacturer shall provide final design of the tube support and stabilizer for Engineer's review.

(f) 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

(a) Each pumping unit shall be equipped with a monitoring system to protect critical machine functions during operation.

(b) Three thermoswitches, one per phase, shall be provided in the motor windings to protect against overheating by initiating an alarm on high temperature.

(c) A moisture sensor shall be provided to protect against damage from water contamination. The sensor shall be arranged to initiate the alarm upon sensing moisture in the oil chamber or prior to water reaching the motor windings.

(d) A bearing temperature sensor shall be provided in main bearing for bearing temperature protection and alarms.

(e) A monitoring device or 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.

(f) The aforementioned shall be furnished for Main Pumps SWP-1 through SWP-6.

2.1.5 Pump Lifting System

(a) 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.

(b) The cable lifting system shall consist of a turnbuckle, shackles, and carrier cable spaces. 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 stain relief for the power and control cables and to allow safe handling of the pumps as required during shipping, installation and maintenance. Provide stainless steel carrier lifting eyes at minimum of 4 feet spacing.

(c) Install a Smart Lift System or equal for each new pump from the bottom of the tube column by using the 3-ton bridge crane hook. The system shall consist of 316 Type stainless steel guide wire, a high tensile strength stainless steel chain sling and a forged stainless steel chain grip for use with the pump lifting crane hook.

(d) Install an additional Smart Lift System or equal to lift the existing sump pump SSP-2 and storm water main pumps SWP1, 3 & 5 from the bottom of the tube column by using the 3-ton bridge crane hook.

2.1.6 Power Cables

(a) The power cable shall be designed specifically for use with submersible pumps. The cable shall be sized according to the National Electrical Code (NEC).

(b) 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. The cable length shall be adequate to reach the junction box without the need for splices. No splices will be allowed.

2.1.7 Cable Entry

(a) The cable entry water seal design shall preclude specific torque requirements and ensure a watertight and submersible seal.

(b) 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.

2.1.8 Cable Junction Box

(a) The junction box 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 leak-proof.

(b) 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 Dewatering Pump Specifics

2.2.1 Design

(a) DP1 (1,000 gpm)

The pump shall be automatically and firmly connected to the discharge connection (permanent installation type), guided by no less than two short guide bars and a cable system extending from El. 370.0 plateform to the discharge connection as shown on the drawings. No portion of the pump/motor unit shall bear directly on the sump floor or on a sump floor mounted stand.

(b) DP2 (500 gpm)

The pump shall be of elevation stand portable installation type and firmly connected the elbow flange of discharge pipe as shown on the drawings.

(c) Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.

2.2.2 Cooling System

(a) Motors shall be cooled by the surrounding environment or pumped water.

2.2.3 Casing

(a) Pump casing shall be of the centerline discharge type.

(b) Pump casing shall be ASTM A48 cast iron, with smooth surfaces devoid of blow holes or other casting irregularities.

(c) Wear Rings shall be nitrile rubber coated steel wear rings.

2.2.4 Impellers

(a) Pump impellers shall be cast iron ASTM A48 and shall be statically and dynamically balanced, enclosed and non-clogging, designed with minimum clearances so as to preclude solids and stringy material from damaging the mechanical seal, on the back of the impeller.

(b) The impeller shall be secured to the shaft with a stainless steel key and lock nut in such a way that it cannot unscrew or become loosened due to rotation in either direction.

(c) Each pump shall be equipped with a stainless steel renewable impeller wear ring, Type 400 Series.

2.2.5 Oil Chamber

(a) The pumps shall be equipped with an oil chamber to function as a buffer between the pumped liquid in the casing and the motor. The oil chamber shall be arranged to accommodate thermal expansion of the oil and furnished with an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components. The oil chamber shall be ASTM A48 cast iron.

2.2.6 Mechanical Seal

(a) Pumps shall have a double or tandem mechanical seals. The upper seal unit, between the oil chamber and motor housing, shall have one stationary ceramic tungstein-carbide or silicon carbide ring and one positively driven rotating tungstein-carbide or silicon carbide seal ring. The lower seal unit, between the pump casing and oil chamber, shall have one stationary ring and one positively driven rotating ring. The rings shall be tungstein-carbide or silicon carbide. Metal parts shall be stainless steel. The spring element of the lower seal shall be protected from solids contained in the pumped liquid. Do not rely upon the pumped liquid for lubrication.

2.2.7 Motor

(a) Submersible pump motors shall be of 460-volt, 3-phase, 60-hertz squirrel cage induction type NEMA Design B suitable for operation in NEC Class I, Division 2, Group C and D hazardous areas as determined and approved by a U.S. nationally recognized testing agency (U.L, FM).

(b) Motors shall have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions. Nameplate horsepower rating shall not be exceeded under maximum load conditions for constant speed pumping units. The motors shall be for continuous load operation and shall be capable of sustaining continuous on-off cycling of ten starts per hour minimum without exceeding the 80 degree C temperature rise.

(c) The stator windings and stator leads shall have a minimum of NEMA Class F (155 degrees C) moisture resistant insulation. The stator coils shall be dipped and baked in Class F varnish and shall be heat-shrink fitted into the stator housing. Impregnation resin shall be applied to stator assembly in three dip and bake steps.

(d) Motors shall have an ASTM A48 cast iron stator housing. For motors that employ cooling water jackets, the water jacket passages shall preclude clogging by solids contained in the pumped liquid.

(e) The motor cables shall be multi-conductor flexible cables designed specifically for use with submersible pumps and shall be of stranded, tinned copper conductors with 600V ethylene-propylene insulation, cabled with non-hygroscopic vulcanized rubber fillers and binder tape, covered with water & oil resistant chloroprene rubber jacket, rated 90^{o} C in 40^{o} C ambient. Separate cables shall be provided for power and control. For application in Class I, Division 2 locations multiple power cables shall be used to limit conductor current to 160A at motor full load. The power and control cables shall have sufficient length to reach the termination boxes as shown on Plans without splices. Refer to Section 16B for the required plugs/receptacles.

(f) Motor cable entries shall have a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Do not use epoxy for this purpose. Cable entries shall have watertight seals. Cable entry leads shall be isolated from the internal motor leads to prevent entry of water into the motor chamber by leakage or wicking. One cable for power and one cable for controls shall be provided. Cables shall be suitable for submersible pump application and shall conform to NEC specifications for cable sizing.

(g) The motor shall be designed for operating under completely submerged or unsubmerged conditions without damage while pumping under load.

(h) The combined service factor (combined effect of voltage, frequency and specific gravity) shall not be less than 1.10.

(i) The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

(j) The rated motor horsepower shall not be less than the brake horse power of the pump throughout the entire pump performance curve from shut-off through run-out.

2.2.8 Shaft

(a) Shafts shall be one piece, fully machined pump and motor shafts. Maximum shaft deflection under maximum pumping load to shall be 0.002 inches at the lower mechanical seal face.

(b) Shafts shall be carbon steel or stainless steel material and adequately designed to meet the maximum torque required at any start-up condition or operating point in the system. Carbon steel shafts shall be protected from exposure to the pumped liquid by a stainless steel sleeve, carbon steel sleeve or chrome plating.

2.2.9 Bearings

(a) The pump shaft shall rotate on permanently lubricated bearings. One assembly shall carry only radial loads and be free to float axially within the frame. The other assembly shall carry both radial and axial loads and be restrained from axial movement.

(b) Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize deflection

(c) Bearings shall conform with ANSI B3.15 and B3.16, Load Ratings and Fatigue Life for Ball and Roller Bearings, and have 20,000 hour minimum L_{10} bearing life at the maximum pumping load that occurs under the specified operating conditions.

2.2.10 Protection Monitoring System

(a) Each pumping unit shall be equipped with a monitoring system to protect critical machine functions during operation.

(b) Three thermoswitches, one per phase, shall be provided in the motor windings to protect against overheating by initiating an alarm on high temperature.

(c) A moisture sensor shall be provided to protect against damage from water contamination. The sensor shall be arranged to initiate the alarm upon sensing moisture in the oil chamber or prior to water reaching the motor windings.

(d) A monitoring device or 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.

2.2.11 Guide Rail And Base Elbow

(a) Each pump shall have a base elbow and guide rail or cable system to permit installation and removal of the pump from its base elbow discharge connection without requiring personnel to enter the wet well.

(b) The guide rail or cable system shall include a bronze or stainless steel nonsparking guide bracket which is an integral part of the pump casing and permits sliding the pumping unit along two unthreaded stainless steel guide rails or cable. Guide system shall be Schedule 40 stainless steel pipe or cable connected to the base elbow at the bottom. Guide rails shall be supported at intermediate locations and at the top with stainless steel brackets bolted to the wall of the wet well or concrete slab. Each pump lifting eye shall be suitable for electric hoist hook.

(c) Each pump shall have a cast iron base elbow arranged for automatic pump connection. The pump casing shall have a machined discharge flange with a bronze or stainless steel nonsparking liner arranged to be nonsparking which, when the pump is lowered into the pumping position, will automatically align and mate with the plain-end of the base elbow. The discharge connection shall require no motion other than vertical to seat the mating flange of the casing to the base elbow. Sealing of the pump connection shall be accomplished by metal to metal watertight contact. The base elbow shall support the weight of the pumping unit and prevent it from bearing directly on the wet well floor.

(d) Anchor bolts, nuts, washers, and accessories and other adapter equipment necessary for mounting the pumping equipment and appurtenances shall be provided. Anchor bolts, nuts, washers, accessories and adaptor equipment shall be ANSI TYPE Series 304 stainless steel.

2.2.12 Power Cable Holder

(a) Contractor shall coordinate the installation of the cable holder with the aluminum hatch cover supplier.

(b) Provide all stainless steel cable support grip, cable pull line, snap hook and anchor as required or as shown on the drawing.

2.3 Operation and Control

2.3.1 Pump controls shall be provided in accordance with Division 16.

2.3.2 Pumps shall function in rising water and in falling water as shown on the drawings.

2.3.3 Float Level Detectors

(a) The float level detecting devices shall be located in the wet well as shown and as specified in Section 16C. One float shall be supplied for each control level.

2.4 Bolts, Studs and Nuts

2.4.1 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.

2.4.2 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.

2.4.3 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.

3) 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 M9

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 5E – 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 Air Moving 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 Duct Construction Standards - Metal and Flexible.

1.4 System Description

1.4.1 The existing Superstructure, Stairway, Intermediate Levels and Wet Well ventilation system with fans SF-4 and EF-1will operate as presently designed. No modifications to the SF-4 and EF-1 fans or to the existing associated ductwork, controls and wiring shall be made.

1.4.2 The Existing Motor Room ventilation system SF-2 will operate when the room temperature exceeds 90 deg F or when combustible gas monitor defects a gas concentration above the sensor set point or when the Motor Room is occupied.

1.4.3 The Existing Motor Control Room and the Existing Wet Well ventilation will be provided by supply fan SF-5, aluminum ductwork and associated dampers and controls. The ventilation system will operate when the combustible gas monitor defects a gas concentration above the sensor set point or when the area is occupied.

1.4.4 The Electrical Control Room ventilation will be provided by exhaust fan EF-2 and associated dampers and controls. The ventilation system will operate when the room temperature exceeds 85 deg F or when the Electrical Control Room is occupied.

1.4.5 The Generator Building ventilation will be provided by exhaust fan EF-3 and EF-4, associated dampers and controls. The ventilation system will operate when the room temperature exceeds 85 deg F or when the Generator Building is occupied.

1.4.6 When the diesel motor/ generator system is energized, the Generator Building motorized supply air damper will open.

1.4.7 All fan and damper motors associated with the existing Motor Room, the existing Motor Control Room and the existing Wet Well shall be rated for Class 1, Div. 2, Group D hazardous locations.

1.4.8 All fan and damper motors associated with the Electrical Control Room and the Generator Building shall be chemical duty rated.

1.5 Submittals

1.5.1 Submit shop drawings and product 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) 2 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.

1.10 Quality Assurance

1.10.1 Contractor shall provide a written certification that the equipment has been installed in accordance with the requirements under this Section.

2. PRODUCTS:

2.1 Duct Work

2.1.1 General

(a) Unless otherwise indicated all duct work shall be low pressure type.

(b) Unless otherwise indicated, all duct work not located in the Wet Well shall be aluminum duct as specified herein. Flexible duct may be used where vibration isolation, such as at fan connections, is required.

2.1.2 Aluminum Duct

(a) Aluminum duct shall conform to ANSI/ASTM Standard B209. The duct shall be non-combustible.

(b) Aluminum used in duct work shall be alloy 3003-H14. Aluminum connectors and bar stock shall be alloy 6061-T6.

2.1.3 Flexible Duct Connections

(a) Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, as indicated.

(b) 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 Duct Supports

Provide aluminum fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.1.5 Ductwork Fabrication and Assembly

(a) Fabricate shop or manufactured duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings.

(b) Except as otherwise indicated, fabricate elbows with centerline radius equal to 1.5 times associated duct 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 Duct Construction Standards.

2.1.6 Air Turning Devices

Multi-blade device with blades aligned in short dimension; aluminum construction with mounting straps.

2.1.7 Duct Access Doors

(a) Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

(b) Review locations prior to fabrication.

(c) Fabricate rigid and close-fitting doors of aluminum alloy 3003-H14. 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 24 x 48 inches.

(f) Access doors with sheet metal screw fasteners are not acceptable.

2.2 Dampers

2.2.1 General

Provide aluminum manual volume control dampers, gravity dampers and motorized dampers in locations shown on the Drawings.

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 to be in accordance with AMCA Standard 500.

(b) Construction

Dampers shall consist of 5" x 1" x 6063T5 extruded aluminum hat channel with .125" minimum wall thickness. Low profile, 5" x 1/2" top and bottom frames on dampers 12" high and less. Mounting flanges on both sides of frame; blades shall be 6063T5 heavy gage extruded aluminum, airfoil shape and completely symmetrical relative to

their axle point, presenting identical resistance to airflow in either direction or pressure on either side of the damper. Seals shall consist of neoprene blade edge seals and flexible metal compressible jamb seals.

(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. Damper motors in the Motor Room, the Motor Control Room and the Wet Well shall be rated for use in Class 1, Division 2 Group D areas.

Power for the motor shall be 120 VAC, single phase. Damper motors in the Electrical Control Room and Generator Building shall be rated NEMA 12.

2.3 Exhaust and Intake Louvers

2.3.1 General

Provide a fixed louver, with external bird screen and insect screen where 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 externally-mounted bird screen for exhaust louvers. The screen shall be constructed of .051" x 3/4" diamond pattern expanded aluminum.

2.3.4 Insect Screen

Provide an internally-mounted insect screen for intake louvers. The screen shall be constructed of .0123" diameter aluminum, 18 x 14 mesh giving a free area ratio of 60%.

2.4 Supply Grilles

2.4.1 Type

Modular supply grilles of the sizes indicated on the plans and outlet schedule. Grilles shall be double-deflection type with two sets of fully adjustable 1-1/4" deep, blades space 1-1/2" on center.

2.4.2 Frame

The outlets shall consist of multiple square double-deflection grilles mounted to an aluminum mounting frame with quick-release fasteners.

2.4.3 Fabrication

Blades and grille border shall be of heavy extruded aluminum construction with factory clear anodize finish. The front set of blades shall run parallel to the short dimension of the outlet.

2.4.4 Dampers

Dampers shall be integral, installed behind each grille and shall be of all-aluminum construction. Damper shall be lever-operated from face, opposed-blade type.

2.5 Centrifugal Fans - Belt Drive (SF-5)

2.5.1 General

(a) Fans used shall not decrease motor size, increase noise or increase tip speed more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.

(b) Base performance on sea level conditions.

(c) Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

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 Wheel and Inlet

The fan wheel shall be centrifugal backward inclined, constructed of aluminum.

2.5.6 Housing

The fan housing shall be constructed of heavy gauge galvanized steel and shall include square duct mounting flanges. Housing shall be field rotatable to any of eight 45 degree incremental air discharge positions. Housing construction shall include one removable access panel located perpendicular to the fan. The access panel must be of sufficient size to permit easy access to all interior components.

2.5.7 Finish

Provide factory finish before assembly with baked phenolic.

2.5.8 Motors

2-speed 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

Precision ground and polished shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.

2.5.10 Drive and Pulleys

Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.

2.5.11 Belt Guard

Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible; of 12 gage, 3/4 inch diamond mesh wire screen welded to steel 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 and individual serial number for future identification.

2.5.13 Inlet Guard

Provide 1/2"x1/2" galvanized welded steel wire on a galvanized frame.

2.5.14 Vibration Isolation

Fans shall be isolated from the building structure by means of neoprene vibration isolators.

2.6 Sidewall Centrifugal Fans – Direct Drive (EF-2)

2.6.1 General

(a) Fans used shall not decrease motor size, increase noise or increase tip speed more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.

(b) Base performance on sea level conditions.

(c) Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

2.6.2 Performance Ratings

Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

2.6.3 Sound Ratings

Conform to AMCA 301, tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

2.6.4 Fabrication

Conform to AMCA 99.

2.6.5 Wheel and Inlet

The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances.

2.6.6 Housing

The fan housing shall be of the round design constructed of heavy gauge aluminum and shall include round duct mounting collars. Housing construction shall include remote accessible fan lubrication piping and drain.

2.6.7 Finish

Factory finish before assembly.

2.6.8 Motors

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.

2.6.9 Shafts and Bearings

Precision ground and polished shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.

2.6.10 Drive

Motor shall be securely attached to the fan shaft.

2.6.11 Disconnect Switch

Fan mounted UL safety disconnect switch complete with internal wiring between motor to switch shall be provided.

2.6.12 Identification

Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.6.13 Vibration Isolation

Fans shall be isolated from the building structure by means of neoprene vibration isolators.

2.6 Roof Centrifugal Fans - Direct Drive (EF-3 and EF-4)

2.6.1 General

(a) Fans used shall not decrease motor size, increase noise or increase tip speed more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent.

(b) Base performance on sea level conditions.

(c) Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.

2.6.2 Performance Ratings

Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

2.6.3 Sound Ratings

Conform to AMCA 301, tested to AMCA 300 and bear the AMCA Certified Sound Rating Seal.

2.6.4 Fabrication

Conform to AMCA 99.

2.6.5 Wheel and Inlet

The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances.

2.6.6 Housing

The fan housing shall be of the round design constructed of heavy gauge aluminum and shall include square duct mounting collars. Housing construction shall include remote accessible fan lubrication piping and drain.

2.6.7 Finish

Factory finish before assembly.

2.6.8 Motors

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.

2.6.9 Shafts and Bearings

Precision ground and polished shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.

2.6.10 Drive

Motor shall be securely attached to the fan shaft.

2.6.11 Disconnect Switch

Fan mounted UL safety disconnect switch complete with internal wiring between motor to switch shall be provided.

2.6.12 Identification

Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.6.13 Vibration Isolation

Fans shall be isolated from the building structure by means of neoprene vibration isolators.

2.7 Propeller Fans (SF-2)

2.7.1 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.

2.7.2 Fabrication

(a) All propeller fans shall conform to AMCA 99.

(b) Statically and dynamically balance fans to eliminate vibration or noise in occupied areas.

(c) Each supply fan shall be enclosed in a weatherproof wall housing with motorized damper.

2.7.3 Performance

Fans used shall not decrease motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Fans shall be capable of accommodating static pressure variations of plus or minus 10 percent. Base performance on sea level conditions.

2.7.4 Impeller

Die cast aluminum alloy, fabricated aluminum or fabricated steel with heavy hubs, statically and dynamically balanced, keyed and locked to shaft by standard square key and set screw, directly connected to motor.

2.7.5 Motor

Self-aligning pre-lubricated ball or sleeve bearings affixed to mounting plate, neoprene vibration isolation between fan assembly and mounting plate. Motor shall operate from 120 VAC, single-phase power. Motor shall be rated for a Class 1, Division 1 Group D area.

2.7.6 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 prepunched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be bolted construction or welded construction.

2.7.7 Wall Collar Assembly

(a) Wall collar shall be constructed of galvanized steel with heavy gauge mounting flanges and prepunched mounting holes. The drive side shall be protected by welded steel wire guards, coated with a thermal setting polyester urethane.

(b) The wall collar shall be suitable for outdoor environments and provide the fan, motor and damper complete protection from the elements.

2.8 Fan Exhaust Dampers Mounted in Wall Collars and Roof Curbs

2.8.1 General

Provide gravity dampers, size and location as shown on plans and in schedule. Dampers may be fan manufacturer=s standard models.

2.8.2 Fabrication

18 gage aluminum frame with 3 2 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.

3. EXECUTION

3.1 Demolition

3.1.1 Existing Motor Room

The existing Motor Room ventilation system demolition consists of removal of existing roof ventilators RV-1 and RV-2, of testing and removal of supply fans SF-1 and SF-3 and of associated motorized dampers, louvers, thermostats, combustible gas monitors, conduits and wiring from the ventilation system. Existing RV-1 and RV-2 roof openings and SF-1 and SF-3 wall openings will be sealed as directed. Supply fan SF-2 will be tested and if found in good working order, stored in a clean, dry and protected place for re-installation with motorized

aluminum dampers. A fan, in good working order, meeting the scheduled requirements, will be provided in lieu of SF-2, if existing SF-2 fails to operate when reinstalled.

3.1.2 Existing Motor Control Room

The existing Motor Control Room ventilation system demolition consists of removal of existing automatic shutters and louvers. Existing stairs wall openings shall be sealed as directed.

Provide wall and floor openings in the locations shown and of the sizes indicated on the drawings.

3.2 Ductwork

3.2.1 Low pressure duct work shall be fabricated and supported in accordance with SMACNA Duct Construction Standards - Metal and Flexible and ASHRAE handbooks. The duct gages, reinforcing and sealing shall be suitable for the operating pressures of the system.

3.2.2 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.

3.2.3 During construction, temporary closures of metal or taped polyethylene shall be provided on open duct 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.

3.2.4 Increase duct 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.

3.2.5 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular duct elbows are used, provide turning vanes.

3.2.6 The installation shall conform to the requirements of NFPA 90A and 90B, as applicable.

3.2.7 Provide ductwork with inside dimensions equal to sizes indicated on Drawings.

3.2.8 Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with ties, braces, hangers and anchors of type holding ducts true-to-shape and preventing buckling.

3.2.9 After installation, seal ductwork to seal class recommended and method prescribed in SMACNA - HVAC Duct Construction Standards.

3.2.10 Complete fabrication at Project necessary to match shop-fabricated Work and accommodate installation requirements.

3.2.11 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 ducts close to walls, overhead construction, columns and other structural and permanent enclosure elements of building.

3.2.12 Coordinate duct installations with installation of accessories, dampers, equipment, controls, and other associated Work of ductwork system.

3.2.13 Support ductwork to comply with SMACNA - HVAC Duct Construction Standards, hangers and support section.

3.2.14 Where dissimilar metal ducts meet, provide positive electrical isolation using insulating materials, sealants and fasteners.

3.2.15 Clean ductwork internally of dust and debris as it is installed. Clean external surfaces of foreign substances causing corrosive deterioration of metal.

3.2.16 Strip protective paper from stainless ductwork surfaces, and repair finish wherever damaged.

3.2.17 Unless otherwise indicated, ducts shall be attached using rivets, bolts or sheet metal screws compatible with the duct material, i.e. aluminum screws for aluminum duct.

3.2.18 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.

3.2.19 Contractor shall verify the location of all duct runs and wall, floor and ceiling penetrations.

3.2.20 Ductwork shall be painted in accordance with Section 9A.

3.3 Fans

3.3.1 Do not operate fans for any purpose until ductwork is clean, bearings lubricated, and fan has been test run under observation.

3.3.2 Install fans as indicated, with resilient mountings and flexible electrical leads.

3.3.3 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.

3.3.4 Each fan shall be provided with the controls as indicated on the electrical drawings. Refer to Division 16.

3.3.5 Fans located in Existing Motor Room, the Existing Motor Control Room and other areas which are indicated on the electrical drawings as hazardous areas shall be explosion proof in accordance with the NEC and AMCA requirements for use in the Class I, Division 2 locations as defined by the NEC.

3.3.6 Fans located in Electrical Room, the Generator Building and other areas which are indicated on the electrical drawings as non-hazard areas as defined by the NEC shall be rated for chemical duty in accordance with the NEC and AMCA requirements.

3.3.7 Support fans in accordance with manufacturer=s instructions. As part of submittals, include drawings showing fan support design and construction materials.

3.4 Fan Schedule:

3.5

	EF 2	SF 2*,**	EF 3***	EF 4***	SF 5*
Fan Type	Sidewall Centrifugal	Sidewall Propeller	Roofl mt'd Centrifugal	Roof mt'd Centrifugal	Utility centrifugal
Size	16@	20@	13@	13@	22@
Capacity CFM	1800	4700	1800	502	6900/8000
SP in w.g.	.5	.5	.75	.375	1.2/1.5
Drive	Direct	Direct	Direct	Direct	Belt
Voltage	460	460	460	460	460
RPM	1750	1750	1725	1725	1750
Motor hp (kW)	1/2 (0.375)	1.5 (1.2)	1/2 (0.375)	1/2 (0.375)	5 (3.75)
Accessories	Wall collar, motor side guard.	Wall collar, motor side guard.	Roof curb	Roof curb	2-speed, Galvanized Inlet guard, motor and belt guard.

* Indicates fan required to replace existing SF-2 if necessary.
** Indicates explosion proof equipment required.
*** Indicates American Petroleum Institute Approved equipment required.

3.5 Damper Schedule:

	DM 1,2 &3*	DM 4*	DM 5A & 5B	DM 6A & 6B	DM 7A 7B **	EF 2	EF 3	EF 4	Gen Room	SF-5
Size	3@ 26.5@x 26.5" EA	14@x 6@	2 @ 30@x 30@ EA.	6 @ 40@x 60@ EA.	2 @ 20@x 40@ EA.	16"x16@	16"x16@	11.25"x 11.25@	4 @ 48" X 52" EA.	18"x12@
Actuator	Electric Motor	Electric Motor	Electric Motor	Electric Motor	Electric Motor	-	-	-	-	-
Voltage	120	120	120	120	120	-	-	-	-	-
ι	1	1	1	1	1	-	-	-	-	-
Configuration	Supply	Supply	Supply	Supply	Supply	Exhaust	Exhaust	Exhaust	Exhaust	Exhaust
Notes	motorized dampers/ louver	motorized damper/ louver	motorized damper/ louver	motorized damper/ louver	motorized dampers/ louver	gravity damper/ louver	gravity damper/ louver	gravity damper/ louver	gravity damper/ louver	gravity damper/ louver

*Indicates explosion proof equipment required.
**Indicates American Petroleum Institute Approved equipment required.

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) Submersible Mixers
(d) Flushing Water Pump
(e) 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 16D - Supervisory Control and Data Acquisition (SCADA) Equipment

1.3 Submittals

1.3.1 Submit shop drawings, product data and O & M 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 Quality Assurance

1.6.1 Provide a written certification that the equipment has been installed in accordance with the requirements under this Section.

1.7 Basis of Payment

1.7.1 Payment: The work specified under this Section and as required shall be included for payment in the Contract lump sum price for 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 and sump pump whether or not shown on the Drawings. Mesh cable grips shall be stainless steel.

2.2 Stilling Well

2.2.1 Furnish and install 2 back up float system stilling wells. The stilling wells shall be provided as indicated on the Drawings and as specified herein. Stilling wells 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 approximately 60% vinyl ester and a minimum of 40% glass material with 304 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.

2.2.4 The stilling well enclosure shall be fabricated and shop assembled in two sections so only the two sections will need to be bolted together and anchored to the concrete during site installation.

2.3 Submersible Mixers

2.3.1 General

(a) Furnish and install four submersible mixers. Each mixer shall be equipped with a 4 HP submersible electric motor connected for operation on 460 Volts, 3 Phase, 60 Hertz, service.

(b) All cables shall be oil resistant chloroprene rubber jacketed.

(c) The mixing equipment specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for said equipment.

(d) Mixer shall be design meeting all NEC requirements for Class I, Division 2, Group D hazardous location.

2.3.2 Mixer Design

(a) The mixers shall be capable of handling re-suspension of highway storm water silt sediment. The mixers shall be easily removed for inspection or service.

(b) A sliding guide bracket shall be an integral part of the mixer unit. The entire weight of the mixer unit shall be guided by a single bracket which must be able to handle all thrust created by the mixer.

(c) The standard mixer with thrust ring, its appurtenances and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 57'.

2.3.3 Mixer Construction

(a) Each mixer shall be of the integral design, close coupled, and submersible type.

(b) All components of the mixer, including motor shall be capable of continuous underwater operation.

(c) Major mixer components shall be of 304 or 316 stainless steel construction. The oil housing cover plate shall be of corrosion resistant composite. All exposed nuts and bolts shall be of stainless steel. The motor housing exterior shall be made of 304 stainless steel.

2.3.4 Motor

(a) The multi-pole motor shall be directly connected to the propeller (gearbox deigns are not acceptable) to produce a propeller speed of 880 RPM maximum.

(b) The mixer motor shall be squirrel cage, induction, shell type design, housed in an air filled watertight chamber. The stator winding shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155EC (311EF). The stator shall be dipped and baked three times in Class F varnish.

(c) The motor shall be designed for continuous duty, capable of sustaining a maximum of at last ten (10) evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum.

(d) The motor cables shall be multi-conductor flexible cables designed specially for use with submersible equipment. Motor cables shall be sized in accordance with NEC requirements. Separate cables shall be provided for power and control. For application in Class I, Division 2 locations. The power and control cables shall have sufficient length to reach the termination boxes as shown on Plans without splices.

(e) Each mixer shall be equipped with a temperature and moisture monitoring system to protect critical machine functions during operation. Three thermo-switches, one per phase, shall be provided to protect against overheating by initiating an alarm on high temperature.

(f) A moisture sensor shall be provided to protect against damage from water contamination. The sensor shall be arranged to initiate the alarm upon sensing moisture in the oil chamber or motor housing prior to water reaching the motor windings.

(g) A monitoring device or 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.

2.3.5 Elastomers

(a) All mating surfaces where watertight sealing is required shall be machined and fitted with a double set of nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of the O-rings without requiring a specific torque limit.

(b) No secondary sealing compounds, rectangle gaskets, elliptical O-rings, grease or other devices shall be used.

2.3.6 Propeller

(a) The propeller shall be of 304 or 316 stainless steel dynamically balanced, non-clogging backward curved design. Each blade shall be laser cut and welded to the hub to ensure that the propeller is properly balanced. The propeller shall be capable of handling solids, fibrous materials, silt sediment and other matter found in normal highway storm water applications.

(b) The propeller shall have three (3) vanes, 14.5 inch diameter minimum, with a blade angle of 11 degree. The minimum pumping capacity shall be 5,000 gpm.

2.3.7 Cable Entry

(a) The cable entry housing shall be an integral part of the back plate. The cable entry shall have a double set of elastomer grommets in order to ensure a redundant system in the event of a cable entry failure. Single sealing systems will not be deemed acceptable.

(b) The cable entry shall be comprised of two cylindrical elastomer grommets, each flanked by washers and a ferrule designed with close tolerance fit against the cable outside diameter and the entry

inside diameter. This will provide a leak proof seal at the cable entrance without the need for specific torque requirements. The assembly shall bear against a shoulder in the stator casing opening and be compressed by a gland nut threaded casing opening and be compressed by a gland nut threaded into it. Interaction between the gland nut and the ferrule shall move the grommet along the cable axially instead of with a rotary motion.

(c) The junction chamber and motor compartment shall be separated by a terminal board which shall protect the motor interior from foreign material gaining access into the mixer top. Connection shall be made between the threaded compressed type binder post thus securely affixing the cable wires to the terminal board. The use of the terminal compressed type post and a terminal board O-ring shall render the motor compartment leak proof from any liquid which may enter the terminal compartment.

(d) Epoxies, silicones, or other secondary sealing systems shall also be considered acceptable.

2.3.8 Bearings

(a) All bearings shall have a minimum B-10 rated life of 100,000 hours and shall have inner and outer races of metal construction. Bearings with races made of nonmetallic construction will not be deemed acceptable

(b) The motor shaft shall be supported by two bearings sets sized to provide a B10 of 100,000 hours at all anticipated axial and radial loadings. The propeller side bearing shall be fixed to absorb the axial loads. Shaft bearings shall be sealed /shielded permanently lubricated.

(c) Mixers without pre-loaded bearings will not be considered acceptable.

2.3.9 Thermal Sensors

(a) Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches embedded in the end coils of the stator winding. These shall be used in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.

2.3.10 Oil Housing

(a) The oil housing shall contain two totally independent mechanical seals each with its own independent single spring system. An oil filled chamber shall separate the seals and provide lubrication.

2.3.11 Mechanical Seals

(a) Each mixer shall be provided with two sets of lapped end face type mechanical seals running in oil reservoirs for cooling and lubrication. The mechanical seals shall contain positively driven rotary tungsten or silicon carbide face rings for stainless steel mixers.

(b) In order to avoid seal failure due to sticking, clogging, and misalignment from elements contained in the mixed media, only the seal faces of the outer seal assembly and its retaining clips shall be exposed to the mixed media. All other components shall be contained in the oil housing. Single mechanical seals or rotary lip seals shall not be considered adequate for this critical sealing area.

(c) The seals shall require neither maintenance nor adjustment, but shall be easy to check and replace. Shaft seals without positively driven rotating members shall not be considered acceptable.

2.3.12 Mixer Mount Assembly

(a) A stainless steel safe-slide, mixer mount assembly kit shall be supplied by the mixer manufacturer and used to mount the mixer during operation and to guide the unit during installation and removal from service. The assembly shall consist of an upper and lower mounting supports and made of 304 stainless steel.

(b) The mixer mount assembly shall include a stainless steel single mast system and it shall securely interface with the mixer manufacturer's upper and lower mounting supports and integrate in such a way to securely support the mixer during operation. All support bracket assemblies shall be supplied by the mixer manufacturer in order to ensure the integrity of the system under operational loads.

(c) The assembly shall also be provided with cable holders to secure the mixer electric power cable. Their purpose shall be to prevent the electric cable from becoming entangled in the mixer propeller during operation. In addition, the mast shall be constructed with a positioning locking plate which will work to positively lock the mast in place at various operating angles.

(d) The assembly shall also be constructed as a safe-slide system suitable for non-sparking type installations.

(e) The mixer must have the capability of redirecting 120E in a horizontal plane. The above can be accomplished without draining the wet well.

(f) Provide a lifting handler on mixer.

2.4 Flushing Water Pump

2.4.1 General

(a) Furnish and install a flushing water pump unit. The pumping unit shall be designed in accordance with type, capacity, head condition and characteristics as noted in each subsection. The pumping unit consists of a pump and a driving motor and all necessary accessories required and specified for satisfactory operation.

(b) The pump shall be designed for continuous operation without cavitation, excessive vibration or noise within the specified pumping range, and shall withstand, without damage, any thrust forces that may develop during pump operation under intended service.

(c) The pump shall be capable of delivering rated capacity, at rated head and speed and operating satisfactorily within the specified pumping range. Pump shall have a minimum 65 percent efficiency at rated conditions

2.4.2 Operating Conditions

(a) The pumping unit shall operate with any single unit in service. The unit shall take suction from a 4" suction header connected to a concrete storage tank whose maximum water elevation is 401.17 feet and whose low water elevation is 396.17 feet. The pump will be installed on the existing concrete pad above floor elevation 393.67 feet, with suction header of centerline elevation 394.8+ and discharge header of centerline elevation 394.8+ as shown on the Plans.

(b) It is an essential requirement that the pump shall have the specified minimum diameter of suction and discharge nozzles.

(c) The new pumping unit shall be designed for capability to produce 225 gpm flow rate at 90 foot head.

2.4.3 Pump Specifics

(a) Casing

1) ASTM A48, Class 30 or better.

2) Suction and discharge flanges integrally cast drilled to ANSI Standard Class 125.

3) Designed to permit inspection of rotating element without disturbing pipe connections or pump alignment.

4) Casing halves flanged, bolted and dowel aligned provide lifting lugs and anchor legs.

5) Interior smooth and free from defects.

6) Drilled and tapped for priming and relief drains, stuffing box drains, suction and discharge gauges and as recommended by the manufacturer.

(b) Shaft

1) Solid forged machinery steel (SAE 1045, ANSI 4140, or ASTM A108 GR1141) finished turned.

2) Key way for impellers.

3) Threaded for shaft nuts.

4) Protected by renewable bronze keyed sleeves from the hub through the stuffing boxes.

5) Sealed for zero leakage.

(c) Impeller

1) Impeller shall be of the double suction, enclosed type, made entirely of bronze(ASTM B584-875), finished smooth all over and of ample strength and stiffness for maintaining the maximum capacity of the unit. It shall be statically and dynamically balanced and shall be keyed to the shaft and securely held in axial position between two shaft sleeves extended through the stuffing box with locking nuts. Direction of rotation shall be as required by piping and pumping units installation shown on the Plans.

(d) Wearing Rings

1) At the running joint between the suction and discharge chambers, there shall be provided renewable wearing rings on both the casing and impeller. The casing ring shall be bronze (ASTM B584-932), and positioned in the casing by tongue and groove fit and locked against rotation by the upper half of the case. Impeller ring shall be of dissimilar bronze (ASTM B584-932).

(e) Bearings

1) The bearing arrangement shall be selected to suit the pump speed and rating for this application. All bearings provided shall have a minimum B-10 life equivalent to AFBMA L-10 life of not less than 100,000 hours and shall be grease lubricated.

2) Bearing shall be anti-friction type and shall be ball-type or roller-type with self-contained grease lubricating system having a large grease well. Means shall be provided for cleaning out old grease when regreasing. Manufacturer shall initially lubricate bearings with Lubrike L-206 or approved equal lithium soap base grease (N.G.L.I. #2).

3) Bearing shells shall be rigidly supported by suitable brackets, cast with pump casing or separately cast. Where bearing brackets are separately cast, they shall be rabbet flanged, bolted and doweled to casing and bored with the casing, as a unit.

4) Each bearing shall be equipped with a resistance temperature detector properly mounted to sense the actual bearing temperature. Bearing temperature sensor shall be 3-wire 100 ohms, Platinum RTD with TCR of 0.003926, complete with waterproof head assemblies.

(f) Coupling

1) A flexible coupling shall be provided between the pump and the electric motor. A coupling guard shall be furnished over the coupling for protection.

2) The coupling shall be capable of transmitting approximately 200% of pump horsepower requirements. The angular velocity shall be 1800 rpm.

3) The coupling shall be Martin Quadra-flex or approved equal.

(g) Mechanical Seals

1) Mechanical seals shall be mounted on a corrosion-resistant shaft sleeve, and located with respect to the casing so that seal lubrication liquid is directed immediately over the seal. The mechanical seal shall be of single, inside, unbalanced type, designed for the pumping pressure range and there shall be no leakage at anytime. The seal material shall be Viton Ni-resist O-ring type. Flushing water (seal water) with regulating valves shall be piped to the pump case. Flushing water outlet shall be piped to drain. Seals shall be John Crane Type 8 or approved equal.

(h) Pump Base

1) Provide a suitable common base of fabricated ASTM A 36 steel. The base shall be provided with a coupling guard, and ample grout holes.

(i) Nameplate

1) Nameplate and other plate shall be of stainless steel, suitably secured to the pump.

(j) Bolts, Studs and Nuts

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) 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.

3) Steel anchor bolts, flange bolts, studs and nuts shall be in conformity with the current ASTM Designation: A307 "Low-Carbon Steel Externally and Internally Threaded Standard Fasteners", Grade B or approved equal.

(k) Accessory Equipment

1) Furnish all necessary bolts with nuts for pump settings and motor mounting bases, including base plates.

2) Furnish one (1) full set of standard and special wrenches to fit all nuts and bolts, and provide all other necessary tools required for ordinary maintenance and inspection of pump and motor. Tools shall be forged steel, case hardened, full finished, and furnished with a metal tool case with a handle and provision for padlocking.

3) Provide one (1) 1/2% accuracy pressure gauges with stainless steel movements with Bourbon tube and socket type as per manufacturer's recommendations for service and pressure. All gauges, unless otherwise specified, shall have dials not less than 6" in diameter, with white faces and black graduations.

4) Pump gauges shall be liquid filled (Glycerine or silicone), such as, Ashcroft 1279. Discharge pressure gauges shall be 0 to 50 psi.

5) All rotating parts such as exposed portions of shafts, couplings, belts, etc., shall be protected with guards of an approved design made of galvanized steel not less than 1/8" in thickness.

6) Spare parts - Furnish the following spare parts:

One set of bearings
One set of shaft sleeves
One mechanical seal
One set of gaskets

2.4.4 Characteristic Curves

(a) Manufacturer shall furnish curves showing the principal characteristics of the pump he proposes to furnish. Curves shall show the relation between delivery and head from no delivery to maximum delivery of pump. The curves shall also show the relation between efficiency and delivery and the horsepower shaft input of the pump. Also furnish overall efficiency curve for the unit.

(b) 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.

2.4.5 Shop Painting

(a) All casting and parts shall be inspected and approved before painting.

(b) All unfinished surface shall be trimmed, thoroughly cleaned, and given a coat of first class iron filler, which shall be rubbed down after drying. The filled and rubbed surfaces shall then be given a coat of sealer which will harden and which will not permit oil to damage the filler.

(c) The entire pumping unit and accessories, which are normally painted, shall receive two coats of rust inhibitive primer. The primer shall be compatible with the top coats to be used. Two coats of high grade paint, 5 dry mil per coat, as recommended by the equipment manufacturers shall be applied for proper protection and to give the equipment a neat finished appearance. The color shall be selected by the DEPARTMENT.

2.4.6 Factory Testing

(a) Pumping unit shall undergo a certified hydrostatic test at 150% of the pressure developed at shut-off head.

(b) All tests shall be performed in accordance with the Hydraulic Institute Test Standards for Centrifugal Pumps.

(c) Submit three (3) copies of certified factory test reports to the DEPARTMENT for review.

2.4.7 Pump Motor

(a) Pump motor shall be three phase power squirrel cage motor.

(b) Starting Torque: Between 1 and 1-1/2 times full load torque.

(c) Locked Rotor KVA per Horsepower: No more than 6.29 for 10 HP motor.

(d) Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

(e) Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

(f) Insulation System: NEMA Class B or better.

(g) Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

(h) Motor Frames: NEMA Standard T-Frames or custom frame of steel, or cast iron with end brackets of cast iron. Aluminum frame is not acceptable.

(i) Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid STATE control relay for wiring into motor starter.

(j) Bearings: Grease lubricated anti-friction ball or roller bearings with housings equipped with plugged provision for re-lubrication, rated for minimum AFBMA 9, L-10 life of 100,000 hours. Thrust bearings shall be provided for vertical motors. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

(k) Sound Power Levels: To NEMA MG 1.

(l) Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

(m) Nominal Efficiency: Shall meet CEE(Consortium for Energy Efficiency) Premium Efficiency Criteria. when tested in accordance with IEEE 112.

(n) Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

(o) RPM: No more than 1800 unless otherwise specified in the equipment specification.

(p) Motor Space Heater: Shall be provided if it is indicated on the motor control schematic.

PART 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.

3.4 Installation of stilling wells

3.4.1 General

(a) Stilling wells shall be installed in accordance with contract drawings and approved shop drawings.

(b) Each stilling well assembly shall be expansion anchored to wet well floor at each of the four legs and laterally supported by closure collars securely bolted to the stilling well frame and expansion anchored to floor concrete at El.380.0.

(c) Non-shrink grout shall be installed under the legs as required for leveling the stilling well to final height.

(d) Equipment within stilling well shall be installed in accordance with manufacturer's recommendations and approved shop drawings.

3.5 Installation of submersible mixers

3.5.1 General

(a) Submersible mixers shall be installed in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.5.2 Mixer Tests

(a) The mixer manufacturer shall perform the following inspections and tests on each mixer before shipment from the factory.

1) Propeller, motor rating, and electrical connections shall first be checked for compliance to the purchase order.

2) A motor and cable insulation test for moisture content or insulation defects shall be made.

3) Prior to shipment the mixer shall be run dry to establish correct rotation and mechanical integrity.

(b) A written report stating that the forgoing steps have been done shall be supplied with each mixer at the time of shipment.

3.6 Installation of Flushing Water Pump

3.6.1 General

(a) Installation of the pumping equipment shall be in complete accordance with the manufacturer's instructions and recommendations, and the reviewed shop drawings.

(b) Anchor bolts shall be installed in the pump foundation using a bolt layout template supplied by the pump manufacturer. Neatly installed ½-inch hard copper pipe shall be provided on each pump to convey leakage to the nearest drainage inlet.

(c) Installation shall include furnishing and applying an initial supply of all lubricants recommended by the pump manufacturer.

3.6.2 Acceptance Tests

(a) Factory Tests:

1) Material and equipment shall be subject to inspection and tests at the place of manufacture and after installation. Final acceptance shall be based on field tests. The Testing Code of the Latest Standards of the Hydraulic Institute shall be followed in making the hydraulic tests.

2) Submit three (3) copies of certified factory test reports to the Engineer for review.

3) Pumps shall not be shipped until the Engineer has reviewed the test reports and authorizes shipment.

4) If the pumps do not meet the design condition and other requirements of these specifications, the manufacturer shall modify or replace the pump units with new units. The testing procedure shall be repeated until the units are approved by the Engineer.

(b) Field Tests:

1) The Contractor shall make field tests to determine compliance with the Specifications within time of completion.

2) Submit three (3) copies of certified field test reports to the Engineer for review.

3.7 Start-up Services

3.7.1 General

(a) DEPARTMENT shall be notified at least two (2) weeks before start-up services are required.

(b) The equipment manufacturer shall provide the services of a field service representative for a total of two (2) trips for a total of not more than two (2) working days for the purpose of instruction and assisting the Contractor and the DEPARTMENT personnel in the start-up and proper operation of the equipment.

(c) Operating and maintenance instructions for the equipment shall be furnished to the Contractor by the equipment manufacturer.

END OF 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

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 the National Electrical Code.

1.2.2 The electrical equipment and installation shall be in compliance with the seismic requirements of International Building Code (IBC) 2003, Seismic Use Group II, Seismic Design Category D, Component Importance Factor 1.0; and NFPA 5000.

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

IBC International Building Code

ICEA Insulated Power Cable Engineers Association

IES Illuminating Engineering Society of North America

NEC National Electrical Code

NEMA National Electrical Manufacturers Association

NESC National Electrical Safety Code

NFPA National Fire Protection association

UL Underwriter's 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 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 meeting. This coordination cost shall be incidental to Pump Station Electrical Work.

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 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 performed and test results shall be kept at the job site and made readily accessible to the Engineer.

1.7.6 The Contractor shall perform all tests necessary to assure proper functioning of materials and equipment under provisions of Subsection 1.21 of SECTION 1A . All systems shall test free from short circuit and ground fault, and shall be free from mechanical and electrical defects. 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.

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 of time.

1.8 Data to be Filed with DEPARTMENT

1.8.1 Submit shop drawings and product data under provisions of Section 1A. Certain data, as specified herein, shall be furnished to 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 Five 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.

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 will be paid for at the Contract lump sum price for PUMP STATION ELECTRICAL WORK.

1.11.2 The work for Electric Service specified under Subsection 3.4 will 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 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 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 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 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 $160,000.

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 compartments shall be provided in the 480V switchgear per the electric utility's requirement. Two NEMA 3R meter sockets shall be mounted outdoor.

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 The Contractor shall coordinate with the electric utility to schedule installation of new service and demolition of existing service equipment. The Contractor shall provide advance notice to the electric utility such that the utility has sufficient time to schedule their work.

3.4.8 The electric service shall include the work to provide power service from the Exchange Avenue to the pump station.

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 telephone line connections for SCADA system. The existing voice and data telephone service in the Maintenance Building shall be abandoned, new service shall be provided at the proposed Electrical Control Building.

The existing telephone wiring inside the pump station shall be removed and new wiring shall be installed from the telephone service box to equipment in the new electric control room.

3.5.2 Charges by the telephone utility shall be paid to the utility by the Contractor under the pay item, PUMP STATION ELECTRICAL WORK.

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.

3.6 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.

3.8 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 exposes conduit and wire, outlet boxes, devices, and similar items which are no longer required.

(c) Cut off the exposed parts of the concealed conduits 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 dry type transformer, circuit breakers, 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 8 as designated by the Engineer. Prior to the removal of any equipment, DEPARTMENT 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 Demolition of Major Electrical Equipment

3.9.1 The existing 2.4 KV outdoor Substation, 1500KVA pad mounted transformer, 1300KW diesel generator and bus ducts shall be removed and disposed of by the Contractor.

3.9.2 There are three 500KVA oil filled transformers in the outdoor substation. The transformer may contain PCB. Refer to Special Provisions Section 2B for PCB Oil Analysis and disposal

3.9.3 The seven existing Benshaw solid STATE starters for the six storm water pumps and the sump pump SSP-2 shall be removed from the existing starter panel (all except that for SSP-2 are in MCC's), and reinstalled in new MCC's. .

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

2.18.1 Section 3A – Cast-In-Place Concrete

2.18.2 Section 16A – General Electric Provisions

2.18.3 Section 16C – Major Electric Equipment

2.18.4 Section 16D – Supervisory Control and Data Acquisition(SCADA) Equipment

2.18.5 Section 16E – Cathodic Protection for Pumps and Discharge Header

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

Fed. Spec. HH-I-595	-	Insulation tape, electrical, pressure sensitive adhesive, plastic
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
NEMA KS1	-	Enclosed and miscellaneous distribution equipment switches (600 volt maximum)

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, 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 210.4(D) and 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 will be paid at the contract lump sum price for PUMP STATION ELECTRICAL WORK.

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

(a) Rigid steel conduit shall be manufactured to conform to Federal Specification WWC=581, NEC Article 344, ANSI C80.1, and UL labeled.

(b) 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.

(6) (f) 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 or 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.

(c) 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 AWGand 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 insulation shall be color coded.

(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, alkalies 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 in non-hazardous locations 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 2, 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 Power receptacles in non-hazardous locations shall be 600VAC, 3-wire, 4-pole, 30A with heavy duty safety disconnect switch in NEMA 4 enclosure. The receptacle shall have a spring-loaded cover mechanically interlocked with the switch operating mechanism. The switch cannot be closed until the plug is fully inserted and the plug cannot be withdrawn or inserted unless the switch is open. The power receptacle shall be Appleton Cat. No. WSR33542 or approved equal. Two matching plugs shall be provided.

2.5.4 Power receptacles in the pump station shall be 600VAC, 3-wire, 4-pole, 30A with non-fused disconnect switch in aluminum enclosure , UL listed as suitable for Class I, Division 2, Group D installations. The receptacle shall have a spring-loaded cover mechanically interlocked with the switch operating mechanism. The switch cannot be closed until the plug is fully inserted and the plug cannot be withdrawn or inserted unless the switch is open. The power receptacle shall be Appleton MD2SR3034U or approved equal. Two matching plugs shall be provided.

2.5.4 Other receptacles shall be as shown on the Drawings.

2.5.5 Receptacles installed outdoors or otherwise exposed to the weather shall be installed with weatherproof flap-type covers to assure weather-proof while in use and shall be of the Ground Fault Circuit Interrupter (GFCI) type, unless otherwise indicated.

2.5.6 Unless otherwise indicated, receptacles shall be installed with their centers 48 inches above the finished floor.

2.5.7 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 2, 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 2, 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.

(c) Ballasts shall be integral with the respective fixture and shall be suitable for starting at -29 degrees C (-20 degrees F).

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 in 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 heacy 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 2, 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 resetable. 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 2, 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 2, 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 2, 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 2, 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 (75 EF) (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 (75 EF), the fans shall stop.

(b) 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 2, Group D locations. Electric thermostats located in the Electrical Control Building shall have NEMA 12 enclosures.

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.

(b) 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, shock-proof, finned tube type. . Heat radiation fins shall be 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

(a) Each Unit heater shall have integral mounted magnetic contactors, fused control power transformer, thermal cutouts and fan delay relay. The unit heater shall be pre-wired, except for field connection of thermostats and electrical service. Internal wiring shall extend to terminal blocks clearly marked. Service wire terminals for field connections shall be numbered.

2.15.3 Unit Heaters In Hazardous Locations

(a) Unit Heaters in hazardous area shall meet UL requirements for Class I, Division 2, Group D classification for hazardous locations.

(b) Each Unit heater shall have integral thermal cutouts and fan delay relay. The devices inside unit heater shall be pre-wired, except those require field connections shall be wired to terminal blocks with wire numbers clearly marked for external connections.

(c) Each heater shall be furnished with a explosion-proof remote control enclosure and a explosion-proof thermostat for field installation. The remote control enclosure shall include a power disconnect switch, heating contactors, fan motor starter, fused control transformer, FAN-OFF-AUTO selector switch, and ON-OFF pilot lights. The thermostat shall be mounted on the side of the control enclosure.

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, smoke/heat detectors, strobes, and horns. 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 Control Panel.

2.16.2 The system shall be complete with four zones - the Electrical Control Building and the three floor levels in the pump station. 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 pump station is classified as NEC Hazardous Location, Class I, Division 2, Group D. All equipment inside the pump station shall be intrinsically safe or explosion-proof.

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.

2.17 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, Electrical Control Building 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 key switches at the pump station main entry and the Electrical Control Room doors; and a control relay in the Control Panel..

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 key switch shall be weatherproof, mounted on a weatherproof single gang stainless steel plate with protective cover and gasket for mounting on single gang outlet box, 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 Owner's existing keying system. Submit sample for approval by the Engineer.

2.17.5 The key switch at Electrical Control Room shall be mounted on a water-proof single gang outlet box recessed in a masonry wall. The key switch at Pump Station may be mounted on a surface mounted water-proof single gang outlet box.

2.18 Time Switches

2.18.1 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.

2.19 Electric Motors

2.19.1 This section outlines the requirements for electric motors as specified with equipment furnished under other Divisions.

2.19.2 Provide all submittals, including the following, and as specified in Division 2.

(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.

2.19.3 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.

(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 10-percent of rated voltage.

(g) Rate motors for continuous operation in 40 degrees C ambient.

2.19.4 Provide motors with the following mechanical protection.

(a) Dry, clean and well ventilated areas: Provide open drip-proof motors.

(b) Wet, damp or dusty areas: Provide totally enclosed, fan-cooled motors with removable drain plug.

(c) Class 1, Division 2 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.

2.19.5 Make conduit box NEMA enclosure ratings compatible with motor enclosures.

2.19.6 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.

2.19.7 Use antifriction ball or roller type bearings at manufacturer's option, unless otherwise specified.

2.19.8 Use regreaseable bearings with support side thrust loadings, with an AFBMA B-10 bearing life rated at least 100,000 hours, based on a reliability of 90 percent in accordance with ANSI B3.15.

2.19.9 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).

2.19.10 Provide steady STATE shaft loading not to exceed 100 percent of full load rating under maximum load, excluding the service factor, unless otherwise specified.

2.19.11 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.

2.19.12 Provide slide rails and sole plates as required for proper installation.

2.19.13 Provide capacitor or open split phase start, for smaller than 373 watts (1/2 hp) motors unless otherwise specified.

2.19.14 Provide horizontal or vertical squirrel cage induction motors for continuous duty with full voltage starting except as otherwise specified.

2.19.15 Provide motor having efficiency meeting the requirements of NEMA MG1-12.55.

2.19.16 Provide motor winding temperature switches or thermal devices as specified.

2.20 Telephone Set

2.20.1 A hazardous area telephone set shall be provided in the pump station operator’s room.

2.20.2 The telephone set shall be of membrane keypad, magnetic reed hook switch, noise reducing microphone, tone dialing, heavy duty handset cord, suitable for wall or desk mounting in NEC Class 1, Division 2, Group D Hazardous Locations.

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 312.6(c), 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. Concrete encasement shall extend six inches above grade, where applicable.

(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 may be supported by trapeze or other hangers approved by the Engineer. Trapeze hangers shall be hot-dip galvanized steel channels or stainless steel channels except that in the wet pit atmosphere, below grade, stainless steel shall be used, 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.

(e) 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.

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.

3.5 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 2 hazardous areas as defined by the NEC.

(a) Wet Well

(b) Pump Room, Stair well and all other indoor areas in the pump station.

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 DEPARTMENT, that the equipment has been properly installed and is in good working order.

1.1.6 The electrical equipment and installation shall be in compliance with the seismic requirements of International Building Code (IBC) 2003, Seismic Use Group II, Seismic Design Category D, Component Importance Factor 1.0; and NFPA 5000.

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) ANSI C37.20.1 Standard for Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.

(e) IBC 2003 International Building Code 2003 (for Seismic Requirement)

1.4 Submittals

1.4.1 Provide shop drawings, product data and O & M data under provisions of Section 1A.

1.4.2 Submittals of shop drawings, product data and O & M 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, engine generator system, SCADA system, 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 will be paid for at the contract lump sum price for PUMP STATION ELECTRICAL WORK.

1.8 System Studies and Circuit Breaker Setting

1.8.1 The manufacturer shall perform short circuit study and relay coordination study of the 480V power system including the 480V switchgear, motor control centers and power panels, and motors larger than 100 HP.

1.8.2 Based on the studies the 480V switchgear manufacturer shall properly select the Circuit protective devices and set the trip devices to form a coordinated power system.

1.8.3 Submit a complete report of the studies including short circuit currents, relay coordination curves and trip device settings of the circuit breakers and motor starters.

1.9 Quality Assurance

1.9.1 Contractor shall provide a written certification that the equipment has been installed in accordance with the requirements under this Section.

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. Additionally, the complete control operation of the motor control center along with the control panel shall be simulated. The Engineer shall be notified a minimum of two weeks in advance to witness the testing and simulation.

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) The Benshaw Model RMB6 solid state starters(with bypass contactors, CT's and LCD display/keypads) and the thermal/seal protection modules for Main Pumps SWP-1 through 6 and submersible sump pumps SSP-1 and 2 shall be installed on the new motor control centers. The Benshaw Model RMB6 solid state starters for Main Pumps SWP-1 through 6 and

Submersible Sump Pumps SSP-2; and the thermal/seal protection modules for Main Pumps SWP-1, 3 and 5 and submersible sump pump SSP-2 are existing and shall be relocated to the new MCC's. The thermal/seal protection modules for main pumps SWP-2, 4 and 6 and submersible sump pump SSP-1 shall be furnished with the new pumps for installation in the MCC's. A new Benshaw solid state starter matching the existing units shall be furnished with the new MCC No. 1 for Sump Pump No. 1. A motor circuit protector with external operating handles and linkages shall be provided in the MCC's for each Benshaw starter. Door cutouts and necessary panel drilling for the LCD display/keypad and the starters shall be completed by

the MCC manufacturer. The Benshaw Model RMB6 solid state starters, the thermal/seal protection modules, and the LCD display/keypads for the starters and the protection modules shall be factory mounted by the MCC manufacturer or integrator. A Devicenet or Modbus Plus module for serial network communication shall be added to each of the 8 Benshaw starters shall be furnished and installed under Section 16D.

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. Circuit breakers rated 600A and larger shall be equipped with electronic trip with adjustable long time, short time and instantaneous trip.

6) Incoming line circuit breakers shall be 100% rated, with microprocessor based adjustable LSI trip. No ground fault trip shall be provided.

7) Unless otherwise indicated, circuit breakers shall have a UL listed interrupting rating of not less than 65,000 RMS symmetrical amperes at 480 volts.

8) 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 shall be provided.

(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) Synchronous Motor Time Delay Relays

Synchronous motor driven time delay relays shall have a nominal 4-inch square face, shall be "on-delay" or "off-delay" as indicated and shall be of the range indicated. They shall be suitable for flush panel mounting. Each relay shall plug into a permanently wired molded case assembly. Time shall be set by turning a knob with a pointer on the face of the relay. The relay shall have a cycle progress pointer which will advance clockwise from the setting back to zero during timing. The relays shall have instantaneous and delayed contacts as required for the functions indicated. Unless otherwise indicated the relays shall be for 120-volt operation.

(h) 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.

(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.

2.2 Automatic Transfer Switches

2.2.1 Automatic transfer switches shall be air break, double throw interrupter type operated by a reliable dual electrical mechanism momentarily energized and mechanically held in both the normal and emergency positions. The switch shall incorporate a timed center-off position for motor load decay. The transfer delay time shall be adjustable from 0 to 20 seconds. 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 transfer switch shall be 3 phase, 3 pole, delayed transition type with a bypass isolation switch.

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 form 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 a 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. The loads shall be disconnected for an adjustable time period between each transfer.

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 under voltage.

5) A contact closed on utility source 2 under voltage.

(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

2.3.1 General

(a) The panels shall match the general construction of the motor control center and shall be of the same height.

(b) The panels shall conform to all applicable standards of NEMA and ANSI and shall consist of formed steel panels containing equipment and devices as indicated.

(c) The control panel shall be complete with float type water level control systems integrated as indicated on the drawings and as specified.

(d) The panels shall be equipped with space heater(s) as specified for motor control centers.

(e) A control panel shall be provided for pumping system monitoring and control.

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 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".

(d) The float control system circuit shall be as specified under “Float Control System”. The float relays shall be intrinsically safe.

(e) The Combustible Gas Detectors shall be as specified under “Combustible Gas Detection System”.

(f) A pump alternator PLC as specified in Section 16D.

(g) 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 two stilling wells 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 Annunciators

2.5.1 The annunciator shall be solid state, modular type, with back lighted engraved nameplates, integral logic cabinet and light box for flush panel mounting, complete with power supply, alarm modules, flasher, audible output and auxiliary output modules, 120V, 60 HZ power input with surge suppression and low voltage ride-through capability, Panalarm series 90 or approved equal.

2.5.2 The annunciator sequence shall be Panalarm Sequence AF with field selectable lock-in and non-lock-in feature. Adjustable time delay automatic acknowledgment shall be provided in each annunciator. Alarm contact voltage shall be supplied by the annunciator and shall not exceed 24 VDC.

2.5.3 Alarm contact follower auxiliary outputs with Form C contacts shall be provided where required for PLC inputs.

2.5.4 An alarm modules shall be provided for each spare nameplate.

2.5.5 Annunciator cabinet shall be Panalarm Model 94CA Series or approved equal

2.5.6 Name plate shall be white with engraved black letters, of triple configuration in each 24mm by 24mm module, filtered lens, color as selected by DEPARTMENT, Panalarm Model 93LA3WH Series or approved equal.

2.5.7 A 42-point annunciator with Model 94CA26 cabinet shall be mounted on the Control Panel as shown on Plans. A Lamp Test and an Alarm Acknowledge pushbuttons and an alarm buzzer shall be furnished for mounting on the Control Panel.

2.6 Combustible Gas Detection System (Gasoline)

2.6.1 The combustible gas detection system shall be a central gas monitoring system capable of continuously monitoring ambient air for gasoline at locations as shown on the drawings, using remote gas sensor/transmitters designed to measure the concentrations of gasoline.

2.6.2 The combustible gas detection system shall operate on the catalytic oxidation principle, and shall be Model 5300 as manufactured by Mine Safety Appliances Company, or approved equal.

2.6.3 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 controls.

2.6.4 The system shall consist of three(3) dual-channel monitor/readout units, one(1) relay programmer module, one(1) power supply unit, four(4) alarm relays, a horn relay, a buzzer and six(6) remotely mounted gas sensor/transmitter units. An independent monitoring channel shall be provided with each sensor/transmitter having a full scale range as specified. The sensor units shall be capable of being located remote from the monitor/readout unit by up to 5000 feet. Sensor unit shall receive power from and send signals corresponding to gas values to the monitor/readout unit. Each sensor unit shall be mounted in an enclosure suitable for NEC Class I, Division 1, Group C & D hazardous locations. The sensor units shall have provisions for mounting to a wall or similar structure.

2.6.5 The combustible gas monitor/readout unit shall be of the panel mounted type suitable for flush mounting in the door of Control Panel CP21 as shown. 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 front. An external sealed switch shall be provided to allow for alarm reset and audible alarm silencing without opening the enclosure. All unused channel spaces shall be neatly blanked off.

2.6.6 Alarms and relays at the monitoring/readout unit shall be set for the following levels of gas concentration:

(a) Gasoline CAUTION" alarm -20% LEL, Instantaneous

(b) Gasoline "WARNING" alarm -50% LEL, Latched, time delay off.

(c) Gasoline "ALARM" -50% LEL Latched, time delay off.

2.6.7 The combustible gas sensor/transmitter shall be of the catalytic bead type sensing element with 3-wire LDL signal transmitting electronic circuit designed to monitor the presence of petroleum in the ambient air. The transmitter circuit shall produce a 4 to 9 kHz frequency output signal proportional to 0 to 100% LDL and shall be mounted in an explosion proof condulet enclosure 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 shall be have 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.

2.6.8 In response to a CAUTION, WARNING or ALARM signal from the gas detection system, due to a high concentration of gasoline in the monitored space, an explosion-proof horn in the Pump Room shall be energized. The ventilation system for the monitored space shall be activated. The horns shall be provided.

2.6.9 A calibration test kit for field checking the calibration of the gas 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.

2.7 LOW VOLTAGE METAL-ENCLOSED DRAWOUT SWITCHGEAR

2.7.1 The Contractor shall furnish and install, where indicated on the drawings, a deadfront type, low voltage metal-enclosed switchgear assembly as specified herein and as shown on the contract drawings.

2.7.2 RATINGS

(a) Voltage rating shall be as indicated on the drawings. The entire assembly shall be suitable for 600 volts maximum AC service.

(b) The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current of 65,000 amperes symmetrical at rated voltage.

(c) The bus system shall have a minimum ANSI 4-cycle short-circuit withstand rating of 100,000 amperes symmetrical.

(d) All circuit breakers shall have a minimum symmetrical interrupting capacity of 65,000 amperes. To ensure a fully selective system, all circuit breakers shall have 30 cycle short-time withstand ratings equal to their symmetrical interrupting ratings through 85,000 amperes, regardless of whether equipped with instantaneous trip protection or not.

(e) All ratings shall be tested to the requirements of ANSI C37.20.1, C37.50 and C37.51 and UL witnessed and approved.

2.7.3 CONSTRUCTION

(a) The switchgear shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide ventilators located on the top of the switchgear over the breaker and bus compartments to ensure adequate ventilation within the enclosure. Hinged rear doors, complete with provisions for padlocking, shall be provided.

(b) The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to the floor without the use of floor sills. Provisions shall be made for jacking of shipping groups, for removal of skids or insertion of equipment rollers. Base of assembly shall be suitable for rolling directly on pipes without skids. The base shall be equipped with slots in the base frame members to accommodate the use of pry bars for moving the equipment to its final position.

(c) Each vertical steel unit forming part of the switchgear line-up shall be a self-contained housing having one or more individual breaker or instrument compartments, a centralized bus compartment and a rear cable compartment. Each individual circuit breaker compartment, or cell, shall be segregated from adjacent compartments and sections by means of steel barriers to the maximum extent possible. It shall be equipped with drawout rails and primary and secondary disconnecting contacts. Removable hinge pins shall be provided on the breaker compartment door hinges. Current transformers for feeder instrumentation, where shown on the plans, shall be located within the appropriate breaker cells and be front accessible and removable.

(d) The stationary part of the primary disconnecting devices for each power circuit breaker shall be breaker mounted and consist of a set of contacts extending to the rear through a glass polyester insulating support barrier; corresponding moving finger contacts, suitably spaced, shall be furnished on the power circuit breaker studs which engage in only the connected position. The assembly shall provide multiple silver-to-silver full floating high pressure point contacts with uniform pressure on each finger maintained by springs. Each circuit shall include the necessary three-phase bus connections between the section bus and the breaker line side studs. Load studs shall be equipped with insulated copper load extension buses terminating in solderless type terminals in the rear cable compartment of each structure. Bus extensions shall be silver-plated where outgoing terminals are attached.

(e) The circuit breaker door design shall be such that the following functions may be performed without the need to open the circuit breaker door: lever circuit breaker between positions, operate manual charging system, close and open circuit breaker, examine and adjust trip unit, and read circuit breaker rating nameplate.

(f) The secondary disconnecting devices shall consist of floating terminals mounted on the stationary unit and engaging mating contacts at the front of the breaker. The secondary disconnecting devices shall be gold-plated and engagement shall be maintained in the “connected” and “test” positions.

(g) The removable power circuit breaker element shall be equipped with disconnecting contacts and interlocks for drawout application. It shall have four positions, “connected,” “test,” “disconnected” and “removed.” The breaker drawout element shall contain a worm gear levering “in” and “out” mechanism with removable lever crank. Levering shall be accomplished via the use of conventional tools. Mechanical interlocking shall be provided so that the breaker is in the tripped position before levering “in” or “out” of the cell. The breaker shall include an optional provision for key locking open to prevent manual or electric closing. Padlocking shall provide for securing the breaker in the connected, test, or disconnected position by preventing levering.

(h) An insulating flash shield shall be mounted above each circuit breaker to prevent flashover from the arc chutes to ground.

(i) The switchgear shall be Cutler-Hammer Magnum DS low voltage metal-enclosed switchgear, utilizing Magnum DS power circuit breakers as herein specified or approved equal.

(j) The switchgear shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

(k) Provide a rear compartment barrier between the cable compartment and the main bus to protect against inadvertent contact with main or vertical bus bars.

(l) Provide in the cell when the circuit breaker is withdrawn, a safety shutter which automatically covers the line and load stabs and protects against incidental contact.

(m) Provide a metal barrier full height and depth between adjacent vertical structures in the cable compartment.

(n) Provide a glass polyester full height and depth barrier between adjacent vertical structures in the bus compartment with appropriate slots for main bus.

2.7.4 BUS

(a) All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on ANSI standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).

(b) Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.

(c) A copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchgear. The ground bus short-time withstand rating shall meet that of the largest circuit breaker within the assembly.

(d) All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with Belleville-type washers.

(e) All horizontal and vertical phase bus bars shall be provided with insulation cover. Grounded metal barriers shall isolate the main bus and connections from cable compartments.

2.7.5 WIRING/TERMINATIONS

(a) Small wiring, necessary fuse blocks and terminal blocks within the switchgear shall be furnished as required. Control components

mounted within the assembly shall be suitably marked for identification corresponding to the appropriate designations on manufacturer's wiring diagrams.

(b) Provide a front accessible, isolated vertical wireway for routing of factory and field wiring. Factory provisions shall be made for securing field wiring without the need for adhesive wire anchors.

(c) Front access to all circuit breaker secondary connection points shall be provided for ease of troubleshooting and connection to external field connections without the need of removing the circuit breaker for access.

(d) All control wire shall be type SIS. Control wiring shall be #14 AWG for control circuits and #12 AWG for shunt trip and current transformer circuits. Wire bundles shall be secured with nylon ties and anchored to the assembly with the use of pre-punched wire lances or nylon non-adhesive anchors. All current transformer secondary leads shall first be connected to conveniently accessible shorting terminal blocks before connecting to any other device. Shorting screws with provisions for storage shall be provided. All groups of control wires leaving the switchgear shall be provided with terminal blocks with suitable numbering strips and provisions for #10 AWG field connections. Each control wire shall be marked to the origin zone/wire name/destination zone over the entire length of the wire using a UV cured ink process. Provide wire markers at each end of all control wiring. Plug-in terminal blocks shall be provided for all shipping split wires. Terminal connections to remote devices or sources shall be front accessible via doors above each circuit breaker.

(e) NEMA 2-hole mechanical- type lugs shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size indicated on the drawings.

(f) Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.

(g) Reusable insulating boots shall be provided to cover all power cable terminations.

2.7.6 CIRCUIT BREAKERS

(7)

(a) All protective devices shall be low voltage power circuit breakers, Cutler-Hammer type Magnum DS or approved equal. All breakers shall be UL listed for application in their intended enclosures for 100% of their continuous ampere rating.

(b) All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standard. The breaker shall carry a UL label.

(c) Breakers shall be provided in drawout configuration. The 800, 1600, 2000 and 3200 ampere frame power circuit breakers shall be provided in the same physical frame size, while 4000 and 5000 ampere frame power circuit breakers shall be provided in a second physical frame size. Both physical frame sizes shall have a common height and depth.

(d) Power circuit breakers shall utilize a two-step stored-energy mechanism to charge the closing springs. The closing of the breaker contacts shall automatically charge the opening springs to ensure quick-break operation.

(e) Breakers shall be manually operated (MO) unless electrically operated (EO) is indicated on the drawings.

(f) Electrically operated breakers shall be complete with 120V AC motor operators. The charging time of the motor shall not exceed 6 seconds.

(g) To facilitate lifting, the power circuit breaker shall have integral handles on the side of the breaker.

(h) The power circuit breaker shall have a closing time of not more than 3 cycles.

(i) The primary contacts shall have an easily accessible wear indicator to indicate contact erosion.

(j) The power circuit breaker shall have three windows in the front cover to clearly indicate any electrical accessories that are mounted in the breaker. The accessory shall have a label that will indicate its function and voltage.

(k) The power circuit breaker shall have auxiliary contacts, 6 N.O and 6 NC for each main breaker and bus tie breaker; 3 NO and 3 NC for each feeder breaker.

2.7.7 TRIP UNITS

(a) Each low voltage power circuit breaker shall be equipped with a solid-state tripping system consisting of three current sensors, microprocessor-based trip device and flux-transfer shunt trip. Current sensors shall provide operation and signal function. The trip unit shall use microprocessor-based technology to provide the basic adjustable time-current protection functions. True rms sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached. Interchangeable current sensors with their associated rating plug shall establish the continuous trip rating of each circuit breaker. The trip unit shall be Cutler-Hammer type Digitrip. 1150 or approved equal.

(b) The trip unit shall have an information system that provides LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A reset button shall be provided to turn off the LED indication after an automatic trip.

(c) The trip unit shall be provided with a display panel, including a representation of the time/current curve that will indicate the protection functions. The unit shall be continuously self-checking and provide a visual indication that the internal circuitry is being monitored and is fully operational.

(d) The trip unit shall be provided with a making-current release circuit. The circuit shall be armed for approximately two cycles after breaker closing and shall operate for all peak fault levels above 25 times the ampere value of the rating plug.

(e) Trip unit shall have selectable thermal memory for enhanced circuit protection.

(f) The trip unit shall provide zone interlocking for the short-time delay and ground fault delay trip functions for improved system coordination. The zone interlocking system shall restrain the tripping of an upstream breaker and allow the breaker closest to the fault to trip with no intentional time delay. In the event that the downstream breaker does not trip, the upstream breaker shall trip after the present time delay. Factory shall wire for zone interlocking for the power circuit breakers within the switchgear.

(g) The trip unit shall have an information system that utilizes battery backup LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. A test pushbutton shall energize a LED to indicate the battery status.

(h) Circuit breakers, where indicated on the drawings, shall have individually adjustable ground fault alarm only.

(i) The trip unit shall be equipped to permit serial communication via a network twisted pair for remote monitoring and control from the SCADA system. The Contractor shall coordinate with the SCADA system integrator to select proper communication protocol and provide necessary interface. Ethernet will be preferred.

(j) The trip unit shall include a power/relay module which shall supply control to the readout display. Following an automatic trip operation of the circuit breaker, the trip unit shall maintain the cause of trip history and the mode of trip LED indication as long as its internal power supply is available. An internal relay shall be programmable to provide contacts for remote ground alarm indication.

(k) The trip unit shall include a voltage transformer module, suitable for operation up to 600V, 50/60 Hz. The primary of the power relay module shall be connected internally to the line side of the circuit breaker through a dielectric test disconnect plug.

(l) The display for the trip units shall be a 24-character LED display.

(m) Metering display accuracy of the complete system, including current sensors, auxiliary CTs, and the trip unit, shall be +/- 1% of full scale for current values. Metering display accuracy of the complete system shall be +/- 2% of full scale for power and energy values.

(n) The unit shall be capable of monitoring the following data:

1) Instantaneous value of phase, neutral and ground

2) Instantaneous value of line-to-line voltage

3) Minimum and maximum current

4) Watts, vars, VA, watthours, varhours, and VA hours.

(o) The energy-monitoring parameter values (peak demand, present demand, and energy consumption) shall be indicated in the trip unit's alphanumeric display panel.

(p) The trip unit shall display the following power quality values: crest factor, power factor, percent total harmonic distortion, and harmonic values of all phases through the 31st harmonic.

(q) An adjustable high load alarm shall be provided, adjustable from 50 to 100% of the long delay pickup setting.

(r) The trip unit shall contain an integral test pushbutton. A keypad shall be provided to enable the user to select the values of test currents within a range of available settings. The protection functions shall not be affected during test operations. The breaker may be tested in the TRIP or NO TRIP test mode.

(s) Programming may be done via a keypad at the faceplate of the unit or via the communication network.

(t) System coordination shall be provided by the following microprocessor-based programmable time-current curve shaping adjustments. The short-time pickup adjustment shall be dependant on the long delay setting.

1) Programmable long-time setting

2) Programmable long-time delay with selectable I2T or I4T curve shaping

3) Programmable short-time setting

4) Programmable short-time delay with selectable flat or I2T curve shaping, and zone selective interlocking

5) Programmable instantaneous setting

6) Programmable ground fault setting trip or ground fault setting alarm

7) Programmable ground fault delay with selectable flat or I2T curve shaping and zone selective interlocking.

(u) The trip unit shall offer a three-event trip log that will store the trip data, and shall time and date stamp the event.

2.7.8 UTILITY METERING

(a) Furnished a separate barriered-off utility metering compartment, complete with hinged sealable door for each utility incoming line.. Bus work shall include provisions for mounting utility company current transformers and potential transformers, or potential taps as required by the utility company. Provide service entrance label and necessary applicable service entrance features per NEC, local code and local utility company requirements.

2.7.9 TRANSIENT VOLTAGE SURGE SUPPRESSION

(a) Electrical Requirements

1) The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

2) Operating Voltage – 480V.

3) Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.

4) Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G).

5) UL 1449 2nd Edition Suppressed Voltage Rating (SVR) –
L-N; L-G; N-G: 800V L-L:1800V

6) ANSI/IEEE Cat. C3 Let Through Voltage – The Line to Neutral let through voltage for Category C3 surges (20 kV, 10 kA) shall be less than 960V.

7) ANSI/IEEE Cat. B3 Let Through Voltage – The Line to Neutral let through voltage for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than165V.

(b) TVSS Design

1) Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression

platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.

2) Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method.

3) Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50kHz	100kHz	500kHz	1MHz		10MHz	100MHz
Insertion Loss (ratio)	40	316	16	89	200	79	
Insertion Loss (dB)	32	50	50	39	46	38	

4) Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

5) Standard Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:

a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

b. Remote Status Monitor – The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

c. Event Counter – The TVSS shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

d. Push to Test – The TVSS shall be equipped with push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

6) Overcurrent Protection Fusing: In order to isolate the TVSS under any fault condition, the manufacturer shall provide:

a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.

c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

c) Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992

1) The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50 µ sec, 20kV open circuit voltage. 8 x 20 µ sec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

a. Service Entrance: 12000 impulse per mode.
b. Distribution Panelboard: 10000 impulse per mode.
c. Branch Location Panelboard: 9000 impulse per mode.

d) SYSTEM APPLICATION

1) Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand Capability with compliance to
ANSI/IEEE C62.41 AND NEMA LS1

Application	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (SWGR)	250kA	125kA	12000

2) Service entrance located TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.

3) The TVSS shall be factory installed inside the switchgear at the assembly point by the original equipment manufacturer.

4) Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.

5) Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.

6) The TVSS shall be integral to switchgear as factory standardized design.

2.7.10 AUTOMATIC TRANSFER CONTROLLER

(a) GENERAL

1) The automatic transfer controller shall be a redundant PLC with a HMI panel mounted in the switchgear programmed to control two utility incoming line breakers, one generator breaker and two bus tie breakers for switching the electric services to the pump station.

2) The PLC shall function as an RTU and communicated via Devicenet with the Pump Station master PLC.

(b) SEQUENCE OF OPERATION –OPEN TRANSITION TRANSFER

1) The power system shall normally operate on two normal Utility sources with the two utility incoming line breakers closed, and, the generator breaker and the two bus tie breakers open. The transfer controller shall indicate real-time values for volts and frequency on the HMI panel along with an indication of the power sources currently in use. The transfer controller shall continuously monitor either single-phase or three-phase voltages and frequencies for Utility 1, Utility 2, and Generator lines and the open-closed status of the three incoming line breakers and two bus tie breakers. The five breakers shall be interlocked in such a way that each side of the switchgear bus can be fed by an incoming line breaker at a time.

2) When the Utility 1 or Utility 2 fails (voltage or frequency is detected to be below the user programmed set points or breaker tripped), the incoming line breaker for the failed line shall be tripped and the two bus tie breakers shall be closed. When the line condition restores to normal the bus tie breakers shall be open and the previous failed incoming line breaker shall be closed after a preset time delay.

3) When both Utility 1 and Utility 2 fail, transfer to Generator shall be initiated - start generator and close tie breakers after a preset time delay, When the Generator line voltage and frequency are detected to be within the programmed parameters the Generator breaker shall be closed.

4) While the Load is connected to the Generator line, the controller shall continue to monitor Utility 1and Utility 2. As soon as the Utility 1or Utility 2 voltage and frequency return to within the programmed limits of Utility 1or Utility 2, and after a programmed time delay, the Load transfer back to Utility 1 or Utility 2 shall be initiated. The Load transfer back to Utility 1or Utility 2 shall be Open type, that is, the Generator line breaker shall be opened first, then only the Utility 1 or Utility 2 breaker shall close.

5) While the Load is connected to the Generator line, and the Utility 1 and Utility 2 voltage and frequency return to within the programmed limits, the Load transfer back to Utility 1 and Utility 2 shall be initiated after a programmed time delay - the generator line breaker opens, the bus tie breakers open and the Utility 1 and 2 breakers closes.

6) When the Utility 1 or Utility 2 voltage or frequency is detected to be below the user programmed set points, transfer to Source 3 shall be initiated. When the Source 3 voltage and frequency fails to be within the programmed parameters, the transfer shall be blocked and the Utility 1 or Utility 2 which voltage and frequency are detected to be within the programmed parameters, the transfer from Utility 1 to Utility 2 or from Utility 2 to Utility 1shall occur.

7) The programming set points and various standard and optional control parameters shall be as described under Transfer Controller section.

(c) TRANSFER CONTROLLER HARDWARE AND FUNCTIONS

1) The Transfer Controller hardware shall include the following:

a. A redundant PLC - Two FlexLogix controllers, analog and digital I/O's and a 6" Panelview color graphic display/keypad HMI panel connected on device net.

b. A 24VDC redundant power supply for the PLC and HMI.

c. Two sets of three push-to-test LED indicating lights (Utility 1, Utility 2 and Generator) showing the line availability and load connection status.

d. A 3-position UTILITY 1 - AUTO - UTILITY 2 manual transfer switch.

e. A 3-position Generator on Bus 1- AUTO - Generator on Bus 2 generator loaded exercise switch.

f. Four-position selector switch permitting four (4) modes of transfer switch operation: TEST (simulates Utility power outage), AUTO (standard automatic operation), OFF (de-energizes control relays and opens the engine start circuit for maintenance purposes), ENGINE START (retains transfer switch in

Utility position and initiates a testing of the engine start circuit). Furnish white pilot light for OFF indication

g. Voltage and frequency sensors for the two utility lines and the generator line.

2) The following logic and functions shall be provided:

a. The six LED lights shall indicate the following:

Utility 1 Available
Utility 2 Available
Generator Line Available
Utility 1 Connected
Utility 2 Connected
Generator Line Connected

b. Three position UTILITY 1 - AUTO - UTILITY 2 manual transfer switch shall allow the operator to test the transfer between the utility lines. If the loaded utility line fails during the test the control shall automatically transfer the load to the other utility line. All the timing and control functions related to the transfer shall apply.

c. Three position Generator on Bus 1- AUTO - Generator on Bus 2 generator loaded exercise switch shall allow the operator to exercise the generator and test the transfer function. If the generator fails during the test the control shall automatically transfer the load to the utility line. All the timing and control functions related to the transfer shall apply.

d. The HMI Panel shall be programmed to show the one line diagram of the two Utility lines, Generator line, two utility breakers, generator breaker, two bus tie breakers and the two switchgear bus, displaying each status/parameter as it is functioning. The graphic of the incoming line, switchgear bus and the circuit breakers shall be color coded to indicate normal/abnormal, open/closed/tripped status. Separate graphics shall be provided to show control parameter settings. The panel graphic shall display actual line-to-line voltage, line frequency and timers. When timers are functioning, the panel shall display the timer counting down. All set points can be reprogrammed from the SCADA system as specified in Section 16D.

e. The control program shall include the following:

i. Programs to provide automatic line transfer control.

ii. Adjustable time delay to initiate transfer between Utility 1 and Utility 2, to override a momentary power outage or voltage fluctuation (0 seconds to 120 seconds).

iii. Adjustable time delay to initiate transfer from Utility to Generator (0 seconds to 30 minutes).

iv. Adjustable time delay to initiate transfer from the generator to the Utility (0 seconds to 30 minutes).

v. Adjustable time delay for breaker closing to allow motor load decay (0 to 20 seconds).

vi. Adjustable Timer to allow the generator to run unloaded after retransfer to the Utility power supply (1 second to 30 minutes).

vii. Adjustable time delay to start engine.

viii. Adjustable time delay for engine cool off.

ix. Additional feature as required.

f. The following features shall be provided:

i. Auxiliary relay contacts that are energized when the power is available on the Utility sources.

3) Auxiliary relay contacts that are energized when the power is available on the generator source.

4) Relay auxiliary contacts (2NO/2NC) to indicate all breaker positions and the availability of each source.

a) Engine start contact which shall be independent from the PLC. Failure of the PLC shall not affect engine starting and generator operation.

(d) COMMUNICATIONS

1) The transfer controller shall be capable of communicating phase and ground current, peak demand, present demand, energy consumption, contact status and mode of trip. The transfer controller shall respond to open and close commands from a master control unit via a communications network. Communication network shall be Devicenet.

2) Provide communications capability to monitor the Utility, generator and bus tie breaker position and Utility and generator source availability. Additional communications capability shall be provided to bypass time delays during transfer or retransfer, and to initiate engine start for no-load or load testing of the transfer switch from a remote master computer.

(e) AUXILIARY DEVICES

1) Voltage and control power transformers of the quantity and ratings as required shall be supplied. Voltage and Control power transformers shall be mounted in an enclosed auxiliary compartment.

(f) Shop Drawings

1) The PLC ladder logic diagrams, description of the transfer controller operation and parameter settings shall be recorded in a CD ROM. The CD ROM and hard copy printouts shall be included in the shop drawing and O&M manual.

2.7.11 ENCLOSURES

(a) NEMA 1 Enclosure

2.7.12 NAMEPLATES

(a) Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16-inch high, minimum.

(b) Furnish master nameplate giving switchgear designation, voltage ampere rating, short-circuit rating, and manufacturer’s name.

(c) Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s drawings.

2.7.13 FINISH

(a) All exterior and interior steel surfaces of the switchgear shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchgear shall be ANSI 61.

2.7.14 ACCESSORIES

(a) Provide a traveling type circuit breaker lifter, rail-mounted on top of switchgear.

2.8 PACKAGED ENGINE GENERATOR SYSTEMS

2.8.1 GENERAL

(a) Description: Furnish all labor, materials, equipment and incidentals required to install, place into operation, and field test a diesel engine driven generator unit and appurtenances as indicated on Plans and as specified here-in-after. The package engine generator system shall consist of diesel engine, generator, cooling system, fuel system, automatic starting system, control system, and base fuel tank. A 480-120/240V or 480-120/208V transformer and a panelboard shall also be provided for the engine generator set auxiliaries.

(b) System Capacity: Not less than 1300 kW, 1625kVA standby, 277/480 volts, 3-Phase, 60 Hertz at 0.8 power factor with fan at elevation of 600 feet above sea level. The standby rating of the generator set shall not exceed the MANUFACTURER's published prime rating by more than 10%. The gross engine horsepower required to produce the standby rating shall not exceed the MANUFACTURER's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in DIN6270 but in no case shall it exceed the MANUFACTURER's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan and all accessories necessary to the unit's proper operation while operating at rated load and at a speed not to exceed 1800 rpm. The engine generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the MANUFACTURER for the actual unit supplied.

(c) Motor Starting Capability: The system shall be capable of starting and running a 200 HP Main Pump with the following loads on line: 75 KW miscellaneous load, 120 HP Sump Pump No. 1, 170 HP Sump Pump No. 2, four (4) 4 HP mixers, and four (4) 200 HP Main Pumps. All the sump pumps and Main Pumps will be driven by solid state reduced voltage starters with automatic by-pass contactors.

(d) These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the application. It is, however, intended to cover the furnishing, the shop testing and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these Specifications or not.

(e) The unit shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. The Contractor shall be responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.

(f) The engine-generator set shall be mounted as shown on the Drawings and shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power. The unit shall feed 480V loads connected to the 480V switchgear via the automatic transfer power circuit breakers

(g) The engine-generator set shall be the UL2200 listed standard product, as modified by these specifications, of a MANUFACTURER regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a MANUFACTURER, the engine must be the principal item manufactured and the completed engine generator set shall be supplied by the MANUFACTURER's authorized distributor only. The distributor shall have a minimum of ten (10) years experience in the field of power generation.

(h) It is the intent of this specification to secure a standby generator system that has been prototype tested, factory built, production tested, site tested and of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the NEC, NFPA 110, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the engine/generator and controls, and assembles the emergency generator system as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen. The unit must be of such physical dimensions as to make a good installation in the space provided as indicated on the Drawings.

(i) The engine generator set manufacturer shall have an authorized engine- generator service facility within a 50 mile radius of the jobsite.

(j) All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein.

(k) The engine generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer.

(l) The Engine/Generator Unit shall be as manufactured by Caterpillar, Cummins Power Generation, Detroit Diesel or Katolight.

2.8.2 CODES AND STANDARDS

(a) The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1) IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

2) NFPA37 – Standard for Installation and Use of Stationary Combustion Engines and Gas Turbines

3) NFPA70 – National Electrical Code.

4) NFPA110 – Emergency and Standby Power Systems.

(b) The generator set and supplied accessories shall meet the requirements of the following standards:

1) NEMA MG1–1998 part 32.

2) UL142 – Sub-base Tanks

3) UL1236 – Battery Chargers

4) UL2200 – Stationary Engine Generator assemblies.

(c) The control system for the generator set shall comply with the following requirements:

1) CSA C22.2, No. 14 – M91 Industrial Control Equipment.

2) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

3) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

4) FCC Part 15, Subpart B.

5) IEC8528 part 4. Control Systems for Generator Sets

6) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

7) UL508. Safety Standard for Industrial control Equipment.

8) UL1236 –Battery Chargers.

(d) The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

2.8.3 ENGINE

(a) The engine shall be water cooled, turbo-charged, V-type, 12-cylinder, four stroke cycle compression ignition diesel and shall operate on #2 domestic burner oil. Diesel engines requiring premium fuels will not be considered. Engine shall be equipped with oil, air and fuel filters; lube oil cooler with copper-nickel core for raw fresh water; fuel priming pump; gear driven water pump, aftercooler pump, and fuel transfer pump, fuel line relief/bypass valve. The maximum allowable engine speed shall be 1800 rpm.

(b) The engine shall incorporate steel spacer plates between the engine block and cylinder heads to eliminate counterbore cracking and stress failures. Engines that use turbochargers shall include in their design a low inertia impeller for faster response time to transient loads. Internal oiling system shall be designed for continual oil spray on the underside of the pistons for greater heat dissipation, therefore eliminating rifle drilling of the connecting rods to increase their structural integrity. The cylinder liners shall be full length water cooled and induction hardened to prevent warpage, improve cooling, and prevent liner shuffling due to cold starts.

(c) The engine design shall incorporate oversize bearing in the crank journals, connecting rod and wrist pin areas to assure structural force distribution under heavy loads and block loading conditions. Valve train shall include roller type followers for extended life and superior valve train response. Intake and exhaust valves, springs, and rotators must be of identical dimensions and metallurgy to eliminate improper assembly at the factory and by field service personnel.

(d) The crankshaft shall be of one-piece design, totally hardened and dynamically balanced at the manufacturer's facility

(e) Rating: Sufficient to operate 100 percent load in an ambient of 122oF at elevation of 600 feet.

(f) The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.

(g) Governor: The governor shall maintain isochronous frequency regulation from no load to 100% of full rated load. Steady-state operating band shall be +/- 0.25%. The governor shall be digital electronic type, factory mounted and warranted by the engine manufacturer, manufactured by Caterpillar, Cummins, Woodward or Barber Coleman.

(h) The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump. fuel priming pump, service meter. engine driven water pump, and unit mounted instruments. Provide a unit mounted instrument panel which shall include a fuel pressure gauge, water temperature gauge, and lubrication oil pressure gauge with the manual reset type low oil pressure, high water temperature, low coolant level, overcrank and overspeed safety shutdowns. Additional instruments and safety shutdowns shall be provided as noted herein.

(i) Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by ordinary mechanics without special diesel experience. The engines shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

(j) The fuel system shall be equipped with fuel filters with replaceable spin-on canister elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure. A primary fuel filter and a water separator shall also be provided in the fuel inlet line to the engine.

(k) The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be full flow type with replaceable spin-on canister elements easily accessible for removal and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler and dipstick oil level indicator.

(l) Provide a unit mounted thermal circulation type dual engine jacket water heaters incorporating a thermostatic switch to maintain engine jacket water at optimum temperature. The heaters shall be 120 volt, single phase, 60 Hertz, size as required, a junction box shall be provided for power connection. The heaters shall be automatically deactivated while the engine is operating. The heater shall be mounted with isolation valves for ease of maintenance. Quick connect /automatic sealing coupler shall be provided to allow the heating elements to be replaced without draining the engine cooling system or significant coolant loss. The hose shall be stainless steel wire braided reinforced with a working pressure of a minimum of 1,250 PSI with manual shutoff valves.

(m) 24 VDC starting motors with positive engagement capable of three complete cranking cycles without overheating.

(n) Replaceable dry element air cleaner with restriction indicator

(o) Engine mounted battery charging alternator, 40-ampere minimum and solid-state voltage regulator

(p) Engine shall be EPA certified.

(q) Certification from manufacturer stating that the engine exhaust emissions meet federal, state and local regulations and restrictions.

2.8.4 COOLING SYSTEM

(a) The engine shall be furnished with a unit mounted radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 110 degrees F. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. Total air restriction from the radiator shall not exceed 0.5 inches of water at both inlet and outlet. Ambient temperature shall be defined as the outside temperature or the temperature of air entering the engine area, not a measurement of air temperature in front of the radiator core. Ductwork with flexible connecting section between radiator and discharge louver frame shall be provided. Radiator shall include duct flange, connecting piping, belts, pulleys, fan, and steady bearings.

(b) The closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine manufacturer.

(c) The expansion tank of the radiator shall be fitted with a low water level switch and wired into the safety shutdown system of the unit.

2.8.5 EXHAUST SYSTEM

(a) Exhaust Silencer: A critical type, side inlet, end outlet silencer Maxim or equal, designed for outside mounting, with muffler companion flanges and flexible stainless steel exhaust bellows properly sized shall be furnished and installed according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine, nor will exhaust system growth, due to thermal expansion, be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust back pressure does not exceed the maximum limitations specified by the engine manufacturer. A tail pipe with suitable rain cap with expanded metal bird screen shall be connected to the silencer.

(b) All indoor exhaust piping shall be stainless steel, shall be lagged to maintain a surface not to exceed 150°F. The insulation shall be furnished and installed so that it does not cover or interfere with the functioning of the flexible exhaust fitting.

(8) (c) Rain Skirt - At the point where the exhaust pipe flexible tubing penetrates the roof of the building, a suitable "rain skirt" and collar shall be provided by the MANUFACTURER. It shall be designed to prevent the

entrance of rain and allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system. This detail shall be shown on the drawings submitted for approval.

2.8.6 BASE

(a) The engine-generator set shall be mounted on a factory installed, formed structural steel base. The whole unit shall be mounted on the top of the fuel tank with vibration isolators including seismic restrains. Isolators shall be shown on the generator set submittal drawings.

(b) The weight of the entire unit consisting of the engine generator set, base, radiator, and all other unit mounted auxiliaries including all liquids (i.e., fuel oil, lube oil, and cooling water) shall be calculated by the manufacturer. The base of the unit shall be designed and manufactured as a heavy duty, formed steel construction with four (4) point lifting provision to support the calculated weight. Details of the base construction as well as the weight calculation shall be included with the drawings submitted for approval.

2.8.7 FUEL TANK

(a) A sub-base fuel tank with sufficient capacity for 24 hours operation of the engine generator set at full load shall be provided. The tank shall be of double walled steel construction, U.L.142 listed and labeled, installed per NFPA37.

(b) The fuel tank shall be heavy duty, designed to support the static and dynamic load of the engine generator set and shall be formed from steel of a minimum metal thickness of 0.25-inch. The height of the tank base shall not exceed 18".

(c) The tank shall have the following accessories:

1) Emergency tank and basin vents.

2) Fuel fill port with locking cap.

3) Mechanical level gauge.

4) Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.

5) Leak detection provisions, wired to the generator set control for local and remote alarm indication.

6) High and low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level.

7) Basin drain.

8) Integral lifting provisions.

2.8.8 ENGINE STARTING SYSTEM

(9) (a) Provide an electronic engine starting system to control 24VDC starting motors with start-stop logic for adjustable cycle cranking and cool down operation Include remote starting control circuit.

(10)

(11) (b) Arrange for manual starting and fully automatic starting with MANUAL-OFF-REMOTE selector switch on generator control panel.

(12)

(c) The starting system shall be interlocked with the air intake dampers in the generator room in such a way that the engine shall not start unless the dampers are open. Upon receiving of an automatic or manual starting signal the starting system shall provide a normally closed relay contact to open the dampers(dampers open on power failure); and the contacts in the end switches of the dampers will permit operation of the engine. A bypass switch shall be provided for bypassing the interlock.

(d) Provide adjustable cranking limit device to limit cranking periods from 1 second up to the maximum duration.

(e) The system shall be capable of providing a minimum of three cranking periods with 15-second intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds.

2.8.9 BATTERIES AND BATTERY CHARGER

(a) Heavy duty 24 volt DC lead acid batteries shall be provided for engine starting and control, sized as recommended by the engine manufacturer. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged. Battery voltage shall be compatible with the starting system. Battery rack, necessary cables, connectors and spacers shall be provided

(b) Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

(c) Battery Charger: A current limiting, automatic float, taper and equalizing battery charger shall be furnished. It shall include surge suppressor and DC current limiting circuit. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 10 amperes. Charger shall be mounted inside the engine control panel or wall mounted. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of: Loss of AC power, Low battery voltage, High battery voltage and Power ON. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses. Alarms shall include charger malfunction and low battery voltage

2.8.10 GENERATOR

(a) Rating: Generator shall be rated 1300 kW minimum, 0.8 power factor at 480/277 volts, 3 phase, 4 wire, 60 hertz,1800 rpm with a maximum temperature rise of 105 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The generator shall conform to NEMA Standard MG-1. It shall have the motor starting capacity as specified here-in-before.

(b) Generator: The generator shall be NEMA MG1, three phase, AC synchronous, 4-pole, drip-proof type with brushless exciter, solid state voltage regulator, revolving field, amortisseur windings, Class H insulation. Temperature rise shall not exceed 105oC over 40oC ambient at rated load for continuous operation.

(c) The generator shall be single prelubricated sealed bearing, brushless, revolving field type, air cooled by a direct drive centrifugal blower fan, coupled directly to the engine flywheel through a flexible driving disc for positive alignment. The rotor shall be dynamically balanced to 25% overspeed. The oprating ambient temperature range shall be -30oF to 104oF. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core.

(d) The exciter shall be brushless type incorporate a full wave, three phase rotating rectifier assembly with hermetically sealed, metallic type silicon diodes to supply main field excitation. The exciter shall consist of stationary field structure and a revolving armature. The exciter shall be direct connected to the end of the generator rotor shaft and shall be of the permanent magnet type. The rotating rectifiers shall be protected by surge suppressors.. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes. The exciter and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

(e) The Generator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full line to ground fault currents. The generator rotor shall be dynamically balanced within 0.0005 in peak-to-peak amplitude displacements at both ends of shaft and shall sustain 25% overspeed without vibration or damage. The generator rotor and stator windings shall be of the layered winding and PMG design, thus providing for better uniformity in cooling, producing higher efficiencies.

(f) Insulation: Generator and exciter windings shall be a full Class H insulated system vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be random or machine wound, and precision made, with turn-to-turn and ground insulation of glass yard and mica materials. The average di-electric strength for the form wound coils of the ground and end turn insulation shall not be less than 400 volts per mil. Spacers shall be tightly secured between end turns, and the end turn assembly securely lashed to the support rings.

(g) Voltage Regulation: An automatic volts-per-hertz type, solid-state voltage regulator of component replacement design, as manufactured by the generator manufacturer, shall be included and shock mounted inside the generator buss housing. The regulator shall include 3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. An over-voltage sensing module with manual reset shall be furnished with the regulator. Voltage regulation from no load to full rated load shall be within +/- 0.5% steady state at 40 degree C ambient temperature. Readily accessible voltage droop, voltage level, and voltage gain controls shall be included in the module. The voltage level adjustment shall be a minimum of +/- 10%. Step-down potential transformers shall be provided for the voltage regulator power input and sensing circuits if required. All solid state components of the regulator are subject to a 100 hour burn in test before assembly. A vibration withstand rating of 4.5 G's are in the 19 to 500 hertz frequency range shall be of the regulator's standard design. The voltage regulator shall be matched and prototype tested by the engine manufacturer with the type of governor provided with the engine.

(h) The generator shall be mounted to the engine under factory supervised quality control programs. The generator and engine shall be designed and assembled by the same manufacturer.

(i) Certification that the engine generator set passed the factory tests and inspections and a list of the tests and inspections.

2.8.11 Engine-Generator Control

(a) The engine-generator set shall be provided with a digital, open protocol microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

(b) The control system shall provide true RMS sensing 0.5% metering, and customer programmable protective relaying with alarm set points for under-voltage, over-voltage, under-frequency, over-frequency, over-current, and reverse power. An adjustable programmable load demand relay that can open and close based on generator kW. All programming can be accomplished through a directed, user-friendly quick access keypad.

(c) The control panel shall be equipped to permit serial communication via Ethernet for remote monitoring and control from the SCADA system. The communication protocol shall meet the requirement of the SCADA system specified under Section 16D.

(d) The control panel shall be mounted on the generator set, or may be mounted in a free-standing panel if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. It shall be the contractor's responsibility to furnish and install complete wiring between the control panel and the engine generator set.

(e) The following control switches shall be mounted on the control panel:

1) Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

2) EMERGENCY STOP switch. Switch shall be red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

3) RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

4) PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

(f) Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1) Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

2) Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.

3) The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

   a. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

(g) Generator Set Alarm and Status Display:

1) The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

   a. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).

   b. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

c. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

d. The control shall include an amber common warning indication lamp.

2) The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

low oil pressure (warning)
low oil pressure (shutdown)
oil pressure sender failure (warning)
low coolant temperature (warning)
high coolant temperature (warning)
high coolant temperature (shutdown)
high oil temperature (warning)
engine temperature sender failure (warning)
low coolant level (warning)
fail to crank (shutdown)
fail to start/overcrank (shutdown)
overspeed (shutdown)
low DC voltage (warning)
high DC voltage (warning)
weak battery (warning)
low fuel-daytank (warning)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (warning)
over load (warning)
emergency stop (shutdown)
configurable conditions

a. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location

3) Engine Status Monitoring.

a. The following information shall be available from a digital status panel on the generator set control :
engine oil pressure (psi or kPA)
engine coolant temperature (degrees F or C)
engine oil temperature (degrees F or C)
engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)

b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

4) Engine Control Functions.

a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

5) Alternator Control Functions:

a. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

b. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e. An individual phase AC over/under voltage monitoring system monitoring all three phases of the alternator that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

f. Generator protection relay coordination curve with generator thermal damage curve shall be included in the shop drawing submittal.

g. When required by National Electrical Code or indicated on project drawings, the control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

6) Other Control Functions

a. The generator set control shall be provided with a network communication module to allow communication with the pump station SCADA system. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

b. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC.

During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

(c) Control Interfaces for Remote Monitoring:

1) The control system shall provide four programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: (1) generator set operating at rated voltage and frequency, (2) common warning, (3) common shutdown, (4) load shed command.

2) A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

3) A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

4) The control shall be provided with a direct serial communication link as described elsewhere in this specification and shown on the drawings.

2.8.12 REMOTE ANNUNCIATOR

(a) Furnish and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel

(b) The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

2.8.13 CIRCUIT BREAKER

A main line, molded or insulated case 100% rated circuit breaker mounted upon and sized to carry the rated output of the generator shall be installed as a load circuit interrupting and protection device. It shall operate both manually for Utility switching functions and automatically during overload and short circuit conditions

2.8.14 AUXILIARY POWER PANEL

A step down transformer and an auxiliary power panel shall be provided to supply power to the engine generator set's auxiliary devices such as battery charger, jacket water heaters, etc. The auxiliary power panel shall be 120/208 3-phase or 120/240 single phase, with main breakers and sufficient branch breakers plus 2 spares. A 480V 3-phase power feeder will be provided for the transformer.

2.8.15 DOCUMENT SUBMITTALS

(a) Documents shall be submitted as per Subsection 1.4. Manufacturer's product literature and performance data for the

engine generator set, accessories, and auxiliary equipments sufficient to verify compliance to specification requirements shall be submitted.

(b) Installation drawings showing plan and elevations of the complete engine-generator unit with base mounted fuel tank; foundation plan; exhaust silencer; starting battery and battery charge.

(c) Engine Data: Manufacturer, Model, Number of cylinders, RPM, Bore x stroke, BMEP at full rated load, Make and model and descriptive literature of electric governor, Fuel consumption rate curves at various loads, Engine continuous pump drive duty HP rating (without fan), Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads).

(d) Generator Data: Manufacturer, Model, Rated KVA, Rated SKVA, Rated kw, Voltage, Class of insulation, Stator(by thermometer) and Field(by resistance) Temperature rise above 40 degree C ambient, Generator efficiency at Full load, 3/4 load, and 50% Load including excitation losses and at 80 percent power factor.

(e) Engine Generator Unit: Weight of skid mounted unit, Overall length Overall width Overall height, Exhaust pipe size, CFM of air required for combustion and ventilation, Heat rejected to jacket water and lubricating oil BTU/hr, Heat rejected to room by engine and generator BTU/hr. Base fuel tank, venting, fuel connection points and fill cap location, Data on all miscellaneous items supplied.

(f) Engine Generator Control:

1) Complete AC and DC power and control schematic diagrams for the engine-generator set and auxiliaries.

2) Interconnection wiring diagrams for all equipment to be provided.

3) Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

4) Sequence of operation: Explanations for all portions of all schematic wiring diagrams.

(g) Test reports as required under Subsection 2.8.16

(h) Manufacturer's published warranty documents.

1) The engine generator set and associated equipment shall be warranted for not less than 5 years from the date of acceptance of the Contract against defects in material and workmanship.

2) The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair part cost, etc.

2.8.16 TESTING

(a) Prototype Test

1) Design prototypes and production models of the same model and capacity as the unit to be furnished shall be prototype tested.

2) Prototype test programs shall include the requirements of NFPA 110 and the following:

Maximum power (KW).
Maximum motor starting (KV A) instantaneous voltage dip.

Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-2240 and 16.40.
Governor speed regulation under steady-state and transient conditions. Voltage regulation and generator transient response.
Fuel consumption at 1/4, 1/2, 3/4, and full load.
Harmonic analysis, voltage waveform deviation, and telephone influence factor.
Three-phase short circuit tests. 9. Alternator cooling air flow.
Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
Endurance testing.

3) The engine/generator set and accessories to be furnished shall not be subjected to prototype tests.

(b) Final Production Tests: The engine generator set shall be shop tested under varying loads with guards and exhaust system in place. Tests shall include:

Single-step load pickup.

Transient and steady-state governing.

Safety shutdown device testing.

Voltage regulation.

Rated power.

Maximum power.

A certified test record shall be submitted prior to shipment.

c) Field Test: An installation check, start-up and load test shall be performed by the manufacturer's field engineers and/or local representatives and shall be in accordance with subsection 1.21 under Section 1A. The tests shall include:

1) Fuel, lubricating oil, antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

2) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.

3) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.

4) Automatic start-up by means of simulated power outage to test remote- automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate KW rating.

5) Submit field test report indicating and interpreting test results; and field inspection records relative to compliance with performance requirement.

2.8.17 SPECIAL TOOLS AND SPARE PARTS TO BE FURNISHED

(a) One set of all special tools that are required for the normal operation and maintenance of the engine generator unit.

(b) Two complete spare replacement sets of all filter elements required for the generator unit.

(c) Three complete replacement sets of each type and size of fuses.

(d) Two complete replacement sets of each type of indicating lamps.

2.9 Carbon Monoxide Detector

2.9.1 Carbon monoxide detector shall include a sensor and a single channel controller.

2.9.2 The sensor shall be of diffusion, electrochemical type consisting of a sensing electrode, a counter electrode and electrolyte enclosed together behind a membrane. The controller shall be of single channel type, with digital display, a strobe and horn, alarm set point potentiometers and alarm relays in a NEMA 4X wall mounting enclosure. The unit will display the monitored gas value on a 1.5 inch minimum height, ultra-bright, 3 digit LED display. A 120VAC operating power input and a 4-20mADC and RS-485 outputs shall be provided.

2.9.3 The carbon monoxide detector shall have a measuring range of 0 to 100 PPM and an alarm set point of 25 PPM.

2.9.4 The carbon monoxide detector shall be Sensidyne or approved equal.

3. EXECUTION:

3.1 Examination

3.1.1 Verify location and layout of 480V switchgear, motor control centers, engine generator set, Intrusion alarm equipment, Fire alarm equipment and Combustible Gas Detection System.

3.1.2 Verify that electrical power is available and of correct characteristics.

3.2 Preparation

3.2.1 Install proper concrete foundation and concrete pad for the engine generator, 480V switchgear, motor control centers, control panel and SCADA panel.

3.3 Installation

3.3.1 Install system and components in accordance with manufacturer's specifications.

3.3.2 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.

3.3.3 Crank case breathers shall be piped to the outside.

3.4 Field Quality Control

3.4.1 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. This service shall include all equipment provided for this project including but not limited to Engine Generator Set, 480V Switchgear, Motor Control Center, Solid State Starters, Automatic Transfer Device, SCADA System, Combustible Gas Detection System, and Fire Alarm System.

3.5 Start-up and Testing

3.5.1 Start-up and testing shall be in accordance with the requirements under subsection 1.21 of SECTION 1A.

3.5.2 The start-up services for the following equipment shall be coordinated with DEPARTMENT and DEPARTMENT shall be notified at least one week in advance:

Engine generator set
480V Switchgear
Motor Control Center
Automatic Transfer Device.
SCADA System
Combustible Gas Detection System.
Fire Alarm System

END OF THIS SECTION

DIVISION - 16E ELECTRICAL

SECTION 16D -SUPERVISORY, CONTROL AND DATA ACQUISITION (SCADA) EQUIPMENT

(13) 1. GENERAL

1.1 Description

1.1.1 A SCADA (Supervisory Control and Data Acquisition) system shall be provided which shall function as the "Master Control Station" for the Pump Station facility. The SCADA system shall consist of, but not be limited to programmable controllers, personal computer, data communication equipment, printers, LED (light emitting diode) digital displays, process instruments and control devices, uninterruptible power system (UPS) and other devices as required and as indicated on Plans.

1.1.2 All materials, equipment, labor, programming, 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-year experience. The system integrator shall design and coordinate the instrument and control system for proper operation with related equipment and materials.

1.1.3 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 they are shown on the drawings or not.

1.1.4 The system integrator shall provide all programming and configuration of equipment and software including development of graphic displays and reports.

1.1.5 The system integrator shall install the control system and perform all on-site testing, start-up, and training of DEPARTMENT’s staff.

1.1.6 All necessary coordination required for interfacing the proposed pump station facility with the proposed SCADA system shall be provided by the system integrator.

1.1.7 The existing SCADA equipment including a computer and a printer at the maintenance office, a Motorola Moscad RTU (remote terminal unit) in the pump station, a Moscad RTU in the generator enclosure, and a Moscad RTU inside the existing Display Panel at DEPARTMENT Dispatcher’s office shall be removed.

1.1.8 The existing Alarm Panel at DEPARTMENT Dispatcher’s office shall be modified - Replace the Moscad RTU with a PLC (programmable logic controller), rewire the indicators and replace indicator nameplates as specified herein or as indicated on Plans.

1.1.9 The existing laptop PC with “PC Anywhere Remote” shall be retained and “PC Anywhere Host” in the existing Maintenance Office computer shall be reinstalled in the new computer for use in the new SCADA system.

1.1.10 The existing Intellution “FIX Dynamic” HMI (human machine interface) software shall be upgraded to iFIX latest version for use in the new SCADA computer.

1.2 SUBMITTALS

1.2.1 Submit product data, shop drawings, project documentation, O & M Data and
record documents in accordance with the provisions of Section 1A and the following.

1.2.2 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, wireways and piping.

1.2.3 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.

1.2.4 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.

1.2.5 Instruction Manuals

Submit instruction manuals covering installation, operation, calibration, maintenance, diagnostic and repair for all hardware and software.

1.2.6 Record Documents

Accurately record actual calibration setting and scales of instruments.

1.3 OPERATIONAL AND PERFORMANCE REQUIREMENTS

1.3.1 The SCADA system includes a PC system as the main HMI device, a master PLC for pumping system control, a RTU with a small PLC programmed as an automatic pump alternator in the Control Panel, a RTU as alarm and status monitoring in the Dispatcher's display panel, a RTU as the automatic transfer Controller for electric services and generator control in the low voltage switch gear, an ultrasonic level transmitter (LT-100) as the primary wet well level measurement device, a hydrostatic level transmitter (LT-101) as the backup level measurement device, and a multi-float/relay system as the back-up pump control system. The eight Benshaw solid STATE reduced voltage starters for the sump pumps and main storm water pumps shall communicate with the master PLC on Devicenet and the power circuit breakers in the 480 volts switchgear shall communicate with the master PLC through Ethernet.

1.3.2 The master PLC shall check the validity of LT-100 and LT-101 level signals using float levels as reference, and select a valid signal for pump control (LT-100 as default). If both level signals are invalid, then the point level inputs signals from the multi-float system shall be used for pump control.

1.3.3 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.

1.3.4 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.

1.3.5 The PLC (RTU-1) in the Control Panel shall be programmed to operate as a 6-pump alternator for the main pumps and as a 2-pump alternator for the sump pumps. Each alternator shall sequence the pumps in it's group in a cyclic mode, alternation shall occur when all pumps are off in a pumping cycle. When the generator is providing power to the 480V switchgear the PLC shall sequence the starting of pumps in proper time interval to reduce the starting and running load of the generator. The PLC shall send the lead-lag sequences to the master PLC such that the master PLC can select the proper pumps to operate in accordance with the wet well level.

1.3.6 The 6-pump alternator for the main pumps and the 2-pump alternator for the sump pumps shall also programmed in the master PLC. In the events of RTU-1 PLC failure in the Control Panel the pump control output circuit of the PLC shall be disabled and master PLC takes over the pump alternator functions.

1.3.7 In the event of power failure of both electric utility sources or the standby generator testing, and the generator is on line the master PLC and RTU-1 shall be programmed in such a way that only one of the sump pumps and main storm water pumps on the generator bus can be started at a time and the next pump can only be started after the generator is stabilized.

1.4 Related Sections

1.4.1 Section 16A - General Electrical Provisions
1.4.2 Section 16B - Basic Electrical Materials and Methods
1.4.3 Section 16C - Major Electrical Equipment

1.5 Reference

1.5.1 ISA Standards and Recommended Practices for Instrumentation and Control

1.6 Guarantee

1.6.1 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.

1.7 Deliver, Storage and Handling

1.7.1 Delivery, storage and handling shall be in accordance with the provisions of Section 1A.

1.8 Basis of Payment

1.8.1 Supervisory, Control and Data Acquisition (SCADA) equipment will be paid for under the contract lump sum price for PUMP STATION SCADA EQUIPMENT.

1.9 SCADA SYSTEM I/O LIST

1.9.1 MASTER PLC HARDWIRED I/O POINTS

DESCRIPTION	DI	DO	AI	AO	NOTE
Pump Station Wet Well Level, FT-100			1		
Pump Station Wet Well Level, FT-101			1		
Main Pump 1 Thru 6 Running	6				
Main Pump 1 Thru 6 HOA in AUTO	6				
Main Pump 1 Thru 6 HOA in OFF	6				
Main Pump 1 Thru 6 Breaker Tripped	6				
Main Pump 1 Thru 6 Fail	6				
Main Pump 1 Thru 6 Motor Hi Temp	6				
Main Pump 1 Thru 6 Motor Hi Moisture	6				
Main Pump 1 Thru 6 Bearing Hi Temp	6				
Main Pump 1 Thru 6 Bearing Hi Moisture	6				
Main Pump 1 Thru 6 Run		6			
Sump Pump 1 & 2 Running	2				
Sump Pump 1 & 2 HOA in AUTO	2				
Sump Pump 1 & 2 HOA in OFF	2				
Sump Pump 1 & 2 Breaker Tripped	2				
Sump Pump 1 & 2 Fail	2				
Sump Pump 1 & 2 Motor Hi Temp	2				
Sump Pump 1 & 2 Motor Hi Moisture	2				

Sump Pump 1 & 2 Bearing Hi Temp	2				
Sump Pump 1 & 2 Run		2			
Mixer 1 Thru 4 Running	4				
Mixer 1 Thru 4 HOA in AUTO	4				
Mixer 1 Thru 4 HOA in OFF	4				
Mixer 1 Thru 4 Breaker Tripped	4				
Mixer 1 Thru 4 Motor Hi Temp/Moisture	4				
Mixer 1 Thru 4 Underload	4				
Mixer 1 Thru 4 Run		4			
Drain Pump 1 Low Level Shutdown		1			El. 370.67'
Drain Pump 2 Low Level Shutdown		1			El. 366.25'
Lead Pump Call		1			
Lag 1 Pump Call		1			
Lag 2 Pump Call		1			
Lag 3 Pump Call		1			
Lag 4 Pump Call		1			
Lag 5 Pump Call		1			
Lead Sump Pump Call		1			
Lag Sump Pump Call		1			
Mixer Call		1			
Wet Well Floats Below Activation Level	19				
Utility Line 1 Power Failure	1				
Utility Line 2 Power Failure	1				
480V SWGR Utility Line 1 Breaker Closed	1				
480V SWGR Utility Line 2 Breaker Closed	1				

480V SWGR Bus Tie Breaker 1 Closed	1				
480V SWGR Bus Tie Breaker 2 Closed	1				
480V SWGR Generator Breaker Closed	1				
480V SWGR Utility Line 1 TVSS Alarm	1				
480V SWGR Utility Line 2 TVSS Alarm	1				
Generator Running	1				
Generator Alarm	1				
Generator DC Power Failure	1				
Generator Room CO Alarm	1	1			
Generator Room CO Detector Failure	1	1			
MCC 1 & 2 Power Failure	2				
MCC 1 & 2 TVSS Alarm	2				
Pump Control Circuit AC Power Failure	1				
Combustible Gas Warning	1				
Combustible Gas Alarm	1				
Combustible Gas Detector Trouble	1				
Fire Alarm	1				
Pump Station Intrusion Alarm	1	1			
Pump station Entry Key Switch Bypass	1				
Control Bldg Intrusion Alarm	1	1			
Control Bldg Entry Key Switch Bypass	1				
UPS Power Feeder Failure	1				
UPS alarm	1				
24VDC Power Supply Alarm	1				
Control Building High Temperature	1				

Alarm Ack		1			To Ann
Dispatcher's Panel Communication Failure		1			To Ann
Enable RTU-1 Output		1			
Control Power Panel TVSS Alarm	1				
Spare	23	6	6		
TOTAL	144	32	8		

1.9.2 MASTER PLC I/O POINTS VIA ETHERNET

(a) From 480V Switchgear:

1) From Utility Line 1, Utility Line 2 & Generator Breaker Trip Unit Breaker status (Closed), 3 phase line voltage, 3 phase current, KW and power factor, and trip settings

2) From Tie Breaker 1 & 2 Trip Unit: Breaker status (Closed) & trip settings.

3) From each Feeder Breaker Trip Unit: Breaker status (Closed), 3 phase current, KW and power factor, and trip settings

(b) From Engine Generator Controller:

Metering: Elapsed Run Time, Engine RPM, DC Voltage, 3 phase current, voltage, KW and KVA; P.F., KWHr,
Alarms: Hi/Lo coolant temp., Low oil pressure, Low DC volts, System not in automatic, Hi/Lo fuel level, Over crank, Over speed, Battery charger malfunction, Generator on load, Circuit breaker tripped.

1.9.3 MASTER PLC I/O POINTS VIA DEVICENET

(a) From RTU-2 Automatic Transfer Controller: Utility Line 1 Available, Run Time; Utility Line 2 Available, Run Time; Generator Line Available, Run time; Number of Transfers, and The Date, Time and Reason for the Last 16 transfers

1.9.4 MASTER PLC I/O POINTS VIA CONTROLNET

3 From RTU-1: Main Pump Lead Lag Sequence, Sump pump Lead Lag sequence, Watchdog Timer.

1.9.5 RTU-1 HARDWIRED I/O POINTS

DESCRIPTION	DI	DO	AI	AO	NOTE
Float Run Lead Sump Pump	1				
Float Run Lag Sump Pump	1				
Sump Pump 1 Run		1			
Sump Pump 2 Run		1			
Float Run Lead Main Pump	1				
Float Run Lag 1 Main Pump	1				
Float Run Lag 2 Main Pump	1				
Float Run Lag 3 Main Pump	1				
Float Run Lag 4 Main Pump	1				
Float Run Lag 5 Main Pump	1				
Main Pump 1 Run		1			
Main Pump 2 Run		1			
Main Pump 3 Run		1			
Main Pump 4 Run		1			
Main Pump 5 Run		1			
Main Pump 6 Run		1			
480V SWGR Bus Tie Breaker 1 Closed	1				
480V SWGR Bus Tie Breaker 2 Closed	1				
480V SWGR Generator Breaker Closed	1				
Spare	5	8			
TOTAL	16	16			

1.9.6 RTU-1 PLC I/O POINTS VIA CONTROLNET

The following information shall be sent to MASTER PLC via ControlNet.

3.1.1.1 Sump Pump Operating Sequence and Main Pump Operating Sequence

3.1.1.2 PLC Normal

3.1.1.3 Generator on line feeding MCC 1, MCC 2 or both.

3.1.1 RTU-3 (Dispatcher's Office Display Panel) HARDWIRED I/O POINTS

DESCRIPTION	DI	DO	AI	AO	NOTE
Main Pump 1 thru 6 Running		6			
Main Pump 1 thru 6 Standby		6			
Main Pump 1 thru 6 Fail		6			
Sump Pump 1 & 2 Running		2			
Sump Pump 1 & 2 Standby		2			
Sump Pump 1 & 2 Fail		2			
Utility Line 1 Power Fail		1			
Utility Line 2 Power Fail		1			
Generator Running		1			
Generator Fail		1			
MCC 1 Power Fail		1			
MCC 2 Power Fail		1			
Pump Control Power Fail		1			
Low Water Level		1			
High Water Level		1			
Pump Alternator RTU-1 Fail		1			
Level Transmitter LT-100 Fail		1			
Level Transmitter LT-101 Fail		1			
UPS Input Power Fail		1			

Combustible Gas Warning	1				
Combustible Gas Alarm	1				
Combustible Gas Detector Trouble	1				
Generator Running		1			
Generator Fail		1			
Generator DC Power Fail		1			
Fire alarm		1			
Dispatcher Alarm Panel Power Fail		1			
Communication Fail		1			
Alarm Silenced		1			
Wet Well Level (LT-100)				1	
Wet Well Level (LT-101)				1	
Horn		1			
Alarm Acknowledged	1				
Lamp Test	1				
Spare	14	15		2	
TOTAL	16	64		4	

1.10 SYSTEM DESCRIPTION

1.10.1 The following points are not intended to be a comprehensive list of the system's features, only summarize the major functions of the system. 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.

1.10.2 The system is based on the SCADA system block diagram shown on Plans. The system shall include:

(a) Redundant programmable logic controllers (PLCs) 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).

1.10.3 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.

1.10.4 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.

1.10.5 Upgrade the existing Intellution FIX Dynamic to iFIX latest version as the SCADA HMI software.

2. PRODUCTS:

2.1 SCADA PANEL AT ELECTRICAL CONTROL ROOM

2.1.1 A SCADA panel shall house a programmable logic controller (PLC) which shall be programmed for automatic control and monitoring of the operations of all control and monitoring functions at the Pump Station. The PLC shall control the starting and stopping of two sump pumps and six main pumps to

prevent highway flooding. The PLC shall be configured to become SCADA master communicating with RTU-1 (Pump alternator PLC) in the Control Panel, RTU-2(Automatic Transfer Controller) in 480V switchgear and RTU-3 in the Dispatcher's Display Panel.

2.1.2 The SCADA panel shall be NEMA 12 floor mounted, 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. The panel shall have a full piano hinge door(s) and a 3-point latch with a locking handle. The handle shall have a cylinder type lock keyed to match DEPARTMENT's system.

2.1.3 The enclosure shall be finished inside and out.. Exterior color shall match that for the motor control center, and the interior color shall be white or as otherwise approved by the Engineer.

3.1 PROGRAMMABLE LOGIC CONTROLLERS

2.2.1 An Allan-Bradley programmable logic controller (PLC) system shall be furnished and shall be programmed to operate all functions herein specified. All analog and discrete inputs and outputs shall be provided as necessary. The logic program shall be of a universal type architecture and shall not be of a proprietary language. In addition, the programmable controller shall be capable of being operated from the District 8 Dispatcher's Alarm Panel via leased telephone lines or radio. The programmable controller equipment supplier shall be responsible for coordinating and providing a complete and properly functioning software package for the control and operation of the equipment as specified herein.

2.2.2 The system integrator shall furnish the station operational program. A 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.

2.2.3 MASTER PLC: The PLC shall be a redundant system consisting of two(2) redundant ControlLogix processors with 1.5 Mbytes of memory, two(2) ControlLogix System Redundancy Modules, two(2) Control Net communication interfaces, two(2) Ethernet modules, two(2) redundant hot-swappable power supplies, Remote I/O system with redundant power supplies, Communication gateways, two(2) Graphic Interface Panels(GIP), necessary cable assembly, and necessary specialty modules to form a complete system. The PLC shall be Allen-Bradley ControlLogix Redundant System with sufficient memory and I/O capacity to handle monitor and control functions of present system plus 20% spare memory and 10% spare I/O. The PLC shall be mounted in the control building SCADA Panel and shall be programmed for monitoring and control functions. The two GIP's shall be

Allen-Bradley PanelView Plus 1250 12.1" TFT active matrix color display with keypad for operator interface, one with NEMA 1 panel mounted enclosure on the SCADA panel door, the other with NEC Class I, Division 2, Group D wall mounted enclosure in the pumping Station. The main processor module shall be capable of accepting additional I/O plug-in modules for expansion. Analog and digital terminal interface modules (Allen-Bradley 1492-IFM and 1492-AIFM), pre-wired cables with removable terminals and connectors.

2.2.4 RTU-1: The PLC shall be a FlexLogix controller with controlnet interface programmed as a two pump alternator for sump pumps and as a 6-pump alternator for the main pumps. The PLC shall be furnished and installed in the Control Panel.

2.2.5 RTU-2: The PLC shall be a redundant FlexLogix controller system with Panelview 600 Plus and I/O modules programmed as an automatic transfer controller for controls of two utility service breakers, a generator breaker and the bus tie breakers in the 480V switchgear. The PLC shall be furnished, installed and programmed by the manufacturer of the 480V switchgear.

2.2.6 RTU-3: The PLC shall be a CompactLogix controller with I/O modules to replace the existing Motolora MOSCAD RTU in the dispatcher's office.

2.2.7 A Devicenet module for serial network communication shall be added to each of the 8 Benshaw starters in the motor control centers.

2.2.8 The PLC system design is based on a specific manufacturer's, other manufacturer's system will be acceptable only if they are proven to be the same as the specified in functionality and reliability.

2.3 COMPUTER WORK STATION

2.3.1 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.

2.3.2 Manufacturers: Computers and peripherals shall be manufactured by Dell, Hewlett-Packard (HP), or IBM.

2.3.3 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

2.3.4 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.

2.3.5 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.

2.3.6 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.

2.3.7 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.

2.4 SYSTEM SOFTWARE

2.4.1 General Requirement

(a) 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. DEPARTMENT shall not be required to expend any programming effort in order to achieve a fully operational system.

(b) Software shall be modular, comprised of an integrated group of proven, standard software modules.

(c) 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.

(d) 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.

(e) 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.

(f) The System Integrator shall develop and implement all specified LCD screens, logs, reports, etc. DEPARTMENT shall provide input to the System Integrator in the areas of presentation format, included information and other general operator interface considerations.

2.4.2 Operating System

(a) 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.

(b) 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.

(c) 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 statements, operator commands, and translate them into actions; respond to and report error conditions relating to program processing.

(d) 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.

(e) 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.

3.1 System Administrator: Full access to system.

3.2 Engineer/Supervisor: Full access to all HMI and control system variables, databases, and programs. Restricted access to system/network parameters.

3.3 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.

(f) 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.

2.4.3 Support Software

(a) 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.

(b) 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.

(c) The support software shall contain Utility Routines which shall allow operator or programmer to:

1) Load and verify CD's.

2) 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:

1) Main memory

2) Execution of all instructions

3) Input/Output system

4) Hard disk

5) 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:

1) Automatic scheduler for automatic (unattended) backup

2) File by file and image backup (selectable).

3) File restoration

4) 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.

(g) 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.

2.4.4 Application Programs

(a) 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:

1) 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.

2) Digital filtering via either an assignable filter constant or by difference equation method.

3) 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.

4) 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.

5) 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.

6) 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.

7) 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.

8) 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.

9) The final format and variables to be printed shall be developed by the System Integrator after consulting with DEPARTMENT 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.

10) Provide the capability to manually OPEN/CLOSE, START/STOP or initiating auto sequences of selected plant equipment via the operator's LCD and keyboard.

11) Provide for output of current or historical trending values to either the LCD or report printer.

12) Provide an optional automatic reset sequence for all alarms.

13) Provide export and import of the system configuration database to/from an ASCII (comma delimited) or Excel format file for modification or printing.

14) Provide a library of standard graphics symbols in conformance with ISA standard S5.1.

15) Perform configuration and operator interface to implement the control strategies included in this Section.

16) 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.

(b) Real Variables Processing

1) 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.

2) 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.

3) 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.

4) 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.

5) 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:

1) 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.

2) 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.

3) 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.

4) The system shall provide for a minimum of 200 calculated variables.

(d) Manual Input Data Handling

1) 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.

2) 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

1) 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

2) 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.

3) 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.

4) 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.

5) 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.

6) 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.

7) 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 DEPARTMENT or Engineer.

8) 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.

9) 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.

10) Single Point Configuration/Status displays: The configuration/status displays shall be of the software vendors standard format.

11) 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.

12) 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.

13) 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.

14) 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

1) 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.

2) 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.

3) 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

1) 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.).

2) 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.

3) 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.

4) 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.

5) 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

1) 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.

2) 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.

3) 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.

4) The monthly report shall conform in all other respects to the requirements for the daily report.

(i) Process Reports

1) Provide fifteen additional process reports incorporating real-time, historical, or manually entered data. Specifics of these reports shall be coordinated with DEPARTMENT during the submittal phase of this project.

2.5 PLC PROGRAM DEVELOPMENT SOFTWARE SYSTEM

2.5.1 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.

2.5.2 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.

2.5.3 The software package shall be completely menu driven and shall be distributed on standard CD’s.

2.5.4 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.

2.5.5 The software package shall include a software license agreement allowing DEPARTMENT 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.

2.5.6 The software shall provide as a minimum the following functions:

(a) Annotation of all ladder elements with at least 3 lines of 6 characters each.

(b) Annotation of all ladder rungs with at least 240 characters.

(c) Provide visual "power flow" monitoring of circuit elements (when connected to the PLC).

(d) Provide annotated ladder diagram printout on a standard IBM compatible dot matrix printer for documentation purposes.

(e) On-line help facility.

(f) Download or upload ladder program from the PLC to the PC.

(g) Provide a ladder element and I/O cross reference table.

(h) Provide all monitoring, forcing, programming error detection, searching, configuration, etc., functions as required to allow an operator/programmer to completely program a PLC.

2.5.7 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.

2.6 GRAPHICAL INTERFACE PANELS (GIP)

2.6.1 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.

2.6.2 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.

2.6.3 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.

2.6.4 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.

2.6.5 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.

2.6.6 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.

2.6.7 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.

2.6.8 Provide capacity for a minimum of 500 text messages.

2.6.9 Provide all configuration, transfer, and graphics software as required.

2.6.10 Unit shall operate from 24V DC power source. Operating temperature range shall be 0-50^{o}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.

2.6.11 Graphical interface panel shall be Allen-Bradley Panel View Plus, Cutler-Hammer PanelMate Power Pro, or approved equal.

2.7 GIP SOFTWARE CONFIGURATION

2.7.1 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.

2.7.2 The GIP shall provide the following general purpose screens:

(a) Two system status screens that summarize the present operational status of the pump station and sluice gate structure.

(b) Main menu and navigation screens for the GIP screens presented in a general to specific hierarchy.

(c) 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.

(d) 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.

(e) GIP Help screen(s) that summarize operator interface formats, use of function keys, navigational standards, etc.

2.7.3 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.

2.8 DISPATCHER'S ALARM PANEL

2.8.1 The existing Dispatcher's Alarm Panel is a 30"W x 72"H x 20"D free standing single door cabinet with 2 water level indicators, 55 alarm lights, lamp test and acknowledge pushbuttons and an alarm horn mounted on the door; and, a Motolora MOSCAD RTD, 24V DC power supply, 24V battery, power failure relay and phone line modem mounted on inside panel.

2.8.2 The MOSCAD RTD shall be replaced by an Allen-Bradley CompactLogix PLC with proper I/O's programmed to provide the functions of an alarm annunciator. Some alarm light name plates shall be replaced to identify the new alarm points as indicated on Plans.

2.9 UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEM

2.9.1 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.

2.9.2 The UPS shall be a single phase, true on-line, solid STATE unit with microprocessor controlled static inverter, hot pluggable batteries, battery charger, LED display and keypad, and manual isolated make before break maintenance bypass switch.

2.9.3 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.

(a) 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^{o}F to 104^{o}F. Final UPS sizing is the responsibility of System Integrator.

(b) 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.

(c) 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.

(d) The UPS system output shall be regulated to 120/208 VAC ± 3%, single phase three wire, 60 HZ ± 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.

(e) The UPS system shall provide computer grade sine wave power with 5 percent or less total harmonic distortion.

(f) 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.

(g) The UPS system shall have an efficiency of at least 92% when operated from AC line.

(h) 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.

(i) 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.

(j) 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.

(k) Topaz P8 or equal 3KVA power conditioner shall be provided.

(l) 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.

(m) 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.

2.10 ULTRASONIC LEVEL TRANSMITTER

2.10.1 The transmitter shall be a microprocessor based electronic unit consisting of an ultrasonic level sensor, an air temperature sensor, and an electronic transmitter packaged in a NEMA 4X nonmetallic enclosure, suitable for outdoor installation. The transducer shall be encapsulated in Tefzel molding, and shall be suitable for operation over a temperature range of -40 to +140 F.

2.10.2 The level sensor shall be a piezo-electric transducer designed to emits sonic pulses and receive the echoes reflected from the material surface, a built-in temperature sensor shall compensates for sound velocity variations due to changes in air temperature.. The sensor shall be hermetically sealed in Tefzel with 2" NPT thread for pipe mounting and 1/2"NPT conduit thread. A flange adapter shall be furnished for flange mounting. The sensor shall have 10 degree conical beam angle, no more than 10" blanking distance, 10" to 20' measuring range, -40 to 175^{o}F operating temperature.

2.10.3 The electronic transmitter unit shall be a microprocessor based echo-time measuring type, designed to sense the surface level and producing 4 - 20 mADC output signal linearly proportional to the level of surface. The electronic transmitter shall generate pulses, transmit gated signals to level sensors, receive and process returned echoes to produce output level signals. An echo analysis and auto false echo suppression software shall be loaded to recognize and remove spurious echoes, noises, and fixed obstruction; and reconstruct fragmented true echoes. The transmitter shall have 3-digit LCD display/calibration unit mounted inside the enclosure. The display shall be programmed to display the elevation of the water level. The system accuracy shall be within 0.15% of selected range and the resolution shall be within 0.125". The transmitter shall be 2-wire type, operated on 24 VDC power supply, -40 to 140^{o}F ambient.

2.10.4 The transmitter shall be Milltronics“SITRANS Probe LU ”or approved equal.

2.10.5 The Contractor shall coordinate the transmitter mounting requirements and shall furnish installation drawings and details, complete with dimensions and elevations, to ensure a proper and satisfactory installation. General installation requirements shall be as indicated on the Drawings.

2.11 EVEL TRANSMITTER - HYDROSTATIC TYPE

2.11.1 The hydrostatic type level transmitter shall include an upper and a lower assembly. The lower assembly shall include housing and gauge pressure diaphragm type transducer as specified herein. The Upper Assembly shall be installed locally and arranged to accept 24 VDC power supply, and shall house the system signal conditioning and transient protective electronics, connections terminal block and the expansion bag of the sealed breathing system. A labyrinth seal vent shall be provided on the side to allow

atmospheric pressure access to the expansion bag of the sealed breathing system. The Connecting Cable between Lower and Upper Assemblies shall consist of ½" O.D., B.F. Goodrich Estane polyurethane jacket, a 3-conductor shielded AWG #16 cable and an integral breather tube which shall form the sealed breathing system between the expansion bag and the Lower Assembly.

2.11.2 The liquid level transmitter shall be a 4-20 mADC, 2-wire, 15-40 VDC loop-powered type with its output signal directly proportional to the measured level excursion over a factory-calibrated range of zero to 15 ft. of water. The transducer shall be of the solid STATE head-pressure sensing type, suitable for continuous submergence and operation.

2.11.3 The transducer housing shall be fabricated of type 316 stainless steel with a bottom diaphragm 2-5/8" diameter of heavy-duty, limp, foul-free, molded Teflon bonded to a synthetic rubber back/seal. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid STATE variable capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm which flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensation and high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory calibrated range.

2.11.4 The transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent overpressures five times the full scale range being sensed. Metallic diaphragms and sensing principles employing LVDT's, resistive or pneumatic elements are not considered equal.

2.11.5 The transmitter shall include easily accessible zero and span adjustments in the upper assembly. ±20% zero and 3 to 100% span adjustment shall be provided, using potentiometer and dip switches. Zero and span adjustments shall be non-interactive for ease of calibration.

2.11.6 The internal pressure of the lower transducer assembly shall be relieved to atmospheric pressure through a heavy duty urethane jacketed hose/cable assembly and a slack PVC bellows mounted in the Upper Assembly. The sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements.

2.11.7 The level transmitter shall be intrinsically safe or an intrinsically safe barrier shall be provided for mounting in the control panel.

2.11.8 The level transmitter shall be mounted on a 1" vertical stainless steel pipe as indicated on Plans.

2.11.9 The level transmitter shall be manufactured by Ametek, Druck, Endress Hauser, or approved equal.

2.12 DIRECT ACTING FLOAT SWITCHES (LS-100A THROUGH LS-100K)

2.12.1 Direct acting float switches equal to Healy-Ruff Co. , Type P Roto-Float for level sensing complete with mounting pipe and stainless steel brackets shall be provided. The floats shall sense water levels as shown on the Drawings. The float shall contain a metal enclosed mercury switch which closes or opens its contacts when floating in a horizontal position. The non-inductive mercury switch rating shall be 10 amps at 120-V, 60Hz. The cable shall be Neoprene Type SO. Each float shall be provided with sufficient length of cable to allow a direct connection to the junction box without field splicing.

2.12.2 Float switches LS-100A through LS-100K shall provide back-up level sensing

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 devices and equipment in accordance with manufacturer's instructions.

3.2.2 The modification, demolition and installation of the SCADA equipment shall be scheduled to minimize interruption of automatic operation and monitoring of the pumping system. The contractor shall submit a detailed schedule for DEPARTMENT’s approval.

3.3 SYSTEM TESTING

3.3.1 System Testing and Start-up including the following, shall be provided as specified under provisions of Section 1A.

3.3.2 SYSTEM SHOP TESTS

(a) The Contractor shall be able to simulate the present SCADA system within his shop. Shop testing shall include, but not necessarily be limited to, the following:

(b) Manually fill-in required additions to data base

(c) Manual forcing of outputs

(d) Operation of the control programs

(e) Recall of simulated data points on the LCD displays and printers

(f) Recall of all reports with partial fill-in data and manual fill-in data at time of testing

(g) Routing testing of logger, alarm printer and LCD displays based upon manual input data

(h) Change of alarm and limit setpoints, etc., and observation of results

(i) Any additional testing which may be found to be necessary at the time the above is observed.

(j) All necessary contact and analog inputs must be provided to permit satisfactory testing of the above. If analog instrument switch over from one test to another is required, it shall be done in a most expeditious predetermined manner so as to permit nearly continuous testing during final shop acceptance.

(k) Prior to such acceptance tests, the Contractor shall submit the detailed procedures of the proposed shop tests and a time schedule within which such tests can be run, both subject to acceptance and approval by the Engineer. The Contractor will be expected to do all necessary pretrial testing and debugging to ascertain that the system is in running order. After the Contractor has confirmed that the proper responses can be achieved, the date for final shop test may be established.

(l) During shop testing, the Contractor shall generate hard copy prints of all reports and graphics, indexes and point I.D.'s on both printer and LCD monitor for submittal, review and correction. A certified letter that the listed shop tests have been performed shall be submitted. DEPARTMENT reserves the right to be present when shop tests are run.

3.3.3 SYSTEM FIELD TESTS

(a) The pre-acceptance test procedures, as outlined in the preceding paragraphs, shall apply. Acceptance testing shall include the following:

(b) Acknowledge receipt of all analog and contact inputs, their reliability value and range.

(c) Transmission of contact and analog signals to perform their intended tasks.

(d) Any additional testing which may be found necessary at the time the above is observed.

FINAL ACCEPTANCE

(a) Satisfactory operation of the work by DEPARTMENT shall be interpreted to mean that the work is sufficiently advanced to form a reliable system for system operation; the I/O control loops, software, control programs and peripheral equipment are operating properly; the necessary debugging programs have been performed; data output is reliable and control loops are operational. Equipment which was found to be ineffective or inoperable has been returned or replaced, and checking and calibrating of systems has been completed.

(b) Final acceptance test will be run for 40 days within which cumulative major component down time, consisting of the computer systems and the PLC's, does not exceed 8 hours. Repeat test if 8 hour limit is exceeded.

(c) Written acceptance by DEPARTMENT shall be the starting date of the guarantee period.

(14) 4. TRAINING

4.1 OPERATOR TRAINING

4.1.1 Operator training shall be provided at DEPARTMENT's facility concurrently with system installation on a prearranged formalized basis and shall include the necessary training aids in conjunction with actual work on the equipment supplied. Work shall include complete review of all operating and training manuals and physical application.

4.1.2 Training shall include operation of the SCADA system, set up the changes of control logic and set points, initiation of diagnostic routine, set up and revisions of graphic and report format, system shutdown and restart, etc. It shall also include care, maintenance and tuning of the monitor and screens.

4.1.3 Upon completion of this program, the operators shall be capable of operating the processor equipment, peripherals and I/O equipment to monitor and control the process, system shutdown and restart, diagnose system failure and to initiate routine switch over procedures and component replacement.

4.1.4 This training shall consist of a minimum of two (2) 3 day (8 hours per day) classes for 2 persons in each class. Training manuals shall be provided.

4.2 PROGRAMMER TRAINING

4.2.1 The Contractor shall make arrangement for two persons from DEPARTMENT District 8 to attend software manufacturers' regular programming classes held by the manufacturers or their representatives. The class shall not be less than 1 week for SCADA HMI software(iFIX) and 1

week for PLC programming(Allen-Bradley PLC). The course fee shall be paid for by the Contractor. The manufacturer shall have regular training facilities within 40 miles of Main Pumping Station.

4.3 MAINTENANCE TRAINING

4.3.1 The Contractor shall provide two 1-day on-site maintenance training classes for 2 persons in each class. The maintenance training may be combined with the OPERATOR TRAINING.

(15) 5. GUARANTEE AND ADDITIONAL SERVICES

5.1 All hardware and software furnished under this contract including but not limited to the Microprocessors, accessory peripherals, discrete devices, analog instruments and control devices shall be unconditionally guaranteed for one year from the date of acceptance.

(16) 6. VISITING JOB SITES

6.1 Prospective bidders are urged to visit the job sites in order to familiarize themselves with the extent and the conditions under which the work must be completed. It is the intent that all work requiring additions, revisions, relocation and/or removals of equipment and facilities be fully included in the original bidding; later claims for extra work will not be approved, occasioned by the failure to comply with this request.

END OF THIS SECTION

DIVISION 16 - ELECTRICAL

SECTION 16E - CATHODIC PROTECTION FOR PUMP DISCHARGE HEADERS

1 GENERAL:

1.1 Section Includes

1.1.1 Galvanic Anodes
1.1.2 Accessory Items
1.1.3 Galvanic Cathodic Protection System Installation
1.1.4 Galvanic Cathodic Protection System Testing

1.2 Related Sections

1.2.1 Section 2A – Site Work (Excavating and Backfilling)
1.2.2 Division 15 – Mechanical
1.2.3 Section 16A – General Electrical Provisions
1.2.4 Section 16B - Basic Electrical Materials and Methods

1.3 References

1.3.1 General: The work shall be performed as shown on all Contract Drawings and according to these Specifications. All items shall comply with all pertinent federal, DEPARTMENT, county and local ordinances and codes. Other requirements of the Contract Documents and all pertinent portions of other Sections of the Specifications apply to the Work of this Section as fully as though repeated herein.

1.3.2 National Association of Corrosion Engineers Standard RP-01-69 (Latest Revision) - Recommended Practice - Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

1.3.3 National Association of Corrosion Engineers Standard RP-02-86 (Latest Revision) - Recommended Practice - The Electrical Isolation of Cathodically Protected Pipelines.

1.3.4 American National Standards Institute (ANSI) Publication C2-77 - National Electrical Safety Code.

1.4 Submittals For Review

1.4.1 Section 1A - Submittals: Procedures for submittals.
1.4.2 Product Data: Provide data for all specified items.
1.4.3 Manufacturer's Installation Instructions: Include procedures applicable to installation of anodes, cadwelds, and isolation flanges.

1.5 Submittals At Project Closeout

1.5.1 Section 1A - Contract Closeout: Procedures for submittals.
1.5.2 Certification of proper installation by Corrosion Engineer.
1.5.3 Test Results: Complete potential profile of protected pipeline section, and test results indicating electrical isolation at isolation flanges. Also provide measurement of initial anode current output.

1.6 Operation And Maintenance Data

1.6.1 Submit under provisions of Section 1A.
1.6.2 Provide Corrosion Engineer's recommendations for testing and maintenance.

1.7 Corrosion Engineer

1.7.1 Contractor shall obtain the services of a corrosion engineer to train Contractor's personnel regarding installation, supervise installation, perform required testing, and provide recommendations and operational training to DEPARTMENT.

1.7.2 Qualifications: Corrosion Engineer shall be accredited as a NACE Senior Corrosion Technologist or better, or be able to demonstrate equivalent training and experience. Corrosion Engineer's qualifications shall be submitted to the DEPARTMENT for review and approval.

1.7.3 Corrosion Engineer shall instruct Contractor's personnel regarding all aspects of the installation of the cathodic protection system.

1.7.4 Corrosion Engineer shall be present on site sufficiently during construction to certify the cathodic protection installation.

1.7.5 Corrosion Engineer shall personally perform all required testing.

1.8 System Description

1.8.1 The storm water pumping station discharge piping is presently protected from corrosion by a galvanic cathodic protection system, which is nearing the end of its design life. As part of this project a new cathodic protection system is being installed to replace the existing system.

1.8.2 The Cathodic Protection System consists of seven(7) 17# high potential magnesium anodes, interspersed between the discharge piping of the stormwater pumping station. The piping to be protected is electrically

solated from the stormwater pumps by isolation flanges located at the wafer style check valves, as shown on the Drawings. Electrical isolation is to be provided for the new pumps as described above. Electrical isolation was provided in the existing cathodic protection system, however some of that isolation has failed in the piping to remain in place and must be replaced, as shown on the Drawings. There may also be buried isolation flanges separating the individual discharge pipes from the 72" manifold. In order to ensure protection of the manifold, a cable must be attached to the manifold and connected to the cathodic protection system.

1.8.3 A Test Station is to be installed immediately north of the Pumping Station, west of the new stairwell entrance. This will provide a location to gather the buried system cables prior to entry into the building, and will provide a connection point for system testing utilizing portable meters.

1.8.4 The existing cable connections to the pump discharge pipes, located on the Discharge Floor, may be reused if practical. If the existing cables cannot be salvaged, new cable connections must be cadwelded to the pipelines, adjacent to the existing connections. All cables will be routed to a Control Panel to be located in the new Electrical Control Building. This panel will allow for monitoring the system by staff and adjustment and balancing of the protective current applied to each pipeline segment. The remaining components of the existing cathodic protection system are to be disconnected and abandoned in place.

1.9 Basis of Payment

1.9.1 The work will be paid for at the Contract lump sum price for CATHODIC PROTECTION FOR PUMP DISCHARGE HEADERS.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Anodes

(a) ASARCO, Federated Metals Division
(b) Corrpro
(c) Dow Magnesium
(d) Platt Brothers & Co.
(e) Stuart Steel Protection Corporation

2.1.2 Cable

(a) General Cable Corp.
(b) Raychem
(c) Rome Cable Corp.

2.1.3 Electrical Insulating Flange Fittings

(a) Advance Products & Systems, Inc. (Trojan)
(b) Central Plastics Co. (Jock)
(c) PSI (Linebacker)

2.1.4 Reference Electrodes

(a) Borin Manufacturing (Stelth Model SRE-001-CUY)
(b) Electrochemical Devices, Inc. (EDI Model UL-CUG-CW15)
(c) Tinker & Razor (Direct Burial)

2.2 Materials

2.2.1 Cast High Potential Magnesium Anodes

(a) The anodes shall be magnesium of the alloy designated DOW Galvomag, with the following composition:

Al	0.010% Max.
Mn	0.50 to 1.30%
Cu	0.02% Max.
Ni	0.001% Max.
Fe	0.03% Max.
Other	0.05% each or 0.3% total
Mg	Balance

(b) The anodes shall have a magnesium weight of 17 lbs. Anode dimensions shall be 3-1/2" x 3-1/2" x 25". As shown on the Drawings.

(c) The anodes shall have a galvanized steel core weighing not more than 0.10 pounds per linear foot, cast into the anode, and extending at least 75% of the length of the anode. A 10 feet length of #12 TW insulated lead wire shall be attached to the anode core by silver soldering. The soldered connection shall be fully potted. Anode lead wire insulation color shall be red.

(d) The anodes shall be prepackaged in 25 lbs. of backfill consisting of 75% hydrated gypsum, 20% bentonite, and 5% sodium sulfate. The anode and backfill shall be contained in a heavy weight cotton cloth bag or cardboard box.

2.2.2 Buried Cables: Buried cables shall be a minimum of No. 8 stranded copper cable type CP with HMWPE insulation. The following cabling shall be installed with No. 8 cable:

(a) Anode to Test Station: all shallowly buried horizontal cabling from augured anode installation hole to test station shall be No. 8.

(b) Manifold to Test Station: cable from cadweld connection to 72" Discharge Header to test station shall be No. 8.

(c) Reference Cell to Test Station: all shallowly buried horizontal cabling from augured reference electrode installation hole to test station shall be No. 8.

(d) Buried connection between anode or reference electrode lead and No. 8 cable shall be made with a split bolt connector and sealed with two half-lapped layers of rubber tape followed by two half lapped layers of vinyl tape, as shown on the drawings.

(e) Cables shall be installed a minimum of 18" below grade.

2.2.3 Braze Covers: Covers shall be specifically designed for repairing coating around thermite brazes. The covers shall consist of a three part assembly, including a protective plastic dome, a base of unbacked elastomeric tape, and an elastomeric filler. Braze covers shall be Handy Cap 2 as manufactured by Royston Laboratories, Inc. or approved equal.

2.2.4 Control Panel: A Control Panel, constructed as laid out in the Drawings, shall be installed to allow the DEPARTMENT to monitor the Cathodic Protection System at frequent intervals. The Control Panel shall consist of the following components:

(a) Enclosure: enclosure shall be a NEMA 12 painted steel enclosure, approximately 18"H×18"W×6"D, with hinged front door and mounting hardware for an internal component mounting panel. Enclosure door shall be equipped with a latching mechanism with provisions for locking.

(b) Mounting Panel: component mounting panel shall be acrylic or similar insulating material, minimum 1/8" thick. Panel is to be mounted at the front of the enclosure and completely fill the opening. All connections are to be made behind the mounting panel, and all operable components are to be accessible from the front. A suggested panel layout is shown on the Drawings. Contractor may propose an alternate layout, but the general arrangement and component labeling must remain the same. Labels may either be engraved into the mounting panel and filled with a contrasting color, or separate nameplates as described in paragraph 2.2.8. If separate nameplates are provided, they may not be glued in place, but must be attached with stainless steel screws.

(c) Potential Meter: a panel mounting voltmeter, minimum 2½"×2½", with a range of 0-2 volts and a minimum input impedance of 1megaohm. Meter dial is to be colored or otherwise marked, as approved by DEPARTMENT, to indicate voltages between 0 and 0.85 as unacceptable, and voltages between 0.85 and 1.20 as acceptable.

(d) Current Meter: a panel mounting ammeter, minimum 2½"×2½", with a range of 0-100 milliamps and a maximum resistance of 0.1 ohms.

(e) Selector Switches:

1) Pipeline selector: three deck, ten(10) active position rotary selector switch. Two(2) decks to be NO contacts and one(1) deck to be NC contacts.
2) Reference selector: single deck, four(4) active position rotary selector switch with NO contacts.

(f) Push-button Switches:

1) Polarized potential switch: momentary contact, SPST, NC pushbutton switch. Minimum pushbutton diameter ½ inch.
2) Total current switch: momentary contact pushbutton switch with three sets of contacts, two(2) NC and one(1) NO. Minimum pushbutton diameter ½ inch.

(g) Rheostats: ceramic body, high-grade resistance alloy windings, vitreous enamel coating, metal spring contact arm, metal graphite composition and solder coated terminals. Rheostats shall have a total resistance of 25 ohms and a minimum wattage rating of ½ watt. Rheostat shaft shall be slotted and mount such that the face of the rheostat shaft is flush with the front of the mounting panel.

(h) Nameplate: the Control Panel is to be supplied with a nameplate in accordance with paragraph 2.2.8. Nameplate is to read, “CATHODIC PROTECTION CONTROL PANEL” in letters ½” high. Nameplate is to be mounted on the front of the enclosure door with stainless steel screws.

2.2.5 Electrical Insulating Flange Fittings: Electrical insulating fittings shall consist of a full face phenolic gasket of minimum 1/8" thickness with integral o-ring seal on each face, bolt insulating sleeves, phenolic insulating washers, and steel following washers. Insulating washers shall be installed on both sides of the flange. The completed flanges shall satisfactorily pass the test, when using the "megger" method listed in the testing section of this Specification. Insulating flanges shall be as shown in the detail included in the Drawings.

2.2.6 Electrical Tape:

(a) Rubber Tape: Shall be used for primary insulation of cable splices. Tape shall be high and low voltage insulating, soft self-fusing rubber. Tape shall be ¾” wide and 30 mil thick. Tape shall be Scotch 23 Rubber Tape as manufactured by 3M Corp. or approved equal.

(b) Vinyl Tape: Shall be used for protective jacketing of splices. Tape must be highly conformable in all weather applications, flame retardant UL listed and CSA certified. Tape shall be Scotch Super 33+ Premium Vinyl Electrical Tape as manufactured by 3M Corp. or approved equal.

2.2.7 Lead Wires:

(a) Lead wires shall be #10 stranded copper conductors or #12 solid copper conductors with TW insulation, as designated on the Drawings and listed below. Test leads shall be of sufficient

length and provided with sufficient slack to allow the ends to be removed twelve inches from the test station. Lead wires shall be installed as follows.

1) Anode leads: #12
2) Reference Electrode Leads: #12
3) Anode leads to test station circuitboard: #12
4) Reference Electrode cable to test station circuitboard: #12
5) 72” pipeline cable to test station circuitboard: #10
6) Test station circuitboard to control panel: #10
7) Pipelines to control panel: #10

(b) Lead wires shall be provided with colored insulation to provide color coding as follows:

1) Anodes: Red
2) Pipelines Black
3) Reference Electrodes Green

(c) Prior to burial or insertion into conduit each lead wire or buried cable shall be identified at each end with an alphanumeric label, uniquely identifying the lead wire, to prevent mis-wiring at the lead wire terminations. Should it be necessary to shorten the lead wire the new end must be immediately re-labeled.

2.2.8 Nameplates: Nameplates shall be constructed of laminated plastic material with engraved black letters on a yellow background. Nameplates shall list: DEPARTMENTs Name, Type of test station (i.e. Insulating Flange or Anode), and pipeline station. Each nameplate shall be 1" x 3". Nameplates shall be attached with stainless steel screws to the test station lids.

2.2.9 Reference Electrode: For the purpose of monitoring the effectiveness of the cathodic protection system, Copper/Copper Sulphate permanent reference electrodes shall be installed. The reference electrodes test lead shall be terminated in the test station. The reference electrode shall be Tinker Razor "Direct Burial" model or approved equal.

2.2.10 Split-bolt Connectors: Anode lead to buried cable wire connections shall be made with split-bolt connectors. Additionally, buried cables shall be connected to a length of #10 TW wire within the outdoor test station to provide flexibility when lifting the test station lid. Split-bolt connectors shall be LOCKTITE Model 3T or approved equal.

2.2.11 Test Stations: Test stations shall be concrete handholes with bolt down covers. The handholes shall be Heavy Duty Handhole (Concrete) in accordance with I.D.O.T. Standard No. 2368-1.

(a) Test station frame and lid shall be Neenah R-6660-1 "Bolt Down" Series Model R-6660-JH with type G handle and Type E exposed hex head bolts.

(b) Each test station shall be equipped with an engraved laminated plastic nameplate as shown in the Drawings. The nameplates shall be attached with stainless steel screws to the test station lid.

(c) Each test station shall be equipped with a circuitboard for connection of the various cables and test leads

2.2.12 Thermite Brazes: The brazing system shall be Cadweld manufactured by Erico Corp. or approved equal. The braze shall be made utilizing molds and thermite mixture of the size and type recommended by the manufacturer for the purpose.

3 EXECUTION

3.1 Initial Testing - NOT USED

3.2 Installation

3.2.1 General

(a) All workmanship shall be of the highest quality. The installation shall conform to the latest applicable industry standards. The Contractor shall furnish personnel who are specifically trained in the installation of corrosion control equipment, or personnel who are supervised by an accredited NACE Senior Corrosion Technologist to instruct the field personnel in proper construction techniques.

(b) The Contractor is advised that this project is to be constructed in proximity to other utilities in common rights-of-way. Some but not necessarily all utilities are shown on the Drawings. The utilities shown have been located based on the information available to the DEPARTMENT and Engineer, neither the DEPARTMENT or Engineer makes any representation regarding the accuracy of the locations shown. The Contractor is solely responsible for identifying, locating and protecting any utilities in the vicinity of the work.

(c) Much of the work is to be constructed in the vicinity of areas which must remain in use during construction. The Contractor must follow all applicable regulations and best practices regarding safety and traffic control.

3.2.2 Anode Installation

(a) Auger anode holes, minimum 12" diameter, at the locations indicated to a depth of approximately 20 feet. Anodes may be slightly relocated to avoid underground or overhead obstacles, but spacing from pipeline must be maintained

(b) Lower anode into augered hole utilizing a rope sling or similar method. Anode must not be dropped and under no circumstances may the anode lead wire be used to support any load. Stake anode lead wire for backfilling.

(c) Pour five (5) gallons of water into augered hole to wet anode.

(d) Backfill augered hole with excavated material. Backfill in six inch lifts, firmly tamping each lift to minimize future settlement. Exercise care to prevent damaging anode lead, and provide sufficient slack in lead to allow for any post-installation movement or settling.

(e) Connect anode lead to a #8 cable and route to test station.

3.2.3 Cable Installation

(a) Anodes

1) Connect the anode locations and test station location with a three (3) feet deep trench, utilizing a Ditch-Witch or similar trenching machine to minimize surface disturbance.

2) Measure out sufficient cable length for installation. Cable is to be one continuous length without splices. At each anode location remove approximately one inch of insulation from the cable. Cut anode lead to proper length and remove approximately one-half inch of insulation from the end of the anode lead wire. Connect anode lead wire to cable utilizing a split-bolt connector as shown on the drawings. Fully tighten split-bolt using two (2) wrenches, do not place any strain on the anode lead or the cable during tightening and leave cable in a straight condition without kinks or bends.
3) Seal connection water tight with two(2) half-lapped layers of rubber tape, followed by two(2) half-lapped layers of plastic tape.
4) Install completed cable in trench and backfill with excavated material. Firmly tamp entire trench to minimize future settlement.

(b) 72” Pipeline Lead

1) Core drill concrete wall adjacent to pipeline to allow cable to pass through.
2) Connect the cored hole location and test station location with a three (3) feet deep trench, utilizing a Ditch-Witch or similar trenching machine to minimize surface disturbance.
3) Measure out sufficient quantity of #8 cable to reach from pipeline to test station location, allowing for slack and additional wire required at test station.
4) Thermite braze test lead to pipeline.
5) Install completed cable in trench and backfill with excavated material. Firmly tamp entire trench to minimize future settlement.

(c) Reference Electrodes

1) Connect the reference electrode locations and test station location with a three (3) feet deep trench, utilizing a Ditch-Witch or similar trenching machine to minimize surface disturbance.
2) Measure out sufficient #8 cable length for installation. Cable is to be one continuous length without splices. At each reference electrode location remove approximately one inch of insulation from the cable. Cut reference electrode lead to proper length and remove approximately one-half inch of insulation from the end of the reference electrode lead wire. Connect reference electrode lead

wire to cable utilizing a split-bolt connector as shown on the drawings. Fully tighten split-bolt using two (2) wrenches, do not place any strain on the reference electrode lead or the cable during tightening and leave cable in a straight condition without kinks or bends.

3) Seal connection water tight with two(2) half-lapped layers of rubber tape, followed by two(2) half-lapped layers of plastic tape.

4) Install completed cable in trench and backfill with excavated material. Firmly tamp entire trench to minimize future settlement.

3.2.4 Reference Electrode Installation

(a) Auger anode holes, minimum 8" diameter, at the locations indicated to a depth of approximately 8 feet. Reference electrodes may be slightly relocated to avoid underground or overhead obstacles, but must remain in approximately the locations shown.

(b) Lower reference electrode into augered hole. Stake reference electrode lead wire for backfilling.

(c) Backfill augered hole with excavated material. Backfill in six inch lifts, firmly tamping each lift to minimize future settlement. Exercise care to prevent damaging reference electrode or lead wire, and provide sufficient slack in lead to allow for any post-installation movement or settling.

(d) Connect reference electrode lead to a #8 cable and route to test station.

3.2.5 Test Station Installation

(a) The test station is generally located on the Drawings, the specific location shall be determined in the field by the Engineer. Test station is to be installed with the hinge to the north.

(b) Excavate to the extent necessary, and thoroughly compact the soil beneath the test station to minimize future settlement. Install test station level and flush with grade.

(c) Route test leads and anode leads into test station utilizing conduit stub provided.

(d) Make lead wire connections as shown on the Drawings or indicated elsewhere in this specification.

(e) Place leads in test station in a neat and orderly manner, and leave test station with lid closed and bolted down.

3.2.6 Control Panel Installation

(a) Mount Control Panel on wall at eye level, at the location designated on the Drawings. Connect conduit from Pump Station.

(b) Route wires through conduit from pipelines and test station.

(c) Cut wires to proper length, re-label and attach to designated terminals in Control Panel.

(d) Adjust rheostats as indicated in paragraph 3.3.

3.2.7 Thermite Brazing

(a) The Contractor shall clean an area approximately 2" x 2", at the location of each braze, by grinding or other approved means to remove all coating, scale and other foreign material and provide a clean surface for the braze

(b) Remove sufficient insulation from the cable to be connected to allow full penetration into the brazing mold without leaving more than 1/4" of exposed bare wire.

(c) All leads No. 10 and smaller shall be provided with a copper sleeve to create sufficient bulk for brazing. The copper sleeve shall be lightly crimped to prevent movement during the brazing process.

(d) Once the braze has cooled the slag shall be removed and the weld tested, in the presence of the Engineer, by a glancing blow with a 1 lb. hammer. Defective brazes shall be removed and remade. Manipulation and pulling of the test lead shall not be used as a method of testing the braze.

(e) Any brazes not tested in the presence of the Engineer shall be excavated and retested or remade.

(f) The completed braze and surrounding area shall be covered with a preformed braze cover to a quality equal or better than the original pipe coating.

3.2.8 Existing Buried Connection Boxes:

(a) Contractor shall locate all eight(8) existing connection boxes, as shown on the Drawings.

(b) Excavate to the top of each connection box, as necessary.

(c) Open connection box and separate test leads, removing any and all connectors.

(d) Cut off any exposed copper wire from each lead wire.

(e) Individually tape or otherwise seal cut end of each lead wire.

(f) Return wires to connection box, close lid and rebury as appropriate.

3.2.9 Restoration

Restore all areas disturbed by the work to their original condition as appropriate and acceptable to the DEPARTMENT.

3.3 Completion Testing

3.3.1 Upon completion of pipeline construction pipeline continuity and isolation shall be tested in accordance with the specifications. During pipeline continuity testing the anodes shall be disconnected. Any deficiencies in either continuity or isolation shall be promptly repaired in a manner acceptable to the Engineer.

3.3.2 Following connection of the anodes the Contractor's Corrosion Engineer shall measure a pipe-to-soil potential profile over the protected pipeline. The profile shall be measured both with the anodes connected and disconnected and both measured potentials shall be reported for each test point.

3.3.3 Measure and report current output of each individual anode and current supplied to each isolated section of pipeline.

3.3.4 Utilizing the rheostats located in the Control Panel, adjust the current supplied to each isolated pipeline section to achieve a polarized pipe-to-soil potential of between –0.850 V and –1.000 V vs $Cu/CuSO_4$. Report final currents and pipe-to-soil potentials.

4 TESTING

4.1 General

4.1.1 The following listed tests, as a minimum, shall be performed by the Contractor's Corrosion Engineer. At appropriate times during the project reports shall be submitted describing the testing to date, including all field data taken and any recommendations for further action.

4.1.2 Should the results of any specified test procedures prove inconclusive, the Corrosion Engineer may supplement the test with a method of his own choosing, subject to approval by the DEPARTMENT.

4.1.3 At the conclusion of the project the results of all tests (with their interpretations and recommendations) shall be submitted in a written report to the Engineer.

4.2 Specific Tests

4.2.1 Soil Resistivity: NOT USED

4.2.2 Continuity: Following the complete installation and backfilling of the pipeline, a survey shall be performed by the Contractor's Corrosion Engineer utilizing the "Null Method" of short location with a pipe locator to locate any inadvertent contacts with underground metallic objects, to confirm pipeline continuity between insulating flanges, and to confirm that the insulating flanges are still providing effective isolation. Any bond or isolation joint found to be ineffective shall be replaced or repaired by the Contractor at no additional cost to the DEPARTMENT.

4.2.3 Flange Isolation: Prior to backfilling at the location of all isolation flanges, test shall be performed using a "Megger" to determine the effectiveness of the flange insulation. The "Megger" test employs a device which impresses a voltage across the isolation fitting and measures either the voltage drop across the fitting, or the presence or absence of a current flow. Either a voltage drop or the absence of a current flow, indicate isolation. Use of a welder or current source of sufficient capacity to damage the flange insulation will not be permitted.

4.2.4 Pipe-to-soil Potential: Following completion and connection of the cathodic protection system the Contractor's Corrosion Engineer shall perform a pipe-to-soil potential profile over the protected length of the pipeline. Potentials shall be measured relative to a copper/copper sulphate reference electrode, and utilizing a potentiometer voltmeter. Potentials are to be measured at the ground surface directly above the pipeline. Potential measurements shall be made at no greater than 100 feet intervals. In the event that potentials significantly different than the

average are measured at a point, potential measurements at no greater than 5 feet intervals shall be taken to delineate the extent of the unusual potentials.

4.2.5 Current Measurement: Current being produced by each anode as well as current received by each pipe segment is to be measured. These currents may be measured either by measurement of the voltage drop across a calibrated shunt utilizing a high input impedance voltmeter, or by insertion of a zero-resistance ammeter into the circuit being measured.

5 SPECIAL CONDITIONS – NONE

6 ACCEPTANCE

6.1 The DEPARTMENT will employ a Corrosion Specialist independent of the Contractor's Corrosion Engineer. Upon receipt of the Contractor's Corrosion Engineer's report the DEPARTMENT shall instruct this Corrosion Specialist to perform a survey similar to that required in paragraph 3.3. Final acceptance of the cathodic protection installation shall be contingent upon the results of the survey indicating satisfactory anode installation, and pipeline continuity and isolation.

6.2 If additional surveys are required because of system deficiencies during the initial survey, then these additional surveys shall be regarded as excess engineering and the costs borne by the Contractor.

END OF SECTION

DRILLED SHAFTS
Effective: May 1, 2001 Revised: February 7, 2005

Description. This work shall consist of all labor, materials, equipment and services necessary to complete the drilled shaft installation according to the details and dimensions shown on the plans, this specification and as directed by the Engineer.

Submittals. The Contractor shall submit the following:

(a) Qualifications. At the time of the preconstruction conference, the Contractor shall provide the following documentation:

(1) A list containing at least 3 projects completed within the 3 years prior to this project's bid date which the Contractor performing this work has installed drilled shafts of similar diameter, length and site conditions to those shown in the plans. The list of projects shall contain names and phone numbers of owner's representatives who can verify the Contractor's participation on those projects.

(2) Name and experience record of the drilled shaft supervisor, responsible for all facets of the shaft installation, and the drill operator(s) who will be assigned to this project. The supervisor and driller shall each have a minimum of 3 years experience in the construction of drilled shafts.

(3) A signed statement that the drilled shaft supervisor has inspected both the project site and all the subsurface information available. In addition to the subsurface information in the contract documents, rock core specimens and/or geotechnical reports, when available, should be requested for evaluation.

(b) Installation Procedure. A submittal detailing the installation procedure will be required for all drilled shafts, unless directed otherwise by the Engineer. The Contractor, meeting the above qualifications, shall prepare the installation procedure, addressing all items shown below and will be responsible for directing all aspects of the shaft construction. The installation procedure shall be submitted to the Engineer at least 45 days prior to drilled shaft construction and shall address each of the following items:

(1) List of proposed equipment to be used including cranes, drill rigs, augers, belling tools, casing, core barrels, bailing buckets, final cleaning equipment, slurry equipment, tremies or concrete pumps, etc.

(2) Details of the overall construction operation sequence, equipment access, and the sequence of individual shaft construction within each substructure bent or footing group. The submittal shall address the Contractor's proposed time delay and/or the minimum concrete strength necessary before initiating a shaft excavation adjacent to a recently installed drilled shaft.

(3) A step by step description of how the Contractor anticipates the shaft excavation to be advanced based on their evaluation of the subsurface data and conditions expected to be encountered. This sequence shall note the method of casing advancement,

anticipated casing lengths, tip elevations and diameters, the excavation tools used and drilled diameters created. The Contractor shall indicate whether wet or dry drilling conditions are expected or if the water table will be sealed from the excavation.

(4) When slurry is proposed, details covering the measurement and control of the hardness of the mixing water, agitation, circulation, de-sanding, sampling, testing and chemical properties of the slurry shall be submitted.

(5) Method(s) and sequence proposed for the shaft cleaning operation as well as recommendations on how the shaft excavation will be inspected under the installation conditions anticipated.

(6) Details of reinforcement placement including cage centralization devices to be used and method to maintain proper elevation and plan location of cage within the shaft excavation during concrete placement. The method(s) of adjusting the cage length if rock is encountered at an elevation other than as estimated in the plans.

(7) Details of concrete placement including proposed operational procedures for free fall, tremie or pumping methods. The sequence and method of casing removal shall also be stated along with the top of pour elevation, and method of forming through water above streambed.

(8) The proposed concrete mix design(s).

The Engineer will evaluate the drilled shaft installation plan and notify the Contractor of acceptance, or if additional information is required, or if there are concerns with the installation's effect on the existing or proposed structure(s).

Materials. The materials used for the construction of the drilled shaft shall satisfy the following requirements:

(a) The drilled shaft portland cement concrete shall be according to Section 1020, except the mix design shall be as follows:

(1) A Type I or II cement shall be used at 395 kg/cu m (665 lb/cu yd). When specified in the plans that soil and ground water sulfate contaminates exceed 500 parts per million, a Type V cement shall be required.

(2) Class C or F fly ash may replace Type I or II cement. The cement replacement shall not exceed 15 percent by mass (weight) at a minimum replacement ratio of 1.5:1. The fly ash shall not be used in combination with ground granulated blast- furnace slag.

(3) Grade 100 or 120 ground granulated blast-furnace slag may replace Type I or II cement. The cement replacement shall not exceed 25 percent by mass (weight) at a minimum replacement ratio of 1:1. The ground granulated blast-furnace slag shall not be used in combination with fly ash.

(4) The maximum water/cement ratio shall be 0.44.

(5) The mortar factor shall be a value which produces a coarse aggregate content comprising between 55 and 65 percent of total aggregate by mass (weight).

(6) The slump at point of placement shall be 175 mm ± 25 mm (7 ± 1 in.). If concrete is placed to displace drilling fluid, or against temporary casing, the slump shall be 200 mm ± 25 mm (8 ± 1 in.) at point of placement. The concrete mix shall be designed to remain fluid throughout the anticipated duration of the pour plus 1 hour.

(7) An air entraining admixture shall be required and the air content range shall be 4.0 to 7.0 percent.

(8) The minimum compressive strength shall be 27,500 kPa (4000 psi) at 14 days. The minimum flexural strength shall be 4,650 kPa (675 psi) at 14 days.

(9) A retarding admixture shall be required.

(10) A water-reducing or high range water-reducing admixture shall be required.

(11) An accelerating admixture may be used with the permission of the Engineer in extraordinary situations.

(12) The coarse aggregate shall be a CA 13, CA 14, CA 16 or a blend of these gradations. The fine aggregate shall consist of sand only according to Article 1003.01(a).

At the Engineers discretion, and at no additional cost to the Department, the Contractor may be required to conduct a minimum 0.76 cu m (1 cu yd) trial batch to verify the mix design.

(b) The sand-cement grout mix used to fill any visible gaps, which may exist between the permanent casing and either the drilled excavation or temporary casing, shall be as follows:

(1) A Type I or II cement shall be used at 110 kg/cu m (185 lb/cu yd). When specified in the plans that soil and ground water sulfate contaminates exceed 500 parts per million, a Type V cement shall be required. The cement shall be according to Section 1001.

(2) The fine aggregate shall be according to Articles 1003.01 and 1003.02.

(3) The water shall be according to Section 1002.

(4) The maximum water shall be sufficient to provide a flowable mixture with a typical slump of 254 mm (10 in.).

(c) Reinforcement shall be according to Section 508 of the Standard Specifications.

(d) Drilling slurry, when required, shall consist of a polymer or mineral base material. Mineral slurry shall have both a mineral grain size that will remain in suspension with sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. The

percentage and specific gravity of the material used to make the suspension shall be sufficient to maintain the stability of the excavation and to allow proper concrete placement. For polymer slurry, the calcium hardness of the mixing water shall not exceed 100 mg/L.

(e) Permanent casing, when required, shall be fabricated from steel satisfying ASTM A252 Grade 2, produced by electric seam, butt, or spiral welding to satisfy the outside diameter(s) and lengths shown in the contract plans or as shown in the Contractor's installation procedure. The minimum wall thickness shall be as required to resist the anticipated installation and dewatering stresses, as determined by the Contractor, but in no case less than 6 mm (1/4 in.).

Equipment. The drilling equipment shall have adequate capacity, including power, torque and down thrust, to create a shaft excavation of the maximum diameter specified to a depth of 20 percent beyond the depths shown on the plans. Standby equipment of sufficient capacity shall be available so that there will be no delay in placing of the concrete once the operation has started. Concrete equipment shall be according to Article 1020.03 of the Standard Specifications.

Construction Requirements. Excavation for drilled shaft(s) shall not proceed until written authorization is received from the Engineer. The Contractor shall furnish an installation log for each shaft installed. Excavation by blasting shall not be permitted unless authorized in writing by the Engineer.

No shaft excavation shall be made within 4 shaft diameters center to center of a shaft with concrete that has a compressive strength less than 10,342 kPa (1500 psi) unless otherwise approved in the Contractor's installation procedure. The site-specific soil strengths and installation methods selected will determine the actual required minimum spacing, if any, to address vibration and blow out concerns.

Materials removed or generated from the shaft excavations shall be disposed of by the Contractor according to Article 202.03 of the Standard Specifications.

The Contractor's methods and equipment shall be suitable for the anticipated conditions and the following requirements noted below:

(a) Construction Tolerances. The following construction tolerances shall apply to all drilled shafts unless otherwise stated in the contract documents:

(1) The center of the drilled shaft shall be within 75 mm (3 in.) of the plan station and offset at the top of the shaft.

(2) The center of the reinforcement cage shall be within 38 mm (1 1/2 in.) of plan station and offset at the top of the shaft.

(3) The out of vertical plumbness of the shaft shall not exceed 1.5 percent.

(4) The out of vertical plumbness of the shaft reinforcement cage shall not exceed 0.83 percent.

(5) The top of the reinforcing steel cage shall be no more than 25 mm (1 in.) above and no more than 75 mm (3 in.) below the plan elevation.

(6) The top of the shaft shall be no more than 25 mm (1 in.) above and no more than 75 mm (3 in.) below the plan elevation.

(7) Excavation equipment and methods used to complete the shaft excavation shall have a nearly planar bottom. The cutting edges of excavation equipment used to create the bottom of shafts in rock shall be normal to the vertical axis of the shaft within a tolerance of 6.25 percent.

(b) Construction Methods. The construction of drilled shafts may involve the use of one or more of the following methods to support the excavation during the various phases of shaft drilling, cleaning and concrete placement dependent on the site conditions encountered. The following are general descriptions indicating the conditions when these methods may be used:

(1) Dry Method. The dry method consists of drilling the shaft excavation, removing accumulated water and loose material from the excavation, placing the reinforcing cage, and concrete in a predominately dry excavation. This method shall be used only at sites where the groundwater and soil conditions are suitable to permit the drilling and dewatering of the excavation without causing excessive water infiltration, boiling, squeezing, or caving of the shaft side walls. This method allows the concrete placement by tremie or concrete pumps, or if the excavation can be dewatered, the concrete can be placed by free fall within the limits specified for concrete placement.

(2) Wet Method. The wet construction method may be used at sites where dewatering the excavation would cause collapse of the shaft sidewalls or when the volume and head of water flowing into the shaft is likely to contaminate the concrete during placement resulting in a shaft defect. This method uses water or slurry to maintain stability of the shaft perimeter while advancing the excavation. After the excavation is completed, the water level in the shaft is allowed to seek equilibrium, the base is cleaned, the reinforcing cage is set and the concrete is discharged at the base using a tremie pipe or concrete pump, displacing the drilling fluid upwards.

(3) Temporary Casing Method. Temporary casing shall be used when either the wet or dry methods provide inadequate support to prevent sidewall caving or ensure excessive deformation of the hole. Temporary casing may also be used to reduce the flow of water into the excavation to allow dewatering, adequate cleaning and inspection, or to insure proper concrete placement. Temporary casing left in place may constitute a shaft defect; no temporary casing will be allowed to remain permanently in place without the specific approval of the Engineer.

Before the temporary casing is broken loose, the level of concrete in the casing shall be a minimum of 1.5 m (5 ft) above the bottom of the casing. After being broken loose and as the casing is withdrawn, additional concrete shall be added to maintain sufficient head so that water and soil trapped behind the casing can be displaced upward and discharged at the ground surface without contaminating the concrete in the shaft or at the finished construction joint.

(4) Permanent Casing Method. When called for on the plans or proposed as part of the Contractor's accepted installation procedure, the Contractor shall install a permanent casing of the diameter, length, thickness and strength specified. When permanent casings are used, the lateral loading design requires intimate contact between the casing and the surrounding soils. If the installation procedure used to set the permanent casing results in annular voids between the permanent casing and the drilled excavation, the voids shall be filled with a sand-cement grout to maintain the lateral load capacity of the surrounding soil, as assumed in the design. No permanent casing will be allowed to remain in place beyond the limits shown on the plans without the specific approval of the Engineer.

(5) Removable Forms. When the shaft extends above streambed through a body of water and permanent casing is not shown, the portion above the streambed shall be formed with removable casings, column forms, or other forming systems as approved by the Engineer. The forming system shall not scar or spall the finished concrete or leave in place any forms or casing within the removable form limits as shown on the plans unless approved as part of the installation procedure. The forming system shall not be removed until the concrete has attained a minimum compressive strength of 17,237 kPa (2500 psi) and cured for a minimum of 72 hours. For shafts extending through water, the concrete shall be protected from water action after placement for a minimum of 7 days.

(c) Slurry. If the Contractor proposes to use a method of slurry construction, it shall be submitted with the installation plan. During construction, the level of the slurry shall be maintained at a height sufficient to prevent caving of the hole. In the event of a sudden or significant loss of slurry to the hole, the construction of that foundation shall be stopped and the shaft excavation backfilled or supported by temporary casing, until a method to stop slurry loss, or an alternate construction procedure has been approved by the Engineer.

(d) Obstructions. Obstructions shall be defined as any object (such as but not limited to, boulders, logs, old foundations etc.) that cannot be removed with normal earth drilling procedures but requires special augers, tooling, core barrels or rock augers to remove the obstruction. When obstructions are encountered, the Contractor shall notify the Engineer and upon concurrence of the Engineer, the Contractor shall begin working to core, break up, push aside, or remove the obstruction. Lost tools or equipment in the excavation as a result of the Contractor's operation shall not be defined as obstructions and shall be removed at the Contractor's expense.

(e) Top of Rock. The actual top of rock will be defined as the point when material is encountered which can not be drilled with a conventional earth auger and/or underreaming tool, and requires the use of special rock augers, core barrels, air tools, blasting or other methods of hand excavation.

(f) Sidewall overreaming. Sidewall overreaming shall be required when the sidewall of the hole is determined by the Engineer to have either softened due to the excavation methods, swelled due to delay in concreting, or degraded because of slurry cake buildup. It may also be required to correct a shaft excavation which has been drilled out of tolerance. Overreaming thickness shall be a minimum of 13 mm (1/2 in.). Overreaming may be accomplished with a grooving tool, overreaming bucket or other approved equipment. Any extra concrete needed as a result of the overreaming shall be furnished and installed at the Contractor's expense.

(g) Excavation Inspection. The Contractor shall be responsible for verification of the dimensions and alignment of each shaft excavation as directed by the Engineer. Unless otherwise specified in the contract documents, the Contractor's cleaning operation shall be adjusted so that a minimum of 50 percent of the base of each shaft shall have less than 13 mm (1/2 in.) of sediment or debris at the time of placement of the concrete. The maximum depth of sediment or any debris at any place on the base of the shaft shall not exceed 38 mm (1 1/2 in.).

Shaft cleanliness will be determined by the Contractor using the methods as submitted in their installation procedure. Visual inspection coupled with the use of a weighted tape may also be used to confirm adequate cleanliness.

(h) Design Modifications. If the top of rock elevation differs from that shown on the plans by more than 10 percent of the length of the shaft above the rock, the Engineer shall be contacted to determine if any drilled shaft design changes may be required. In addition, if the type of soil or rock encountered is not similar to that shown in the subsurface exploration data, the Contractor may be required to extend the drilled shaft length(s) beyond those specified in the plans. In either case, the Engineer will determine if revisions are necessary and the extent of the modifications required.

(i) Reinforcement Cage Construction and Placement. The shaft excavation shall be cleaned, inspected and accepted prior to placing the reinforcement cage. The reinforcement cage shall be completely assembled prior to drilling and be ready for adjustment in length as required by the conditions encountered. The cage shall be lifted using multiple point sling straps or other approved methods to avoid cage distortion or stress. Additional cross frame stiffeners may also be required for lifting or to keep the cage in proper position during lifting and concrete placement.

The Contractor shall attach suitable centralizes to keep the cage away from the sides of the shaft excavation and ensure that at no point will the finished shaft have less than the minimum concrete cover(s) shown on the plans. The cage centralizes or other approved non-corrosive spacing devices shall be used at sufficient intervals (near the bottom and at intervals not exceeding 3 m (10 ft) throughout the length of the shaft) to ensure proper cage alignment and clearance for the entire shaft.

If the top of rock encountered is deeper than estimated in the plans, and/or if the conditions differ such that the length of the shaft is increased, additional longitudinal bars shall be either mechanically spliced or lap spliced to the lower end of the cage and confined with either hoop ties or spirals to provide the additional length. If the additional shaft length is less than the lap splice shown, subject to the approval of the Engineer, a mechanical splice may be used in lieu of the lap splice in order to take advantage of or utilize that lap length in the extension of the shaft reinforcement. The Contractor shall have additional reinforcement available or fabricate the cages with additional length as necessary to make the required adjustments in a timely manner as dictated by the encountered conditions. The additional reinforcement may be non-epoxy coated at the option of the Contractor. Any reinforcement fabricated in advance but not incorporated into the installed shaft(s) shall not be paid for but shall remain the property of the Contractor.

(j) Concrete placement. Concrete work shall be performed according to the applicable portions of Section 503 of the Standard Specifications and as specified herein.

Concrete shall be placed as soon as possible after reinforcing steel is set and secured in proper position. The pour shall be made in a continuous manner from the bottom to the top elevation of the shaft as shown on the contract plan or as approved in the Contractor's installation procedure. Concrete placement shall continue after the shaft excavation is full and until good quality, uncontaminated concrete is evident at the top of shaft. The elapsed time from the beginning of concrete placement in the shaft to the completion of the placement shall not exceed 2 hours. The Contractor may request a longer placement time provided the concrete mix maintains the minimum slump requirements over the longer placement time as demonstrated by trial mix and slump loss tests. Concrete shall be placed either by free fall, or through a tremie or concrete pump subject to the following conditions:

(1) The free fall placement shall only be permitted in shafts that can be dewatered to ensure less than 75 mm (3 in.) of standing water exist at the time of placement without causing side wall instability. The maximum height of free fall placement shall not exceed 18.3 m (60 ft). Concrete placed by free fall shall fall directly to the base without contacting either the rebar cage or hole sidewall. Drop chutes may be used to direct concrete to the base during free fall placement.

Drop chutes used to direct placement of free fall concrete shall consist of a smooth tube of either one continuous section or multiple pieces that can be added and removed. Concrete may be placed through either a hopper at the top of the tube or side openings as the drop chute is retrieved during concrete placement. The drop chute shall be supported so that the free fall does not exceed 18.3 m (60 ft) at all times and to ensure the concrete does not strike the rebar cage. If placement cannot be satisfactorily accomplished by free fall in the opinion of the Engineer, the Contractor shall use either tremie or pumping to accomplish the pour.

(2) Tremies shall consist of a tube of sufficient length, weight, and diameter to discharge the initial concrete at the base of the shaft. The tremie shall be according to Article 503.08 of the Standard Specifications and contain no aluminum parts that may have contact with the concrete. The inside and outside surfaces of the tremie shall be clean and smooth to permit both flow of concrete and unimpeded withdrawal during concrete placement.

(3) Concrete pumps: Pumps and lines may be used for concrete placement and shall have a minimum 100 mm (4 in.) diameter.

The tremie or pump lines used for wet method concrete placement shall be watertight and not begin discharge until placed within 250 mm (10 in.) of the shaft base. Valves, bottom plates or plugs may be used only when they can be removed from the excavation or be of a material approved by the Engineer that will not cause a defect in the shaft if not removed. The discharge end shall be immersed at least 1.5 m (5 ft) in concrete at all times after starting the pour. Sufficient concrete head shall be maintained in the tremie at all times to prevent water or slurry intrusion in the shaft concrete.

If at any time during the concrete pour in the "wet" hole, the tremie or pump line orifice is removed from the fluid concrete and discharges through drilling fluid or water above the rising concrete level, the shaft may be considered defective.

Vibration of concrete is not recommended when placed while displacing drilling fluid or water. In dry excavations, vibration is allowed only in the top 3 m (10 ft) of the shaft.

Conformity with Contract. In addition to Article 105.03, the Contractor shall be responsible for correcting all out of tolerance excavations and completed shafts as well as repairing any defects in the shaft to the satisfaction of the Engineer at no additional cost to the Department. No time extensions will be allowed to repair or replace unacceptable work. When a shaft excavation is completed with unacceptable tolerances, the Contractor will be required to submit for approval his/her proposed corrective measures. Any proposed design modification with computations submitted by the Contractor shall be signed and sealed by an Illinois licensed Structural Engineer.

Method of Measurement. The items Drilled Shaft in Soil and Drilled Shaft in Rock, will be measured for payment and the length computed in meters (feet) for all drilled shafts installed according to the plans, specifications, and accepted by the Engineer. The length shall be measured at each shaft. The length in soil will be defined as the difference in elevation between the top of the drilled shaft shown on the plans, or as installed as part of the Contractor's installation procedure, and the bottom of the shaft or the top of rock (when present) whichever is higher. The length in rock will be defined as the difference in elevation between the measured top of rock and the bottom of the shaft. When permanent casing is installed as specified on the plans, it will be measured in meters (feet) and shall be the length of casing installed.

Basis of Payment. This work will be paid for at the contract unit price per meter (foot) for DRILLED SHAFT IN SOIL, and/or DRILLED SHAFT IN ROCK, of the diameter(s) specified. The price shall be payment in full for all labor, materials, equipment, and services necessary to complete the work as specified. When the shaft is detailed with a belled base, furnishing and installing it shall not be paid for separately but shall be included in the cost of the appropriate drilled shaft item(s).

When permanent casing is furnished and installed as specified, it will be paid for at the contract unit price per meter (foot) for PERMANENT CASING. Permanent casing installed at the Contractor's option shall not be included in this item, but shall be considered as included in the appropriate drilled shaft item(s) above.

Obstruction mitigation shall be paid for according to Article 109.04 of the Standard Specifications.

No additional compensation, other than noted above, will be allowed for removing and disposing of excavated materials, for furnishing and placing concrete, bracing, lining, temporary casings placed and removed or left in place, for grouting of any voids, or for any excavation made or concrete placed outside of the plan diameter(s) of the shaft(s) specified.

Reinforcement bars, spirals and ties shall be as specified and paid for under the items, REINFORCEMENT BARS or REINFORCEMENT BARS EPOXY COATED, according to Section 508 of the Standard Specifications.

CONCRETE ADMIXTURES (BDE)

Effective: January 1, 2003 Revised: July 1, 2004

Revise Article 1020.05(b) of the Standard Specifications to read:

"(b) Admixtures. Except as specified, the use of admixtures to increase the workability or to accelerate the hardening of the concrete will be permitted only when approved in writing by the Engineer. The Department will maintain an Approved List of Concrete Admixtures. When the Department permits the use of a calcium chloride accelerator, it shall be according to Article 442.02, Note 5.

When the atmosphere or concrete temperature is 18 °C (65 °F) or higher, a retarding admixture meeting the requirements of Article 1021.03 shall be used in the Class BD Concrete and portland cement concrete bridge deck overlays. The amount of retarding admixture to be used will be determined by the Engineer. The proportions of the ingredients of the concrete shall be the same as without the retarding admixture except that the amount of mixing water shall be reduced, as may be necessary, in order to maintain the consistency of the concrete as required. In addition, a high range water-reducing admixture shall be used in Class BD Concrete. The amount of high range water-reducing admixture will be determined by the Engineer. At the option of the Contractor, a water-reducing admixture may be used. Type I cement shall be used.

For Class PC and PS Concrete, a retarding admixture may be added to the concrete mixture when the concrete temperature is 18 °C (65 °F) or higher. Other admixtures may be used when approved by the Engineer, or if specified by the contract. If an accelerating admixture is permitted by the Engineer, it shall be the non-chloride type.

At the Contractor's option, admixtures in addition to an air-entraining admixture may be used for Class PP-1 concrete. The accelerator shall be the non-chloride type. If a water-reducing or retarding admixture is used, the cement factor may be reduced a maximum 18 kg/cu m (0.30 hundredweight/cu yd). If a high range water-reducing admixture is used, the cement factor may be reduced a maximum 36 kg/cu m (0.60 hundredweight/cu yd). Cement factor reductions shall not be cumulative when using multiple admixtures. An accelerator shall always be added prior to a high range water-reducing admixture, if both are used.

If Class C fly ash or ground granulated blast-furnace slag is used in Class PP-1 concrete, a water-reducing or high range water-reducing admixture shall be used. However, the cement factor shall not be reduced if a water-reducing, retarding, or high range water-reducing admixture is used. In addition, an accelerator shall not be used.

For Class PP-2 or PP-3 concrete, a non-chloride accelerator followed by a high range water-reducing admixture shall be used, in addition to the air-entraining admixture. For Class PP-3 concrete, the non-chloride accelerator shall be calcium nitrite.

For Class PP-2 or PP-3 concrete, the Contractor has the option to use a water-reducing admixture. A retarding admixture shall not be used unless approved by the Engineer. A water-reducing, retarding, or high range water-reducing admixture shall not be used to reduce the cement factor.

When the air temperature is less than 13 °C (55 °F) for Class PP-1 or PP-2 concrete, the non-chloride accelerator shall be calcium nitrite.

For Class PP-4 concrete, a high range water-reducing admixture shall be used in addition to the air-entraining admixture. The Contractor has the option to use a water-reducing admixture. An accelerator shall not be used. For stationary or truck mixed concrete, a retarding admixture shall be used to allow for haul time. The Contractor has the option to use a mobile portland cement concrete plant according to Article 1103.04, but a retarding admixture shall not be used unless approved by the Engineer. A water-reducing, retarding, or high range water-reducing admixture shall not be used to reduce the cement factor.

If the Department specifies a calcium chloride accelerator for Class PP-1 concrete, the maximum chloride dosage shall be 1.0 L (1.0 quart) of solution per 45 kg (100 lb) of cement. The dosage may be increased to a maximum 2.0 L (2.0 quarts) per 45 kg (100 lb) of cement if approved by the Engineer. If the Department specifies a calcium chloride accelerator for Class PP-2 concrete, the maximum chloride dosage shall be 1.3 L (1.3 quarts) of solution per 45 kg (100 lb) of cement. The dosage may be increased to a maximum 2.6 L (2.6 quarts) per 45 kg (100 lb) of cement if approved by the Engineer.

For Class PV, MS, SI, RR, SC and SH concrete, at the option of the Contractor, or when specified by the Engineer, a water-reducing admixture or a retarding admixture may be used. The amount of water-reducing admixture or retarding admixture permitted will be determined by the Engineer. The air-entraining admixture and other admixtures shall be added to the concrete separately, and shall be permitted to intermingle only after they have separately entered the concrete batch. The sequence, method and equipment for adding the admixtures shall be approved by the Engineer. The water-reducing admixture shall not delay the initial set of the concrete by more than one hour. Type I cement shall be used.

When a water-reducing admixture is added, a cement factor reduction of up to 18 kg/cu m (0.30 hundredweight/cu yd), from the concrete designed for a specific slump without the admixture, will be permitted for Class PV, MS, SI, RR, SC and SH concrete. When an approved high range water-reducing admixture is used, a cement factor reduction of up to 36 kg/cu m (0.60 hundredweight/cu yd), from a specific water cement/ratio without the admixture, will be permitted based on a 14 percent minimum water reduction. This is applicable to Class PV, MS, SI, RR, SC and SH concrete. A cement factor below 320 kg/cu m (5.35 hundredweight/cu yd) will not be permitted for Class PV, MS, SI, RR, SC and SH concrete. A cement factor reduction will not be allowed for concrete placed underwater. Cement factor reductions shall not be cumulative when using multiple admixtures.

For use of admixtures to control concrete temperature, refer to Articles 1020.14(a) and 1020.14(b).

The maximum slumps given in Table 1 may be increased to 175 mm (7 in.) when a high range water-reducing admixture is used for all classes of concrete except Class PV and PP."

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 may 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 to the satisfaction of the Engineer as to manufacturer and trade name of the material they contain.

Prior to inclusion of a product on the Department's Approved List of Concrete Admixtures, the manufacturer shall submit a report prepared by an independent laboratory accredited by the AASHTO Accreditation Program. 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.

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 335 kg/cu m (5.65 cwt/cu yd). Compressive strength test results for six months and one year will not be required.

In addition to the report, 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 335 kg/cu m (5.65 cwt/cu yd). The manufacturer may select their lab or an independent lab to perform this testing. The laboratory is not required to be accredited by the AASHTO Accreditation Program.

Prior to the approval of an admixture, the Engineer may conduct all or part of the applicable tests on a sample that is representative of the material to be furnished. The test and reference concrete mixtures tested by the Engineer will contain a cement content of 335 kg/cu m (5.65 cwt/cu yd). For freeze-thaw testing, the Department will perform the test according to Illinois Modified AASHTO T 161, Procedure B.

The manufacturer shall include in the submittal the following information according to ASTM C 494; the average and manufacturing range of specific gravity, the average and manufacturing range of solids in the solution, and the average and manufacturing range of pH. The submittal shall also include an infrared spectrophotometer trace no more than five years old.

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 the AASHTO Accreditation Program.

All admixtures, except chloride-based accelerators, shall contain no more than 0.3 percent chloride by mass (weight).

1021.02 Air-Entraining Admixtures. Air-entraining admixtures shall conform to the requirements of AASHTO M 154.

If the manufacturer certifies that the air-entraining admixture is an aqueous solution of Vinsol resin that has been neutralized with sodium hydroxide (caustic soda), testing for compliance with the requirements may be waived by the Engineer. In the certification, the manufacturer shall show

complete information with respect to the formulation of the solution, including the number of parts of Vinsol resin to each part of sodium hydroxide. Before the approval of its use is granted, the Engineer will test the solution for its air-entraining quality in comparison with a solution prepared and kept for that purpose.

1021.03 Retarding and Water-Reducing Admixtures. The admixture shall comply with the following requirements:

(a) The retarding admixture shall comply with the requirements of AASHTO M 194, Type B (retarding) or Type D (water-reducing and retarding).

(b) The water-reducing admixture shall comply with the requirements of AASHTO M 194, Type A.

(c) The high range water-reducing admixture shall comply with the requirements of AASHTO M 194, Type F (high range water-reducing) or Type G (high range water-reducing and retarding).

When a Type F or Type G high range water-reducing admixture is used, water-cement ratios shall be a minimum of 0.32.

Type F or Type G admixtures may be used, subject to the following restrictions:

For Class MS, SI, RR, SC and SH concrete, the water-cement ratio shall be a maximum of 0.44.

The Type F or Type G admixture shall be added at the jobsite unless otherwise directed by the Engineer. The initial slump shall be a minimum of 40 mm (1 1/2 in.) prior to addition of the Type F or Type G admixture, except as approved by the Engineer.

When a Type F or Type G admixture is used, retempering with water or with a Type G admixture will not be allowed. An additional dosage of a Type F admixture, not to exceed 40 percent of the original dosage, may be used to retemper concrete once, provided set time is not unduly affected. A second retempering with a Type F admixture may be used for all classes of concrete except Class PP and SC, provided that the dosage does not exceed the dosage used for the first retempering, and provided that the set time is not unduly affected. No further retempering will be allowed.

Air tests shall be performed after the addition of the Type F or Type G admixture.

1021.04 Set Accelerating Admixtures. The admixture shall comply with the requirements of AASHTO M 194, Type C (accelerating) or Type E (water reducing and accelerating)"

CURING AND PROTECTION OF CONCRETE CONSTRUCTION (BDE)
Effective: January 1, 2004 Revised: November 1, 2005

Revise the second and third sentences of the eleventh paragraph of Article 503.06 of the Standard Specifications to read:

"Forms on substructure units shall remain in place at least 24 hours. The method of form removal shall not result in damage to the concrete."

Delete the twentieth paragraph of Article 503.22 of the Standard Specifications.

Revise the "Unit Price Adjustments" table of Article 503.22 of the Standard Specifications to read:

"UNIT PRICE ADJUSTMENTS	
Type of Construction	Percent Adjustment in Unit Price
For concrete in substructures, culverts (having a waterway opening of more than 1 sq m (10 sq ft)), pump houses, and retaining walls (except concrete pilings, footings and foundation seals):	
When protected by:	
Protection Method II	115%
Protection Method I	110%
For concrete in superstructures:	
When protected by:	
Protection Method II	123%
Protection Method I	115%
For concrete in footings:	
When protected by:	
Protection Method I, II or III	107%
For concrete in slope walls:	
When protected by:	
Protection Method I	107%"

Delete the fourth paragraph of Article 504.05(a) of the Standard Specifications.

Revise the second and third sentences of the fifth paragraph of Article 504.05(a) of the Standard Specifications to read:

"All test specimens shall be cured with the units according to Article 1020.13."

Revise the first paragraph of Article 504.06(c)(6) of the Standard Specifications to read:

" Curing and Low Air Temperature Protection. The curing and protection for precast, prestressed concrete members shall be according to Article 1020.13 and this Article."

Revise the first sentence of the second paragraph of Article 504.06(c)(6) of the Standard Specifications to read:

" For curing, air vents shall be in place and shall be so arranged that no water can enter the void tubes during the curing of the members."

Revise the first sentence of the third paragraph of Article 504.06(c)(6) of the Standard Specifications to read:

"As soon as each member is finished, the concrete shall be covered with curing material according to Article 1020.13."

Revise the eighth paragraph of Article 504.06(c)(6) of the Standard Specifications to read:

" The prestressing force shall not be transferred to any member before the concrete has attained the compressive strength of 28,000 kPa (4000 psi) or other higher compressive release strength specified on the plans, as determined from tests of 150 mm (6 in.) by 300 mm (12 in.) cylinders cured with the member according to Article 1020.13. Members shall not be shipped until 28-day strengths have been attained and members have a yard age of at least 4 days."

Delete the third paragraph of Article 512.03(a) of the Standard Specifications.

Delete the last sentence of the second paragraph of Article 512.04(d) of the Standard Specifications.

Revise the "Index Table of Curing and Protection of Concrete Construction" table of Article 1020.13 of the Standard Specifications to read:

"INDEX TABLE OF CURING AND PROTECTION OF CONCRETE CONSTRUCTION			
TYPE OF CONSTRUCTION	CURING METHODS	CURING PERIOD DAYS	LOW AIR TEMPERATURE PROTECTION METHODS
Cast-in-Place Concrete: [11/]			
Pavement Shoulder	1020.13(a)(1)(2)(3)(4)(5) [3/ 5/]	3	1020.13(c)
Base Course Base Course Widening	1020.13(a)(1)(2)(3)(4)(5) [1/ 2/]	3	1020.13(c)
Driveway Median Curb Gutter Curb and Gutter Sidewalk Slope Wall	1020.13(a)(1)(2)(3)(4)(5) [4/ 5/]	3	1020.13(c) [16/]
Paved Ditch Catch Basin Manhole Inlet Valve Vault	1020.13(a)(1)(2)(3)(4)(5) [4/]	3	1020.13(c)
Pavement Patching	1020.13(a)(1)(2)(3)(4)(5) [2/]	3 [12/]	1020.13(c)
Pavement Replacement	1020.13(a)(1)(2)(3)(4)(5) [1/ 2/]	3	442.06(h) and 1020.13(c)
Railroad Crossing	1020.13(a)(3)(5)	1	1020.13(c)
Piles	1020.13(a)(3)(5)	7	1020.13(e)(1)(2)(3)
Footings Foundation Seals	1020.13(a)(1)(2)(3)(4)(5) [4/ 6/]	7	1020.13(e)(1)(2)(3)
Substructure	1020.13(a)(1)(2)(3)(4)(5) [1/ 7/]	7	1020.13(e)(1)(2)(3)
Superstructure (except deck)	1020.13(a)(1)(2)(3)(5) [8/]	7	1020.13(e)(1)(2)
Deck	1020.13(a)(5)	7	1020.13(e)(1)(2) [17/]
Retaining Walls	1020.13(a)(1)(2)(3)(4)(5) [1/ 7/]	7	1020.13(e)(1)(2)
Pump Houses	1020.13(a)(1)(2)(3)(4)(5) [1/]	7	1020.13(e)(1)(2)
Culverts	1020.13(a)(1)(2)(3)(4)(5) [4/ 6/]	7	1020.13(e)(1)(2) [18/]
Other Incidental Concrete	1020.13(a)(1)(2)(3)(5)	3	1020.13(c)

Precast Concrete: [11/]		
Bridge Beams Piles Bridge Slabs Nelson Type Structural Member	1020.13(a)(3)(5) [9/ 10/]	As required. [13/] 504.06(c)(6), 1020.13(e)(2) [19/]
All Other Precast Items	1020.13(a)(3)(4)(5) [2/ 9/ 10/]	As required. [14/] 504.06(c)(6), 1020.13(e)(2) [19/]
Precast, Prestressed Concrete: [11/]		
All Items	1020.13(a)(3)(5) [9/ 10/]	Until strand tensioning is released. [15/] 504.06(c)(6), 1020.13(e)(2) [19/]

Notes-General:

1/ Type I, membrane curing only

2/ Type II, membrane curing only

3/ Type III, membrane curing only

4/ Type I, II and III membrane curing

5/ Membrane curing will not be permitted between November 1 and April 15.

6/ The use of water to inundate footings, foundation seals or the bottom slab of culverts is permissible when approved by the Engineer, provided the water temperature can be maintained at 7 °C (45 °F) or higher.

7/ Asphalt Emulsion for Waterproofing may be used in lieu of other curing methods when specified and permitted according to Article 503.18.

8/ On non-traffic surfaces which receive protective coat according to Article 503.19, a linseed oil emulsion curing compound may be used as a substitute for protective coat and other curing methods. The linseed emulsion curing compound will be permitted between April 16 and October 31 of the same year, provided it is applied with a mechanical sprayer according to Article 1101.09 (b), and meets the material requirements of Article 1022.07.

9/ Steam curing (heat and moisture) is acceptable and shall be accomplished by the method specified in Article 504.06(c)(6).

10/ A moist room according to AASHTO M 201 is acceptable for curing.

11/ If curing is required and interrupted because of form removal for cast-in-place concrete items, precast concrete products, or precast prestressed concrete products, the curing shall be resumed within two hours from the start of the form removal.

12/ Curing maintained only until opening strength is attained, with a maximum curing period of three days.

13/ The curing period shall end when the concrete has attained the mix design strength. The producer has the option to discontinue curing when the concrete has attained 80 percent of the mix design strength or after seven days. All strength test specimens shall remain with the units and shall be subjected to the same curing method and environmental condition as the units, until the time of testing.

14/ The producer shall determine the curing period or may elect to not cure the product. All strength test specimens shall remain with the units and shall be subjected to the same curing method and environmental condition as the units, until the time of testing.

15/ The producer has the option to continue curing after strand release.

16/ When structural steel or structural concrete is in place above slope wall, Article 1020.13(c) shall not apply. The protection method shall be according to Article 1020.13(e)(1).

17/ When Article 1020.13(e)(2) is used to protect the deck, the housing may enclose only the bottom and sides. The top surface shall be protected according to Article 1020.13(e)(1).

18/ For culverts having a waterway opening of 1 sq m (10 sq ft) or less, the culverts may be protected according to Article 1020.13(e)(3).

19/ The seven day protection period in the first paragraph of Article 1020.13(e)(2) shall not apply. The protection period shall end when curing is finished. For the third paragraph of Article 1020.13(e)(2), the decrease in temperature shall be according to Article 504.06(c)(6)."

Add the following to Article 1020.13(a) of the Standard Specifications:

"(5) Wetted Cotton Mat Method. After the surface of concrete has been textured or finished, it shall be covered immediately with dry cotton mats. The cotton mats shall be placed in a manner which will not mar the concrete surface. A texture resulting from the cotton mat material is acceptable. The cotton mats shall then be wetted immediately and thoroughly soaked with a gentle spray of water. For bridge decks, a foot bridge shall be used to place and wet the cotton mats.

The cotton mats shall be maintained in a wetted condition until the concrete has hardened sufficiently to place soaker hoses without marring the concrete surface. The soaker hoses shall be placed on top of the cotton mats at a maximum 1.2 m (4 ft) spacing. The cotton mats shall be kept wet with a continuous supply of water for the remainder of the curing period. Other continuous wetting systems may be used if approved by the Engineer.

After placement of the soaker hoses, the cotton mats shall be covered with white polyethylene sheeting or burlap-polyethylene blankets.

For construction items other than bridge decks, soaker hoses or a continuous wetting system will not be required if the alternative method keeps the cotton mats wet. Periodic wetting of the cotton mats is acceptable.

For areas inaccessible to the cotton mats on bridge decks, curing shall be according to Article 1020.13(a)(3)."

Revise the first paragraph of Article 1020.13(c) of the Standard Specifications to read:

"Protection of Portland Cement Concrete, Other Than Structures, From Low Air Temperatures. When the official National Weather Service forecast for the construction area predicts a low of 0 ºC (32 ºF), or lower, or if the actual temperature drops to 0 ºC (32 ºF), or lower, concrete less than 72 hours old shall be provided at least the following protection:"

Delete Article 1020.13(d) and Articles 1020.13(d)(1),(2),(3),(4) of the Standard Specifications.

Revise the first five paragraphs of Article 1020.13(e) of the Standard Specifications to read:

"Protection of Portland Cement Concrete Structures From Low Air Temperatures. When the official National Weather Service Forecast for the construction area predicts a low below 7 ºC (45 ºF), or if the actual temperature drops below 7 ºC (45 ºF), concrete less than 72 hours

old shall be provided protection. Concrete shall also be provided protection when placed during the winter period of December 1 through March 15. Concrete shall not be placed until the materials, facilities, and equipment for protection are approved by the Engineer.

When directed by the Engineer, the Contractor may be required to place concrete during the winter period. If winter construction is specified, the Contractor shall proceed with the construction, including concrete, excavation, pile driving, steel erection, and all appurtenant work required for the complete construction of the item, except at times when weather conditions make such operations impracticable.

Regardless of the precautions taken, the Contractor shall be responsible for protection of the concrete placed and any concrete damaged by cold temperatures shall be removed and replaced at no additional cost to the Department."

Add the following at the end of the third paragraph of Article 1020.13(e)(1) of the Standard Specifications:

" The Contractor shall provide means for checking the temperature of the surface of the concrete during the protection period."

Revise the second sentence of the first paragraph of Article 1020.13(e)(2) of the Standard Specifications to read:

" The Contractor shall provide means for checking the temperature of the surface of the concrete or air temperature within the housing during the protection period."

Delete the last sentence of the first paragraph of Article 1020.13(e)(3) of the Standard Specifications.

Add the following Article to Section 1022 of the Standard Specifications:

"**1022.06 Cotton Mats.** Cotton mats shall consist of a cotton fill material, minimum 400 g/sq m (11.8 oz/sq yd), covered with unsized cloth or burlap, minimum 200 g/sq m (5.9 oz/sq yd), and be tufted or stitched to maintain stability.

Cotton mats shall be in a condition satisfactory to the Engineer. Any tears or holes in the mats shall be repaired."

Add the following Article to Section 1022 of the Standard Specifications:

"**1022.07 Linseed Oil Emulsion Curing Compound.** Linseed oil emulsion curing compound shall be composed of a blend of boiled linseed oil and high viscosity, heavy bodied linseed oil emulsified in a water solution. The curing compound shall meet the requirements of a Type I according to Article 1022.01, except the drying time requirement will be waived. The oil phase shall be 50 ± 4 percent by volume. The oil phase shall consist of 80 percent by mass (weight) boiled linseed oil and 20 percent by mass (weight) Z-8 viscosity linseed oil. The water phase shall be 50 ± 4 percent by volume."

Revise Article 1020.14 of the Standard Specifications to read:

"**1020.14 Temperature Control for Placement.** Temperature control for concrete placement shall be according to the following.

(a) Temperature Control other than Structures. The temperature of the concrete immediately before placement shall be a minimum of 10 °C (50 °F) and a maximum of 32 °C (90 °F). Aggregates and/or water shall be heated or cooled as necessary to produce concrete within these temperature limits.

When the temperature of the plastic concrete reaches 30 °C (85 °F), an approved retarding admixture shall be used or the approved water reducing admixture in use shall have its dosage increased by 50 percent over the dosage recommended on the Department's Approved List of Concrete Admixtures for the temperature experienced. The amount of retarding admixture to be used will be determined by the Engineer. This requirement may be waived by the Engineer when fly ash compensated mixtures are used.

Plastic concrete temperatures up to 35 °C (96 °F), as placed, may be permitted provided job site conditions permit placement and finishing without excessive use of water on and/or overworking of the surface. The occurrence within 24 hours of unusual surface distress shall be cause to revert to a maximum 32 °C (90 °F) plastic concrete temperature.

Concrete shall not be placed when the air temperature is below 5 °C (40 °F) and falling or below 2 °C (35 °F), without permission of the Engineer. When placing of concrete is authorized during cold weather, the Engineer may require the water and/or the aggregates to be heated to between 20 °C (70 °F) and 65 °C (150 °F). The aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might damage the materials. No frozen aggregates shall be used in the concrete.

For pavement patching, refer to Article 442.06(e) for additional information on temperature control for placement.

(b) Temperature Control for Structures. The temperature of the concrete, as placed in the forms, shall be a minimum of 10 °C (50 °F) and a maximum of 32 °C (90 °F). Aggregates and/or water shall be heated or cooled as necessary to produce concrete within these temperature limits. When insulated forms are used, the temperature of the concrete mixture shall not exceed 25 °C (80 °F). If the Engineer determines that heat of hydration might cause excessive temperatures in the concrete, the concrete shall be placed at a temperature between 10 °C (50 °F) and 15 °C (60 °F). When concrete is placed in contact with previously placed concrete, the temperature of the concrete may be increased as required to offset anticipated heat loss.

Concrete shall not be placed when the air temperature is below 7 °C (45 °F) and falling or below 4 °C (40 °F), without permission of the Engineer. When placing of concrete is authorized during cold weather, the Engineer may require the water and/or the aggregates to be heated to between 20 °C (70 °F) and 65 °C (150 °F). The aggregates may be heated by

either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might damage the materials. No frozen aggregates shall be used in the concrete.

When the temperature of the plastic concrete reaches 30 °C (85 °F), an approved retarding admixture shall be used or the approved water reducing admixture in use shall have its dosage increased by 50 percent over the dosage recommended on the Department's Approved List of Concrete Admixtures for the temperature experienced. The amount of retarding admixture to be used will be determined by the Engineer. This requirement may be waived by the Engineer when fly ash compensated mixtures are used.

(c) Temperature. The concrete temperature shall be determined according to ASTM C 1064."

DISADVANTAGED BUSINESS ENTERPRISE PARTICIPATION

Effective: September 1, 2000 Revised: June 22, 2005

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 DBE Directory or most recent addendum.

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% 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% 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 firms 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 5.0% 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 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 firmly committed 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 DBE Directory as a reference source for DBE companies certified by the Department. 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.

BIDDING PROCEDURES. Compliance with the bidding procedures of this Special Provision is required prior to the award of the contract and the failure of the as-read low bidder to comply will render the bid not responsive.

(a) In order to assure the timely award of the contract, the as-read low bidder shall submit a Disadvantaged Business Utilization Plan on Department form SBE 2026 within seven (7) working days after the date of letting. To meet the seven (7) day requirement, the bidder may send the Plan by certified mail or delivery service within the seven (7) working day period. If a question arises concerning the mailing date of a Plan, the mailing date will be established by the U.S. Postal Service postmark on the original certified mail receipt from the U.S. Postal Service or the receipt issued by a delivery service. It is the responsibility of the bidder to ensure that the postmark or receipt date is affixed within the seven (7) working days if the bidder intends to rely upon mailing or delivery to satisfy the submission day requirement. The Plan is to be submitted 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). It is the responsibility of the bidder to obtain confirmation of telefax delivery. The Department will not accept a Utilization

Plan if it does not meet the seven (7) day submittal requirement and the bid will be declared not responsive. In the event the bid is declared not responsive due to a failure to submit a Plan or failure to comply with the bidding procedures set forth herein, the Department may elect to cause the forfeiture of the penal sum of the bidder's proposal guaranty, and may deny authorization to bid the project if re-advertised for bids. The Department reserves the right to invite any other bidder to submit a Utilization Plan at any time for award consideration or to extend the time for award.

(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. The signatures on these forms must be original signatures. All elements of information indicated on the said form shall be provided, including but not limited to the following:

(1) The name and address of each DBE to be used;

(2) A description, including pay item numbers, of the commercially useful work to be done by each DBE;

(3) The price to be paid to each DBE for the identified work specifically stating 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) A commitment statement signed by the bidder and each DBE evidencing availability and intent to perform commercially useful work on the project; and

(5) If the bidder is a joint venture comprised of DBE firms and non-DBE firms, the plan must also include a clear identification of the portion of the work to be performed by the DBE partner(s).

(d) The contract will not be awarded until the Utilization Plan submitted by the bidder is approved. The Utilization Plan will be approved by the Department if the Plan commits sufficient commercially useful DBE work performance to meet the contract goal. The Utilization Plan will not be approved by the Department if the Plan does not commit sufficient DBE performance to meet the contract goal unless the bidder documents that it made a good faith effort to meet the goal. The good faith procedures of Section VIII of this special provision apply. If the Utilization Plan is not approved because it is deficient in a technical matter, unless waived by the Department, the bidder will be notified and will be allowed no less than a five (5) working day period in order to cure the deficiency.

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% 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 firm does not count toward the DBE goals.

(b) DBE as a joint venture Contractor: 100% 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% 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 firm does not count toward the DBE goal.

(d) DBE as a trucker: 100% 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 contact. Credit will be given for the full value of all such DBE trucks operated using DBE employed drivers. Goal credit will be limited to the value of the reasonable fee or commission received by the DBE if trucks are leased from a non-DBE company.

(e) DBE as a material supplier:

(1) 60% goal credit for the cost of the materials or supplies purchased from a DBE regular dealer.

(2) 100% goal credit for the cost of materials or supplies obtained from a DBE manufacturer.

(3) 100% credit for the value of reasonable fees and commissions for the procurement of materials and supplies if not a regular dealer or manufacturer.

GOOD FAITH EFFORT PROCEDURES. If the bidder cannot obtain sufficient DBE commitments to meet the contract goal, the bidder must document in the Utilization Plan the good faith efforts made in the attempt 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 could reasonably be expected to obtain sufficient DBE participation. The Department will consider the quality, quantity, and intensity of the kinds of efforts that the bidder has made.

Mere *pro forma* efforts are not good faith efforts; rather, the bidder is expected to have taken those 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 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 a good faith effort has not been made, the Department will notify the bidder of that preliminary determination by contacting the responsible company official designated in the Utilization Plan. The preliminary determination shall include a statement of reasons why good faith efforts have not been found, and may include additional good faith efforts that the bidder could take. The notification will designate a five (5) working day period during which the bidder shall take additional efforts. The bidder is not limited by a statement of additional efforts, but may take other action beyond any stated additional efforts in order to obtain additional DBE commitments. The bidder shall submit an amended Utilization Plan if additional DBE commitments to meet the contract goal are secured. If additional DBE commitments sufficient to meet the contract goal are not secured, the bidder shall report the final good faith efforts made in the time allotted. All additional efforts taken by the bidder will be considered as part of the bidder's good faith efforts. If the bidder is not able to meet the goal after taking additional efforts, the Department will make a pre-final determination of the good faith efforts of the bidder and will notify the designated responsible company official of the reasons for an adverse determination.

(c) The bidder may request administrative reconsideration of a pre-final determination adverse to the bidder within the five (5) working days after 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 pre-final 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. In addition, the request shall be considered a consent by the bidder to extend the time for award. 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 (10) 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.

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 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) 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. If a DBE listed in the Utilization Plan is terminated for reasons other than convenience, or fails to complete its work on the contract for any reason, the Contractor shall make good faith efforts to find another DBE to substitute for the terminated 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 DBE that was terminated, but only to the extent needed to meet the contract goal or the amended contract goal. 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 and provide a full accounting of the efforts undertaken to obtain substitute DBE participation. The Bureau 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.

(c) 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 (30) calendar days after payment has been made by the Department to the Contractor for such work or material, the Contractor shall submit a DBE Payment Report on Department form SBE 2115 to the Regional Engineer. If full and final payment has not been made to the DBE, the Report 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 Plan, the Department will deduct from contract payments to the Contractor the amount of the goal not achieved as liquidated and ascertained damages.

(d) 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.

(e) 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.

FLAGGER VESTS (BDE)

Effective: April 1, 2003 Revised: August 1, 2005

Revise the first sentence of Article 701.04(c)(1) of the Standard Specifications to read:

"The flagger shall be stationed to the satisfaction of the Engineer and be equipped with a fluorescent orange, fluorescent yellow/green or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of the American National Standards Institute specification ANSI/ISEA 107-1999 for Conspicuity Class 2 garments and approved flagger traffic control signs conforming to Standard 702001 and Article 702.05(e)."

Revise Article 701.04(c)(6) of the Standard Specifications to read:

"(6) Nighttime Flagging. Flaggers shall be illuminated by an overhead light source providing a minimum vertical illuminance of 108 lux (10 fc) measured 300 mm (1 ft) out from the flagger's chest. The bottom of any luminaire shall be a minimum of 3 m (10 ft) above the pavement. Luminaire(s) shall be shielded to minimize glare to approaching traffic and trespass light to adjoining properties.

The flagger vest shall be a fluorescent orange or fluorescent orange and fluorescent yellow/green vest meeting the requirements of the American National Standards Institute specification ANSI/ISEA 107-1999 for Conspicuity Class 3 garments."

HAND VIBRATOR (BDE)
Effective: November 1, 2003

Add the following paragraph to Article 1103.17(a) of the Standard Specifications:

"The vibrator shall have a non-metallic head for areas containing epoxy coated reinforcement. The head shall be coated by the manufacturer. The hardness of the non-metallic head shall be less than the epoxy coated reinforcement, resulting in no damage to the epoxy coating. Slip-on covers will not be allowed."

PARTIAL PAYMENTS (BDE)
Effective: September 1, 2003

Revise Article 109.07 of the Standard Specifications to read:

"**109.07 Partial Payments.** Partial payments will be made as follows:

(a) Progress Payments. At least once each month, the Engineer will make a written estimate of the amount of work performed in accordance with the contract, and the value thereof at the contract unit prices. The amount of the estimate approved as due for payment will be vouchered by the Department and presented to the State Comptroller for payment. No amount less than $1000.00 will be approved for payment other than the final payment.

The failure to perform any requirement, obligation, or term of the contract by the Contractor shall be reason for withholding any progress payments until the Department determines that compliance has been achieved. Furthermore, progress payments may be reduced by liens filed pursuant to Section 23(c) of the Mechanics Lien Act, 770 ILCS 60/23(c).

(b) Material Allowances. At the discretion of the Department, payment may be made for materials, prior to their use in the work, when satisfactory evidence is presented by the Contractor. Satisfactory evidence includes justification for the allowance (to expedite the work, meet project schedules, regional or national material shortages, etc.), documentation of material and transportation costs, and evidence that such material is properly stored on the project or at a secure location acceptable and accessible to the Department.

Material allowances will be considered only for nonperishable materials when the cost, including transportation, exceeds $10,000 and such materials are not expected to be utilized within 60 days of the request for the allowance. For contracts valued under $500,000, the minimum $10,000 requirement may be met by combining the principal (material) product of no more than two contract items. An exception to this two item limitation may be considered for any contract regardless of value for items in which material (products) are similar except for type and/or size.

Material allowances shall not exceed the value of the contract items in which used and shall not include the cost of installation or related markups. Amounts paid by the Department for material allowances will be deducted from estimates due the Contractor as the material is

used. Two-sided copies of the Contractor's cancelled checks for materials and transportation must be furnished to the Department within 60 days of payment of the allowances or the amounts will be reclaimed by the Department."

PAYMENTS TO SUBCONTRACTORS (BDE)

Effective: June 1, 2000 Revised: September 1, 2003

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 no later than 30 days from the receipt of each payment made to the Contractor.

State law addresses the timing of payments to be made to subcontractors. Section 7 of the Prompt Payment Act, 30 ILCS 540/7, generally requires that when a Contractor receives any payment from the Department, the Contractor is required to make corresponding, proportional payments to each subcontractor performing work within 15 calendar days after receipt of the state payment. Section 7 of the State Prompt Payment Act further provides that interest in the amount of 2% per month, in addition to the payment due, shall be paid to any subcontractor 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 throughout the contracting chain.

This Special Provision establishes the required federal contract clause, and adopts the 15 calendar day requirement of the Act for purposes of compliance with the federal regulation regarding payments to subcontractors. This contract is subject to the following payment obligations.

As progress payments are made to the Contractor in accordance with Article 109.07 of the Standard Specifications for Road and Bridge Construction, the Contractor shall make a corresponding partial payment within 15 calendar days to each subcontractor in proportion to the work satisfactorily completed by each subcontractor. The proportionate amount of partial payment due to each subcontractor 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 shall be paid in full within 15 calendar days after the subcontractor's work has been satisfactorily completed. The Contractor shall hold no retainage from the subcontractors.

This Special Provision does not create any rights in favor of any subcontractor against the State of Illinois or authorize any cause of action against the State of Illinois on account of any payment, nonpayment, delayed payment or interest claimed by application of the State Prompt Payment Act. The Department will neither determine the reasonableness of any cause for delay of payment nor enforce any claim to payment, including interest. Moreover, the Department will not approve any delay or postponement of the 15 day requirement. State law creates 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 in accordance with the Public Construction Bond Act, 30 ILCS 550.

PERSONAL PROTECTIVE EQUIPMENT (BDE)
Effective: July 1, 2004

All personnel, excluding flaggers, working outside of a vehicle (car or truck) within 7.6 m (25 ft) of pavement open to traffic shall wear a fluorescent orange, fluorescent yellow/green or a combination of fluorescent orange and fluorescent yellow/.green vest meeting the requirements of the American National Standards Institute specification ANSI/ISEA 107-1999 for Conspicuity Class 2 garments. Other types of garments may be substituted for the vest as long as the garments have manufacturers tags identifying them as meeting the ANSI Class 2 requirement.

PORTLAND CEMENT (BDE)
Effective: January 1, 2005 Revised: November 1, 2005

Add the following paragraph after the last paragraph of Article 1001.01 of the Standard Specifications.

"For portland cement according to ASTM C 150, the bill of lading shall state if limestone has been added. The bill of lading shall also state that the limestone addition is not in excess of five percent by mass (weight) of the cement."

PORTLAND CEMENT CONCRETE (BDE)
Effective: November 1, 2002

Add the following paragraph after the fourth paragraph of Article 1103.01(b) of the Standard Specifications:

"The truck mixer shall be approved before use according to the Bureau of Materials and Physical Research's Policy Memorandum, "Approval of Concrete Plants and Delivery Trucks"."

Add the following paragraph after the first paragraph of Article 1103.01(c) of the Standard Specifications:

"The truck agitator shall be approved before use according to the Bureau of Materials and Physical Research's Policy Memorandum, "Approval of Concrete Plants and Delivery Trucks"."

Add the following paragraph after the first paragraph of Article 1103.01(d) of the Standard Specifications:

"The nonagitator truck shall be approved before use according to the Bureau of Materials and Physical Research's Policy Memorandum, "Approval of Concrete Plants and Delivery Trucks"."

Revise the first sentence of the first paragraph of Article 1103.02 of the Standard Specifications to read:

"The plant shall be approved before production begins according to the Bureau of Materials and Physical Research's Policy Memorandum, "Approval of Concrete Plants and Delivery Trucks"."

REINFORCEMENT BARS (BDE)

Effective: November 1, 2005 Revised: November 2, 2005

Revise Article 1006.10(a) of the Supplemental Specifications to read:

"(a) Reinforcement Bars. Reinforcement bars will be accepted according to the current Bureau of Materials and Physical Research Policy Memorandum, "Reinforcement Bar and Dowel Bar Plant Certification Procedure". The Department will maintain an approved list of producers.

(1) Reinforcement Bars (Non-Coated). Reinforcment bars shall be according to ASTM A 706M (A 706), Grade 420 (60) for deformed bars and the following.

a. Chemical Composition. The chemical composition of the bars shall be according to the following table.

CHEMICAL COMPOSITION		
Element [1/]	Heat Analysis (% maximum)	Product Analysis (% maximum)
Carbon	0.30	0.33
Manganese	1.50	1.56
Phosphorus	0.035	0.045
Sulfur	0.045	0.055
Silicon	0.50	0.55
Nickel	[2/]	[2/]
Chromium	[2/]	[2/]
Molybdenum	[2/]	[2/]
Copper	[2/]	[2/]
Titanium	[2/]	[2/]
Vanadium	[2/]	[2/]
Columbium	[2/]	[2/]
Aluminum	[2/, 3/]	[2/, 3/]
Tin [4/]	0.040	0.044

Note 1/. The bars shall not contain any traces of radioactive elements.

Note 2/. There is no composition limit but the element must be reported.

Note 3/. If aluminum is not an intentional addition to the steel for deoxidation or killing purposes, residual aluminum content need not be reported.

Note 4/. If producer bar testing indicates an elongation of 15 percent or more and passing of the bend test, the tin composition requirement may be waived.

b. Heat Numbers. Bundles or bars at the construction site shall be marked or tagged with heat identification numbers of the bar producer.

c. Guided Bend Test. Bars may be subject to a guided bend test across two pins which are free to rotate, where the bending force shall be centrally applied with a fixed or rotating pin of a certain diameter as specified in Table 3 of ASTM A 706M (A 706). The dimensions and clearances of this guided bend test shall be according to ASTM E 190.

d. Spiral Reinforcment. Spiral reinforcement shall be deformed or plain bars conforming to the above requirements or cold-drawn steel wire conforming to AASHTO M 32.

(2) Epoxy Coated Reinforcement Bars. Epoxy coated reinforcement bars shall be according to Article 1006.10(a)(1) and shall be epoxy coated according to AASHTO M 284M (M 284) and the following.

a. Certification. The epoxy coating applicator shall be certified under the Concrete Reinforcing Steel Institute's (CRSI) Epoxy Plant Certification Program.

b. Coating Thickness. The thickness of the epoxy coating shall be 0.18 to 0.30 mm (7 to 12 mils). When spiral reinforcment is coated after fabrication, the thickness of the epoxy coating shall be 0.18 to 0.50 mm (7 to 20 mils).

c. Cutting Reinforcement. Reinforcement bars may be sheared or sawn to length after coating, providing the end damage to the coating does not extend more than 13 mm (0.5 in.) back and the cut is patched before any visible rusting appears. Flame cutting will not be permitted."

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.

WORKING DAYS (BDE)
Effective: January 1, 2002

The Contractor shall complete the work within 230 working days.

PAYROLLS AND PAYROLL RECORDS (BDE)
Effective: August 10, 2005

FEDERAL AID CONTRACTS. Add the following State of Illinois requirements to the Federal requirements contained in Section V of Form FHWA-1273:

"The payroll records shall include each worker's name, address, telephone number, social security number, classification, rate of pay, number of hours worked each day, starting and ending times of work each day, total hours worked each week, itemized deductions made, and actual wages paid.

The Contractor and each subcontractor shall submit payroll records to the Engineer each week from the start to the completion of their respective work. The submittals shall be on the Department's form SBE 48, or an approved facsimile. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate box ("No Work", "Suspended", or "Complete") checked on the form."

STATE CONTRACTS. Revise Section IV of Check Sheet #5 of the Recurring Special Provisions to read:

"IV. COMPLIANCE WITH THE PREVAILING WAGE ACT

1. Prevailing Wages. All wages paid by the Contractor and each subcontractor shall be in compliance with The Prevailing Wage Act (820 ILCS 130), as amended, except where a prevailing wage violates a federal law, order, or ruling, the rate conforming to the federal law, order, or ruling shall govern. The Contractor shall be responsible to notify each subcontractor of the wage rates set forth in this contract and any revisions thereto. If the Department of Labor revises the wage rates, the Contractor will not be allowed additional compensation on account of said revisions.

2. Payroll Records. The Contractor and each subcontractor shall make and keep, for a period of three years from the date of completion of this contract, records of the wages paid to his/her workers. The payroll records shall include each worker's name, address, telephone number, social security number, classification, rate of pay, number of hours worked each day, starting and ending times of work each day, total hours worked each week, itemized deductions made, and actual wages paid. Upon two business days' notice, these records shall be available, at all reasonable hours at a location within the State, for inspection by the Department or the Department of Labor.

3. Submission of Payroll Records. The Contractor and each subcontractor shall submit payroll records to the Engineer each week from the start to the completion of their respective work. The submittals shall be on the Department's form SBE 48, or an approved facsimile. When there has been no activity during a work week, a payroll record shall still be submitted with the appropriate box ("No Work", "Suspended", or "Complete") checked on the form.

Each submittal shall be accompanied by a statement signed by the Contractor or subcontractor which avers that: (i) such records are true and accurate; (ii) the hourly rate paid to each worker is not less than the general prevailing rate of hourly wages required by the Act; and (iii) the Contractor or subcontractor is aware that filing a payroll record that he/she knows to be false is a Class B misdemeanor.

4. Employee Interviews. The Contractor and each subcontractor shall permit his/her employees to be interviewed on the job, during working hours, by compliance investigators of the Department or the Department of Labor."

STEEL COST ADJUSTMENT (BDE)

Effective: April 2, 2004 Revised: July 1, 2004

Description. At the bidder's option, a steel cost adjustment will be made to provide additional compensation to the Contractor or a credit to the Department for fluctuations in steel prices. The bidder must indicate on the attached form whether or not steel cost adjustments will be part of this contract. This attached form shall be submitted with the bid. Failure to submit the form shall make this contract exempt of steel cost adjustments.

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), frames and grates, and other miscellaneous items will be subject to a steel cost adjustment when the pay item 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) Evidence that increased or decreased steel costs have been passed on to the Contractor.

(b) The dates and quantity of steel, in kg (lb), shipped from the mill to the fabricator.

(c) The quantity of steel, in kg (lb), 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 X D

Where: SCA = steel cost adjustment, in dollars
Q = quantity of steel incorporated into the work, in kg (lb)
D = price factor, in dollars per kg (lb)

$D = CBP_M - CBP_L$

Where: CBP_M = The average of the Consumer Buying Price indices for Shredded Auto Scrap (Chicago) and No. 1 Heavy Melt (Chicago) as published by the American Metal Market (AMM) for the day the steel is shipped from the mill. The indices will be converted from dollars per ton to dollars per kg (lb).

CBP_L = The average of the Consumer Buying Price indices for Shredded Auto Scrap (Chicago) and No. 1 Heavy Melt (Chicago) as published by the AMM for the day the contract is let. The indices will be converted from dollars per ton to dollars per kg (lb).

The unit masses (weights) 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 CBP_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 CBP_L and CBP_M in excess of five percent, as calculated by:

Percent Difference = $\{(CBP_L - CBP_M) \div CBP_L\} \times 100$

Steel cost adjustments will be calculated by the Engineer and will be paid or deducted when all other contract requirements for the steel items 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.

Attachment

Item	Unit Mass (Weight)
Metal Piling (excluding temporary sheet piling)	
Furnishing Metal Pile Shells 305 mm (12 in.), 3.80 mm (0.179 in.) wall thickness)	34 kg/m (23 lb/ft)
Furnishing Metal Pile Shells 305 mm (12 in.), 6.35 mm (0.250 in.) wall thickness)	48 kg/m (32 lb/ft)
Furnishing Metal Pile Shells 356 mm (14 in.), 6.35 mm (0.250 in.) wall thickness)	55 kg/m (37 lb/ft)
Other piling	See plans
Structural Steel	See plans for weights
Reinforcing Steel	See plans for weights
Dowel Bars and Tie Bars	3 kg (6 lb) each
Mesh Reinforcement	310 kg/sq m (63 lb/100 sq ft)
Guardrail	
Steel Plate Beam Guardrail, Type A w/steel posts	30 kg/m (20 lb/ft)
Steel Plate Beam Guardrail, Type B w/steel posts	45 kg/m (30 lb/ft)
Steel Plate Beam Guardrail, Types A and B w/wood posts	12 kg/m (8 lb/ft)
Steel Plate Beam Guardrail, Type 2	140 kg (305 lb) each
Steel Plate Beam Guardrail, Type 6	570 kg (1260 lb) each
Traffic Barrier Terminal, Type 1 Special (Tangent)	330 kg (730 lb) each
Traffic Barrier Terminal, Type 1 Special (Flared)	185 kg (410 lb) each
Steel Traffic Signal and Light Poles, Towers and Mast Arms	
Traffic Signal Post	16 kg/m (11 lb/ft)
Light Pole, Tenon Mount and Twin Mount, 9 m – 12 m (30 - 40 ft)	21 kg/m (14 lb/ft)
Light Pole, Tenon Mount and Twin Mount, 13.5 m – 16.5 m (45 - 55 ft)	31 kg/m (21 lb/ft)
Light Pole w/Mast Arm, 9 m – 15.2 m (30 - 50 ft)	19 kg/m (13 lb/ft)
Light Pole w/Mast Arm, 16.5 m – 18 m (55 - 60 ft)	28 kg/m (19 lb/ft)
Light Tower w/Luminaire Mount, 24 m – 33.5 m (80 - 110 ft)	46 kg/m (31 lb/ft)
Light Tower w/Luminaire Mount, 36.5 m – 42.5 m (120 - 140 ft)	97 kg/m (65 lb/ft)
Light Tower w/Luminaire Mount, 45.5 m – 48.5 m (150 - 160 ft)	119 kg/m (80 lb/ft)
Metal Railings (excluding wire fence)	
Steel Railing, Type SM	95 kg/m (64 lb/ft)
Steel Railing, Type S-1	58 kg/m (39 lb/ft)
Steel Railing, Type T-1	79 kg/m (53 lb/ft)
Steel Bridge Rail	77 kg/m (52 lb/ft)
Frames and Grates	
Frame	115 kg (250 lb)
Lids and Grates	70 kg (150 lb)

RETURN WITH BID

ILLINOIS DEPARTMENT OF TRANSPORTATION

OPTION FOR STEEL COST ADJUSTMENT

The bidder shall submit this form with his/her bid. Failure to submit the form shall make this contract exempt of steel cost adjustments. 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?

Yes ☐ No ☐

Signature: _____ **Date:** _____

ILLINOIS DEPARTMENT OF LABOR

PREVAILING WAGES FOR
ST. CLAIR COUNTY
EFFECTIVE JULY 2005

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.

Saint Clair County Prevailing Wage for November 2005

Trade Name	RG	TYP	C	Base	FRMAN	*M-F>8	OSA	OSH	H/W	Pensn	Vac	Trng
ASBESTOS ABT-GEN		BLD		23.800	24.300	1.5	1.5	2.0	5.000	5.950	0.000	0.600
ASBESTOS ABT-MEC		BLD		25.290	26.290	1.5	1.5	2.0	4.450	2.500	0.000	0.250
BOILERMAKER		BLD		27.000	29.500	1.5	1.5	2.0	7.020	10.21	0.000	0.210
BRICK MASON		BLD		25.520	27.170	1.5	1.5	2.0	4.750	7.700	2.000	0.420
CARPENTER		ALL		29.730	31.230	1.5	1.5	2.0	4.800	3.500	0.000	0.350
CEMENT MASON		ALL		26.200	26.950	1.5	1.5	2.0	5.000	7.750	0.000	0.100
CERAMIC TILE FNSHER		BLD		22.040	0.000	1.5	1.5	2.0	4.800	4.100	0.000	0.250
ELECTRIC PWR EQMT OP		ALL		29.820	35.940	1.5	2.0	2.0	4.120	7.450	0.000	0.150
ELECTRIC PWR GRNDMAN		ALL		22.260	35.940	1.5	2.0	2.0	3.080	5.570	0.000	0.110
ELECTRIC PWR LINEMAN		ALL		34.280	35.940	1.5	2.0	2.0	4.740	8.570	0.000	0.170
ELECTRIC PWR TRK DRV		ALL		24.340	35.940	1.5	2.0	2.0	3.370	6.080	0.000	0.120
ELECTRICIAN		ALL		31.460	33.350	1.5	1.5	2.0	5.030	6.130	0.000	0.470
ELECTRONIC SYS TECH		BLD		22.970	24.470	1.5	1.5	2.0	2.800	4.690	2.250	0.250
ELEVATOR CONSTRUCTOR		BLD		32.700	36.790	2.0	2.0	2.0	7.275	3.420	1.960	0.000
FLOOR LAYER		BLD		26.030	26.780	1.5	1.5	2.0	4.750	3.500	0.000	0.350
GLAZIER		BLD		28.730	0.000	2.0	2.0	2.0	7.150	5.920	2.300	0.160
HT/FROST INSULATOR		BLD		29.640	30.640	1.5	1.5	2.0	4.450	7.860	0.000	0.450
IRON WORKER		ALL		25.390	26.890	1.5	1.5	2.0	6.210	7.900	0.000	0.420
LABORER	N	ALL		23.300	23.800	1.5	1.5	2.0	5.000	5.950	0.000	0.600
LABORER	S	ALL		20.900	21.400	1.5	1.5	2.0	4.750	7.000	0.000	0.500
MACHINIST		BLD		35.630	37.630	2.0	2.0	2.0	3.880	4.750	2.460	0.000
MARBLE FINISHERS		BLD		22.040	0.000	1.5	1.5	2.0	4.800	4.100	0.000	0.250
MARBLE MASON		BLD		25.520	27.170	1.5	1.5	2.0	4.750	7.700	2.000	0.420
MILLWRIGHT		ALL		29.730	31.230	1.5	1.5	2.0	4.800	3.500	0.000	0.350
OPERATING ENGINEER		ALL	1	25.350	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	2	24.220	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	3	19.740	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	4	19.800	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	5	19.470	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	6	25.900	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	7	26.200	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
OPERATING ENGINEER		ALL	8	26.480	26.480	1.5	1.5	2.0	5.900	10.60	0.000	1.000
PAINTER		BLD		24.600	25.600	1.5	1.5	2.0	4.400	5.150	0.000	0.350
PAINTER		HWY		25.000	26.000	1.5	1.5	2.0	3.900	5.150	0.000	0.350
PAINTER OVER 30FT		BLD		25.600	26.600	1.5	1.5	2.0	4.400	5.150	0.000	0.350
PAINTER PWR EQMT		BLD		25.600	26.600	1.5	1.5	2.0	4.400	5.150	0.000	0.350
PAINTER PWR EQMT		HWY		26.000	27.000	1.5	1.5	2.0	3.900	5.150	0.000	0.350
PILEDRIVER		ALL		29.730	31.230	1.5	1.5	2.0	4.800	3.500	0.000	0.350
PIPEFITTER	NW	BLD		28.000	30.000	1.5	1.5	2.0	5.200	6.840	0.000	0.400
PIPEFITTER	SE	BLD		29.250	31.750	1.5	1.5	2.0	5.350	3.750	0.000	0.375
PLASTERER		BLD		26.150	27.150	1.5	1.5	2.0	5.000	7.000	0.000	0.250
PLUMBER	NW	BLD		29.450	31.950	1.5	1.5	2.0	4.800	5.200	0.000	0.250
PLUMBER	SE	BLD		30.000	32.500	1.5	1.5	2.0	5.600	3.750	0.000	0.375
ROOFER		BLD		25.250	27.250	1.5	1.5	2.0	5.200	5.300	0.000	0.200
SHEETMETAL WORKER		ALL		27.210	28.460	1.5	1.5	2.0	6.000	4.770	1.630	0.120
SPRINKLER FITTER		BLD		31.080	33.080	2.0	2.0	2.0	5.900	5.850	0.000	0.400
TERRAZZO FINISHER		BLD		30.050	0.000	1.5	1.5	2.0	0.000	0.000	0.000	0.000
TERRAZZO MASON		BLD		29.550	29.850	1.5	1.5	2.0	0.000	3.750	0.000	0.000
TRUCK DRIVER		ALL	1	24.905	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		ALL	2	25.305	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		ALL	3	25.505	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		ALL	4	25.755	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		ALL	5	26.505	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		O&C	1	19.924	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		O&C	2	20.244	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		O&C	3	20.404	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		O&C	4	20.604	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000
TRUCK DRIVER		O&C	5	21.204	0.000	1.5	1.5	2.0	7.000	3.200	0.000	0.000

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

ST. CLAIR COUNTY

LABORERS (NORTH) - The area bounded by Route 159 to a point south of Fairview Heights and west-southwest to Route 3 at Monroe County line.

PLUMBERS & PIPEFITTERS (SOUTHEAST) - That part of the county bordered by Rt. 50 on the North and West including Belleville.

PLUMBERS (NORTHWEST) - Towns of Aloraton, Brooklyn, Cahokia, Caseyville, Centreville, Dupo, East Carondelet, E. St. Louis, Fairview Heights, French Village, National City, O'Fallon, Sauget, and Washington Park.

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.

Oil and chip resealing (O&C) means the application of road oils and liquid asphalt to coat an existing road surface, followed by application of aggregate chips or gravel to coated surface, and subsequent rolling of material to seal the surface.

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 AND MARBLE FINISHER

The handling, at the building site, of all sand, cement, tile, marble or stone and all other materials that may be used and installed by [a] tile layer or marble mason. In addition, the grouting, cleaning, sealing, and mixing on the job site, and all other work as required in assisting the setter. The term "Ceramic" is used for naming the classification only and is in no way a limitation of the product handled. Ceramic takes into consideration most hard tiles.

ELECTRONIC SYSTEMS TECHNICIAN

Installation, service and maintenance of low-voltage systems which utilizes the transmission and/or transference of voice, sound, vision, or digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background/foreground music, intercom and telephone interconnect, field programming, inventory control systems, microwave transmission, multi-media, multiplex, radio page, school, intercom and sound burglar alarms and low voltage master clock systems.

Excluded from this classification are energy management systems, life safety systems, supervisory controls and data acquisition systems not intrinsic with the above listed systems, fire alarm systems, nurse call systems and raceways exceeding fifteen feet in length.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION
Class 1. Drivers on 2 axle trucks hauling less than 9 ton. Air compressor and welding machines and brooms, including those pulled by separate units, truck driver helpers, warehouse employees, mechanic helpers, greasers and tiremen, pickup trucks when hauling materials, tools, or workers to and from and on-the-job site, and fork lifts up to 6,000 lb. capacity.

Class 2. Two or three axle trucks hauling more than 9 ton but hauling less than 16 ton. A-frame winch trucks, hydrolift trucks, vactor trucks or similar equipment when used for transportation purposes. Fork lifts over 6,000 lb. capacity, winch trucks, four axle combination units, and ticket writers.

Class 3. Two, three or four axle trucks hauling 16 ton or more. Drivers on water pulls, articulated dump trucks, mechanics and working forepersons, and dispatchers. Five axle or more combination units.

Class 4. Low Boy and Oil Distributors.

Class 5. Drivers who require special protective clothing while employed on hazardous waste work.
TRUCK DRIVER - OIL AND CHIP RESEALING ONLY.

This shall encompass laborers, workers and mechanics who drive contractor or subcontractor owned, leased, or hired pickup, dump, service, or oil distributor trucks. The work includes transporting materials and equipment (including but not limited to, oils, aggregate supplies, parts, machinery and tools) to or from the job site; distributing oil or liquid asphalt and aggregate; stock piling material when in connection with the actual oil and chip contract. The Truck Driver (Oil & Chip Resealing) wage classification does not include supplier delivered materials.

OPERATING ENGINEERS

GROUP I. Cranes, Dragline, Shovels, Skimmer Scoops, Clamshells or Derrick Boats, Pile Drivers, Crane-Type Backhoes, Asphalt Plant Operators, Concrete Plant Operators, Dredges, Asphalt Spreading Machines, All Locomotives, Cable Ways, or Tower Machines, Hoists, Hydraulic Backhoes, Ditching Machines or Backfiller, Cherrypickers, Overhead Cranes, Roller, Steam or Gas, Concrete Pavers, Excavators, Concrete Breakers, Concrete Pumps, Bulk Cement Plants, Cement Pumps, Derrick-Type Drills, Boat Operators, Motor Graders or Pushcats, Scoops or Tournapulls, Bulldozers, Endloaders or Fork Lifts, Power Blade or Elevating Graders, Winch Cats, Boom or Winch Trucks or Boom Tractors, Pipe Wrapping or Painting Machines, Asphalt Plant Engineer, Journeyman Lubricating Engineer, Drills (other than Derrick Type), Mud Jacks, or Well Drilling Machines, Boring Machines or Track Jacks, Mixers, Conveyors (Two), Air Compressors (Two), Water Pumps regardless of size (Two), Welding Machines (Two), Siphons or Jets (Two), Winch Heads or Apparatuses (Two), Light Plants (Two), Waterblasters (two), All Tractors regardless of size (straight tractor only), Fireman on Stationary Boilers, Automatic Elevators, Form Grading Machines, Finishing Machines, Power Sub-Grader or Ribbon Machines, Longitudinal Floats, Distributor Operators on Trucks, Winch Heads or Apparatuses (One), Mobil Track air and heaters (two to five), Heavy Equipment Greaser, Relief Operator, Assistant Master Mechanic and Heavy Duty Mechanic, all Operators (except those listed below).

GROUP II. Assistant Operators.

GROUP III. Air Compressors (One), Water Pumps, regardless of Size (One), Waterblasters (one), Welding Machine (One), Mixers (One Bag), Conveyor (One), Siphon or Jet (One), Light Plant (One), Heater (One), Immobile Track Air (One), and Self Propelled Walk-Behind Rollers.

GROUP IV. Asphalt Spreader Oilers, Fireman on Whirlies and Heavy Equipment Oilers, Truck Cranes, Dredges, Monigans, Large Cranes - (Over 65-ton rated capacity) Concrete Plant Oiler, Blacktop Plant Oiler, and Creter Crane Oiler (when required).

GROUP V. Oiler.

GROUP VI. Master Mechanics, Operators on equipment with Booms, including jibs, 100 feet and over, and less than 150 feet long.

GROUP VII. Operators on equipment with Booms, including jibs, 150 feet and over, and less than 200 feet long.

GROUP VIII. Operators on Equipment with Booms, including jibs, 200 feet and over; Tower Cranes; Whirlie Cranes; and Operator Foreman.

TERRAZZO FINISHER

The handling of all materials used for Mosaic and Terrazzo work including preparing, mixing by hand, by mixing machine or transporting of pre-mixed materials and distributing with shovel, rake, hoe, or pail, all kinds of concrete foundations necessary for Mosaic and Terrazzo work, all cement terrazzo, magnesite terrazzo, Do-O-Tex terrazzo, epoxy matrix ter-razzo, exposed aggregate, rustic or rough washed for exterior or interior of buildings placed either by machine or by hand, and any other kind of mixture of plastics composed of chips or granules when mixed with cement, rubber, neoprene, vinyl, magnesium chloride or any other resinous or chemical substances used for seamless flooring systems, and all other building materials, all similar materials and all precast terrazzo work on jobs, all scratch coat used for Mosaic and Terrazzo work and sub-bed, tar paper and wire

mesh (2x2 etc.) or lath. The rubbing, grinding, cleaning and finishing of same either by hand or by machine or by terrazzo resurfacing equipment on new or existing floors. When necessary finishers shall be allowed to assist the mechanics to spread sand bed, lay tarpaper and wire mesh (2x2 etc.) or lath. The finishing of cement floors where additional aggregate of stone is added by spreading or sprinkling on top of the finished base, and troweled or rolled into the finish and then the surface is ground by grinding machines.

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 618/993-7271 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.