CITY OF GRAND ISLAND

Working Together for a Better Tomorrow. Today.

SPECIFICATION PACKAGE

for

URANIUM REMOVAL WATER TREATMENT PLANT – EQUIPMENT INSTALLATION AND PUMP MODIFICATIONS

Bid Opening Date/Time
Tuesday, January 31, 2012 @ 2:00 P.M. (Local Time)
City of Grand Island, City Hall
100 East 1st Street, P.O. Box 1968
Grand Island, NE 68802-1968

Contact
City of Grand Island – Utilities Department
Platte Generating Station
308/385-5496

Date issued: January 16, 2012

City of Grand Island
Platte Generating Station

Uranium Removal Water Treatment Plant -
Equipment Installation and Pump Modifications

TABLE OF CONTENTS

A. Advertisement to Bidders

B. Bid Data Form

C. Checklist for Bid Submission

D. Instructions to Bidders

E. Sample Contract Agreement

F. Specifications

a. General Specifications

b. Detailed Specifications

G. Insurance Requirements

H. Site Map and Standard Plan Drawings

ADVERTISEMENT TO BIDDERS
FOR
URANIUM REMOVAL WATER TREATMENT PLANT-
EQUIPMENT INSTALLATION AND PUMP MODIFICATIONS
FOR
CITY OF GRAND ISLAND, NEBRASKA

Sealed bids will be received at the office of the City Clerk, 100 E. First Street, P.O. Box 1968, Grand Island, Nebraska 68802, until Tuesday, January 31, 2012 at 2:00 p.m. local time for Uranium Removal Water Treatment Plant-Equipment Installation and Pump Modifications, FOB the City of Grand Island, freight prepaid. Bids will be publicly opened at this time in the Grand Island City Hall Council Conference Room #1 located on 1st floor of City Hall. Submit an original and three copies. Bid proposal package is also available on-line at www.grand-island.com under Business-Bid Calendars. Bids received after the specified time will be returned unopened to sender.

The successful bidder will be required to comply with fair labor standards as required by Nebraska R.R.S.73-102 and comply with Nebraska R.R.S. 48-657 pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. Successful bidder shall maintain a drug free workplace policy. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

Each bidder shall submit with the bid a certified check, a cashiers check, or bid bond payable to the City Treasurer in an amount no less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within fourteen (14) days at the bid price if accepted by the City. **Your certified check, cashier's check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered.** Surety companies authorized to do business in the State of Nebraska must issue bid bonds.

Bids will be evaluated by the Purchaser based on price, schedule, quality, adherence to schedule, plan and specifications, economy and efficiency of operation, experience and reputation of the bidder, ability, capacity, and skill of the bidder to perform contract required and adaptability of the particular items to the specific use intended.

The Purchaser reserves the right to reject any or all bids, to waive irregularities therein, and to accept whichever bid that may be in the best interest of the City, at its sole discretion.

No bidder may withdraw his bid for a period of thirty (30) days after date of bid opening.

RaNae Edwards, City Clerk

(All bids must be submitted on this form)

URANIUM REMOVAL WATER TREATMENT PLANT –
EQUIPMENT INSTALLATION AND PUMP MODIFICATIONS

BID DATA FORM

CITY OF GRAND ISLAND
GRAND ISLAND, NE

The undersigned bidder, having examined all specifications and other bidding documents, and all addenda thereto, and being acquainted with and fully understanding all conditions relative to the specified materials and equipment, hereby proposes to provide such equipment FOB the City of Grand Island, freight prepaid, at the following price:

ITEM DESCRIPTION	EXTENDED COST
Base Bid:	
Material	$ _____
Labor	$ _____
Applicable Sales tax*	$ _____
Total Base Bid	$ _____

*** If bidder fails to include sales tax in their bid price or takes exception to including sales tax in their bid price, the City will add a 7.0% figure to the bid price for evaluation purposes; however, the City will only pay actual sales tax due.**

☐ By checking this box, Bidder acknowledges that Addenda Number(s) _____ were received and considered in Bid preparation.

☐ By checking this box, Bidder acknowledges **prepurchased Equipment must be delivered after March 30, 2012,** and the specified completion date of the project is **May 30, 2012.**

According to Nebraska Sales and Use Tax Requirements, Section 1-017, Contractors, check which option you have selected to file with the Nebraska Department of Revenue:

Nebraska law provides a sales and use tax exemption on contractor labor charges for the construction, repair, or annexation of any structure used for the generation, transmission, or distribution of electricity. Separately stated contractor labor would be exempt, all materials are taxable according to the contractor's option.

Option 1 (Section 1-017.05)_____ Option 2 (Section 1-017.06)_____ Option 3 (Section 1-017.07)_____

If the Nebraska sales and use tax election is not filed or noted above, the contractor will be treated as a retailer under Option 1 for sales and use tax purposes.

_____
Bidder Company Name Date

_____
Company Address City State Zip

_____
Print Name of Person Completing Bid Signature

Telephone No._____ Fax No._____

☐ By checking this box, Bidder acknowledges there are Exceptions noted to the bid.
NOTE: Any exceptions to specifications must be fully explained on a separate sheet attached to bid.

CHECKLIST FOR BID SUBMISSION

FOR

URANIUM REMOVAL WATER TREATMENT PLANT – EQUIPMENT INSTALLATION AND PUMP MODIFICATIONS

Bids must be received by the City Clerk before *2:00 P.M. on Tuesday, January 31, 2012*.

The following items must be completed for your bid to be considered.

- ❑ A signed original and three copies of the bidding documents.
- ❑ A reference list of at least three projects of similar scope and complexity.
- ❑ A summary of the experience of the service supervisor proposed for this project.
- ❑ Firm lump sum pricing; firm unit pricing in case adjustments are necessary, and breakout of sales tax pricing.
- ❑ A proposed construction/test schedule.
- ❑ A description of the system proposed, including equipment, controls, alarms and operation.
- ❑ Selection of Nebraska Sales Tax Option.
- ❑ Acknowledgment that the Prepurchased Equipment must be delivered after March 30, 2012 and the specified completion date is May 30, 2012.
- ❑ Bidders must complete and sign the Bid Data Form provided in these Documents. All blank spaces must be filled in. Bidders shall acknowledge receipt of any Addenda information on the Bid Data Form.
- ❑ A certified check, cashiers check or bid bond in a separate envelope attached to the **outside of the envelope containing the bid**. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened.

  Please check off each item as completed.

_____ _____

Company Signature

Telephone No. _____ Fax No. _____

INSTRUCTIONS TO BIDDERS

1. GENERAL INFORMATION.

   The following instructions outline the procedure for preparing and submitting Bids. Bidders must fulfill all requirements as specified in these Documents.

2. TYPE OF BID.

   Bidders shall be required to submit prices for all items listed in the Bid Data Form.

3. PREPARATION OF BIDS.

   Bidders shall use only the Bid Data Form provided in these Documents. All blank spaces in the Bid Data Form, must be filled in, preferably in BLACK ink, in both words and figures where required. No changes to the wording or content of the forms is permitted. Written amounts shall govern in case of discrepancy between the amounts stated in writing and the amounts stated in figures.

   Prices stated shall be f.o.b. with freight and full insurance paid by Bidder, to the job site located in Grand Island.

   The Bidder shall acknowledge receipt of all addenda in the Bid Data Form. Bids received without acknowledgement or without the Addendum enclosed will be considered informal.

4. SUBMISSION OF BIDS.

   All Bids must be submitted intact not later than the time prescribed, at the place, and in the manner set forth in the ADVERTISEMENT FOR BIDS. Bids must be made on the Bid Data Form provided here in. Each Bid must be submitted intact in a sealed envelope, so marked as to indicate its contents without being opened, and delivered in person or addressed and mailed in conformance with the instructions in the ADVERTISEMENT FOR BIDS.

5. BID SECURITY.

   Bids must be accompanied by cash, a certified check, or cashier's check drawn on a bank which is insured by the Federal Deposit Insurance Corporation, or a bid bond issued by a Surety authorized to issue such bonds in the state where the Work is located, in the amount of 5 percent of the bid amount payable to OWNER. This bid security shall be given as a guarantee that the Bidder will not withdraw his Bid for a period of 30 days after bid opening, and that if awarded the Contract, the successful Bidder will execute the attached Contract and furnish a properly executed Performance Bond and Payment Bond each in the full amount of the Contract price within the time specified.

   The Attorney-in-Fact that executes this bond in behalf of the Surety must attach a notarized copy of his power of attorney as evidence of his authority to bind the Surety on the date of execution of the bond. Where State Statue requires, certification by a resident agent shall also be provided.

6. RETURN OF BID SECURITY.

   Within 15 days after the award of the Contract, the OWNER will return the bid securities to all Bidders whose Bids are not to be further considered in awarding the contract. All other retained bid securities will be held until the Contract has been finally executed, after which all bid securities, other than Bidders' bonds and guarantees which have been fortified, will be returned to the respective Bidders whose Bids they accompanied.

7. BASIS OF AWARD.

   The award will be made by the OWNER on the basis of the Bid from the lowest responsive, responsible Bidder which, in the OWNER's sole and absolute judgment will best serve the interest of the OWNER. All Bids will be considered on the following basis:

Conformance with the terms of the Bid Documents.	Bid price. Cost of installation.

Suitability to project requirements. Responsibility and qualification of Bidder.
Delivery time.

The OWNER reserves the right to reject all Bids, or any Bid not in conformance with the intent of the Bid Documents, and to waive any informalities and irregularities in said Bids.

8. EXECUTION OF CONTRACT.

The successful Bidder shall, within 15 days after receiving notice of award, sign and deliver to the OWNER the Contract hereto attached together with the acceptable bonds as required in these Bid Documents. Within 15 days after receiving the signed Contract with acceptable bond(s) from the successful Bidder, the OWNER's authorized agent will sign the Contract. Signature by both parties constitutes execution of the Contract.

9. PERFORMANCE AND PAYMENT BONDS.

The successful Bidder shall file with the OWNER Performance and Payment Bonds in the full amount (100 percent) of the Contract price, as security for the faithful performance of the Contract and the payment of all persons supplying labor and materials for the Work under this Contract, and to cover all guarantees against defective workmanship or materials, or both, for a period of 1 year after the date of final acceptance of the Work by the OWNER. The Surety furnishing these bonds shall have a record of service satisfactory to the OWNER, be authorized to do business in the State where the OWNER's project is located and shall be named on the current list of approved Surety Companies, acceptable on Federal bonds as published by the Audit Staff, Bureau of Accounts, U.S. Treasury Department.

The Attorney-in-Fact (Resident Agent) who executes these bonds on behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bond.

10. TIME OF COMPLETION.

The time of completion of the Work to be performed under this Contract is the essence of the Contract. The time allowed for the completion of the Work is stated in the Bid Data Form.

11. GRATUITIES AND KICKBACKS.

City Code states that it is unethical for any person to offer, give, or agree to give any City employee or former City employee, or for any City employee or former City employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, or preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or subcontract, or to any solicitation or proposal therefor. It shall be unethical for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.

12. FISCAL YEAR.

The City of Grand Island, Nebraska operates on a fiscal year beginning October 1st and ending on the following September 30th. It is understood and agreed that any portion of this agreement which will be performed in a future fiscal year is contingent upon the City Council adopting budget statements and appropriations sufficient to fund such performance.

CONTRACT AGREEMENT

THIS AGREEMENT made and entered into by and between **[SUCCESSFUL BIDDER]**, hereinafter called the Contractor, and the **CITY OF GRAND ISLAND, NEBRASKA**, hereinafter called the City.

WITNESSETH:

THAT, WHEREAS, in accordance with law, the City has caused contract documents to be prepared and an advertisement calling for bids to be published for *URANIUM REMOVAL WATER TREATMENT PLANT – EQUIPMENT INSTALLATION AND PUMP MODIFCATIONS;* and

WHEREAS, the City, in the manner prescribed by law, has publicly opened, examined, and canvassed the bids submitted, and has determined the aforesaid Contractor to be the lowest responsive and responsible bidder, and has duly awarded to the said Contractor a contract therefore, for the sum or sums named in the Contractor's bid, a copy thereof being attached to and made a part of this contract;

NOW, THEREFORE, in consideration of the compensation to be paid to the Contractor and of the mutual agreements herein contained, the parties have agreed and hereby agree, the City for itself and its successors, and the Contractor for itself, himself, or themselves, and its, his, or their successors, as follows:

ARTICLE I. That the following documents shall comprise the Contract, and shall together be referred to as the "Agreement" or the "Contract Documents";

1. This Contract Agreement.
2. City of Grand Island's Specification for this project.
3. [NAME OF SUCCESSFUL BIDDER] bid signed and dated [DATE OF BID].

In the event of any conflict between the terms of the Contract Documents, the provisions of the document first listed shall prevail.

ARTICLE II. That the contractor shall (a) furnish all tools, equipment, superintendence, transportation, and other construction materials, services and facilities; (b) furnish, as agent for the City, all materials, supplies and equipment specified and required to be incorporated in and form a permanent part of the completed work; (c) provide and perform all necessary labor; and (d) in a good substantial and workmanlike manner and in accordance with the requirements, stipulations, provisions, and conditions of the contract documents as listed in the attached General Specifications, said documents forming the contract and being as fully a part thereof as if repeated verbatim herein, perform, execute, construct and complete all work included in and covered by the City's official award of this contract to the said Contractor, such award being based on the acceptance by the City of the Contractor's bid;

ARTICLE III. That the City shall pay to the Contractor for the performance of the work embraced in this contract and the Contractor will accept as full compensation therefore the sum (subject to adjustment as provided by the contract) of **[DOLLAR AMOUNT] ($00.00)** for all services, materials, and work covered by and included in the contract award and designated in the foregoing Article II; payments thereof to be made in cash or its equivalent in the manner provided in the General Specifications.

The total cost of the Contract includes:

Base Bid:	$	.00
Sales Tax on Materials/Equipment:	$	.00
Sales Tax on Labor:	$	.00
Total	$	.00

The City of Grand Island, Nebraska operates on a fiscal year beginning October 1st and ending on the following September 30th. It is understood and agreed that any portion of this agreement which will be performed in a future fiscal year is contingent upon the City Council adopting budget statements and appropriations sufficient to fund such performance.

ARTICLE IV. The Contractor hereby agrees to act as agent for the City in purchasing materials and supplies for the City for this project. The City shall be obligated to the vendor of the materials and supplies for the purchase price, but the Contractor shall handle all payments hereunder on behalf of the City. The vendor shall make demand or claim for payment of the purchase price from the City by submitting an invoice to the Contractor. Title to all materials and supplies purchased hereunder shall vest in the City directly from the vendor. Regardless of the method of payment, title shall vest immediately in the City. The Contractor shall not acquire title to any materials and supplies incorporated into the project. All invoices shall bear the Contractor's name as agent for the City. This paragraph will apply only to these materials and supplies actually incorporated into and becoming a part of the finished product of the URANIUM REMOVAL WATER TREATMENT PLANT – EQUIPMENT INSTALLATION AND PUMP MODIFICATIONS.

ARTICLE V. That the Contractor shall start work as soon as possible after the contract is signed and the required bonds and insurance are approved, and that the Contractor shall deliver the equipment, tools, supplies, and materials F.O.B. Platte Generating Station, and complete the work on or before ***May 30, 2012***.

ARTICLE VI. The Contractor agrees to comply with all applicable State fair labor standards in the execution of this contract as required by Section 73-102, R.R.S. 1943. The Contractor further agrees to comply with the provisions of Section 48-657, R.R.S. 1943, pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. During the performance of this contract, the Contractor and all subcontractors agree not to discriminate in hiring or any other employment practice on the basis, of race, color, religion, sex, national origin, age or disability. The Contractor agrees to comply with all applicable Local, State and Federal rules and regulations. The Contractor agrees to maintain a drug-free workplace policy and will provide a copy of the policy to the City upon request. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

GRATUITIES AND KICKBACKS

City Code states that it is unethical for any person to offer, give, or agree to give any City employee or former City employee, or for any City employee or former City employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, or preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any

other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or subcontract, or to any solicitation or proposal therefor. It shall be unethical for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.

[SUCCESSFUL BIDDER]

By_____ Date _____

Title_____

CITY OF GRAND ISLAND, NEBRASKA

By_____ Date _____
Mayor

Attest:_____
City Clerk

The contract is in due form according to law and hereby approved.

_____ Date _____
Attorney for the City

CITY OF GRAND ISLAND

Working Together for a Better Tomorrow, Today.

REQUEST FOR BIDS - GENERAL SPECIFICATIONS

The Bid shall be in accordance with the following and with all attached BID DATA and DETAILED SPECIFICATIONS.

All prices are to be furnished and installed FOB, Grand Island, Nebraska. **All prices shall be firm, and shall include all sales and use taxes as lawfully assessed under laws and regulations of the State of Nebraska.** * If bidder fails to include sales tax in their bid price or takes exception to including sales tax in their bid price, the City will add a 7.0% figure to the bid price for evaluation purposes; however, the City will only pay actual sales tax due.

Bids shall include the following on the **outside** of the mailing envelope: **"Uranium Removal Water Treatment Plant-Equipment Installation and Pump Modifications".** All sealed bids are due no later than **Tuesday, January 31, 2012 at 2:00 p.m. local time**. Submit **an original and three copies** of the bid to:

Mailing Address: City Clerk
City Hall
P. O. Box 1968
Grand Island, NE 68802

Street Address: City Clerk
City Hall
100 E. First Street
Grand Island, NE 68801

Bids will be opened at this time in the City Hall Council Conference Room #1 located on 1st floor of City Hall. Any bid received after the specified date will not be considered. No verbal bid will be considered.

Bids will be evaluated by the Purchaser based on price, schedule, quality, adherence to schedule, plan and specifications, economy and efficiency of operation, experience and reputation of the bidder, ability, capacity, and skill of the bidder to perform contract required and adaptability of the particular items to the specific use intended.

The successful bidder will be required to comply with fair labor standards as required by Nebraska R.R.S.73-102 and comply with Nebraska R.R.S. 48-657 pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. Contractor shall maintain a drug free workplace policy. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

The equipment and materials must be new, the latest make or model, unless otherwise specified. Prior to approving the invoice for payment, the City reserves the right to thoroughly inspect and test the equipment to confirm compliance with specifications. Any equipment or material which does not meet the City's requirements will be returned at vendor's expense for correction. The invoice will be paid after approval at the next regularly scheduled Council meeting and occurring after departmental approval of invoice; the City Council typically meets the second and fourth Tuesday of each month. Invoices must be received well in advance of Council date to allow evaluation and processing time.

Each bidder shall submit with the bid a certified check, a cashiers check, or bid bond payable to the City Treasurer in an amount no less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within fourteen (14) days at the bid price if accepted by the City. **Your certified check, cashier's check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered.** Surety companies authorized to do business in the State of Nebraska must issue bid bonds.

Successful bidder shall comply with the City's insurance requirements; performance and payment bonds are required for this project as outlined in the Detailed Specifications and Instructions to Bidders.

All bids shall be valid for at least thirty (30) working days after the bid deadline for evaluation purposes.

All bids must be on the bid form and must be signed and dated to be accepted. Please contact Lynn Mayhew at 308-385-5495, for questions concerning this specification.

Contract Drawings
and
Specifications

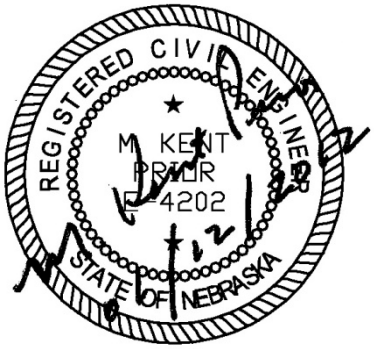
City of Grand Island Utilities Department

Uranium Removal WTP
Equipment Installation Package

ISSUED FOR BID

HDR PROJECT NO. 145910

JANUARY 12, 2012


REGISTERED CIVIL ENGINEER
M KENT
PRYOR
E-4202
STATE OF NEBRASKA


PROFESSIONAL ELECTRICAL ENGINEER
KEVIN KARL
THEARNES
E-8566
STATE OF NEBRASKA

2012/01/12

Table of Contents

DIVISION 01 - GENERAL REQUIREMENTS

01060	SPECIAL CONDITIONS
01060A	WRT SITE PREPARATION CHECKLIST
01340	SUBMITTALS
01600	PRODUCT DELIVERY, STORAGE, AND HANDLING
01650	FACILITY START-UP
01710	CLEANING
01733	CLEANING AND DISINFECTION OF FACILITIES

DIVISION 03 - CONCRETE

03308	CONCRETE, MATERIALS AND PROPORTIONING
03311	CONCRETE MIXING, PLACING, JOINTING, AND CURING

DIVISION 05 - METALS

05505	METAL FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07900	JOINT SEALANTS

DIVISION 09 - FINISHES

09905	PAINTING AND PROTECTIVE COATINGS

DIVISION 11 - EQUIPMENT

11005	EQUIPMENT: BASIC REQUIREMENTS
11006	PRE-PURCHASED EQUIPMENT: BASIC REQUIREMENTS
11060	PUMPING EQUIPMENT: BASIC REQUIREMENTS
11072	PUMPING EQUIPMENT: VERTICAL TURBINE (LINE SHAFT)
11301	URANIUM REMOVAL SYSTEM (PRE-PURCHASED)

DIVISION 15 - MECHANICAL

15060	PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS
15061	PIPE: STEEL
15062	PIPE: DUCTILE
15605	HVAC: EQUIPMENT
15890	HVAC: DUCTWORK
15970	INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS

DIVISION 16 - ELECTRICAL

16010	ELECTRICAL: BASIC REQUIREMENTS
16060	GROUNDING
16120	WIRE AND CABLE: 600 VOLT AND BELOW
16130	RACEWAYS AND BOXES
16220	MOTORS

16265 VARIABLE FREQUENCY DRIVES: LOW VOLTAGE
16441 PANELBOARDS
16442 MOTOR CONTROL EQUIPMENT
16491 LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)
16493 CONTROL EQUIPMENT ACCESSORIES

DIVISION 1

GENERAL REQUIREMENTS

2012/01/10

SECTION 01060
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 SPECIAL TERMS AND CONDITIONS

A. Definitions:
   1. Furnish or Install or Provide or Supply:
      a. The word "Furnish" or the word "Install" or the word "Provide" or the word "Supply," or any combination or similar directive or usage thereof, shall mean FURNISHING AND INCORPORATING IN THE WORK including all necessary labor, materials, equipment, and everything necessary to perform the Work indicated, unless specifically limited in the context.

B. Construction and Intent of the Contract Documents:
   1. The Contract Documents comprise the entire agreement between City and Contractor concerning the Work.
      a. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
      b. The Contract Documents will be construed in accordance with the law of the State of Nebraska.
   2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
      a. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for.
      b. Clarifications and interpretations of the Contract Documents shall be issued by the Engineer.
   3. Reference to Standards and Specifications of Technical Societies; Reporting and Resolving Discrepancies:
      a. Reference to standards, Specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, Specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
      b. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, Specification, manual or code or of any instruction of any Supplier, Contractor shall report it to Engineer in writing at once, and, Contractor shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued by either Change Order or a Work Directive; provided, however, that Contractor shall not be liable to City or Engineer for failure to report any such conflict, error, ambiguity or discrepancy unless Contractor knew or reasonably should have known thereof.

c. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by Change Order or Work Directive, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and:
   1) The provisions of any such standard, Specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
   2) The provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

d. No provision of any such standard, Specification, manual, code or instruction shall be effective to change the duties and responsibilities of City, Contractor or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to City, Engineer or any of Engineer's Consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the General Conditions or any other provision of the Contract Documents.

4. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of Engineer as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise).
   a. The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of the General Conditions or any other provision of the Contract Documents.
5. The Specifications may vary in form, format and style.
   a. Some Specification Sections are written in varying degrees of streamlined or declarative style and some Sections may be relatively narrative by comparison.
   b. Omissions of such words and phrases as "the Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined Sections.
   c. Omitted words and phrases shall be supplied by inference.
   d. Similar types of provisions may appear in various parts of a Section or articles within a part depending on the format of the Section.
   e. The Contractor shall not take advantage of any variation of form, format or style in making claims for extra Work.
6. The cross referencing of Specification Sections under the subparagraph heading "Related Sections include but are not necessarily limited to:" and elsewhere within each Specification Section is provided as an aid and convenience to the Contractor.
   a. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each Section or whether or not the cross referencing is complete.

C. Supervision and Construction Procedures:
1. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to City and Engineer except under extraordinary circumstances.
   a. The superintendent will be Contractor's representative at the site and shall have authority to act on behalf of Contractor.

b. All communications to the superintendent shall be as binding as if given to Contractor.
1) Contractor's superintendent shall be on site at all times Work is in progress whether work in progress is that of the General Contractor or any subcontractor(s).

2. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from City or Engineer, is obligated to act to prevent threatened damage, injury or loss.
a. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby.
b. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Construction Change Directive or Change Order will be issued to document the consequences of such action.

D. Contractor's Insurance:
1. With respect to all liability insurance required to be purchased by the Contractor, Engineer shall be named "Additional Insured" provided that:
a. Any additional cost to name Engineer as "Additional Insured" will be borne by Engineer.
b. If the additional cost is not acceptable to Engineer, Engineer will not be named "Additional Insured."

E. Schedule of Values:
1. The Schedule of Values shall indicate estimated quantities and respective costs and, at a minimum, segregate the lump sum bid items by Project Classified System, design element and Specification Section.
a. Schedule of Values shall be submitted to Engineer for review, comment, and approval 14 days after award.

F. Substantial Completion:
1. In the event the Engineer’s initial Substantial Completion inspection finds Work that is not substantially complete and subsequent inspections are required, all costs associated with the Engineer's re-inspection for determination of substantial completion shall be the sole responsibility of the Contractor and shall be reimbursed to the City either by direct payment to the City or by adjustment of the final Contract Amount.

G. Reports of Exploration and Tests:
1. The following are reports of explorations and tests of subsurface conditions at the site of the Work:
a. Geotechnical Exploration. City of Grand Island Treatment Building. City of Grand Island Well Field. Grand Island, NE, August 30, 2011. Prepared by Geotechnical Services, Inc.

H. Pre-Purchased Equipment
1. Owner has executed a contract for the procurement of materials and equipment to be furnished and delivered to the Site for installation by Contractor. See Specification Section 11301 and Shop Drawing Transmittal 11301-01. Equipment supplier is as follows:

Equipment/Section	Manufacturer (Seller/Supplier)	Description
Uranium Removal System 11301	Water Remediation Technology, LLC	Provide uranium removal filters, piping and appurtenances

2. BIDDER shall examine all information to determine the complete cost of receiving, storing, handling, installing and complete coordination of the inspection, adjustment, prestart-up, start-up, performance testing and training for the OWNER-procured equipment, materials and systems. Bidder shall review information concerning equipment weights and pick points and other information necessary for receipt of delivery, storage, handling, installation and coordination and scheduling of Seller's Special Services.
3. Contractor shall be responsible for the installation and coordination of the procured equipment including the schedule coordination, inspection, logistics planning, receipt, offloading, proper storage and preventive maintenance, if required, as well as the installation, start-up and other requirements of the Contract as if the procured equipment were originally procured from Sellers by Contractor. Contractor shall perform such duties in accordance with the requirements of the Procurement Contract, comply with the construction schedule with no delays to the Work and shall accept full care, custody and control of the equipment and materials.
4. As part of Contractor's responsibility in performing the scope of Work set forth herein, Contractor shall be responsible for, and shall maintain a current inventory of all materials, supplies and equipment purchased by Contractor and/or furnished by Owner for Contractor's use in performing the Work. Any lost, damaged or stolen inventory items shall be replaced at the Contractor's cost, on a monthly basis. All inventory items remaining at the conclusion of the Work shall be the property of the Owner.
5. Bidders shall examine the Procured Equipment information available in electronic (.pdf) format included with the bidding documents.

1.2 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference shall be held at Platte Generating Station, 1035 West Wildwood Drive, Grand Island, Nebraska, 68801 after award of Contract.
   1. Owner's Representative will notify the Contractor as to the date and time of the conference 2 weeks in advance of the proposed date.
   2. Contractor's Project Manager and Project Superintendent and Contractor's Subcontractor Representatives shall attend.

1.3 ORDER OF CONSTRUCTION AND CONSTRUCTION SCHEDULE

A. Construction operations will be scheduled to allow the Owner uninterrupted operation of existing adjacent facilities.
   1. Coordinate connections with existing work to ensure timely completion of interfaced items.

B. At no time shall Contractor or his employees modify operation of the existing facilities or start construction modifications without approval of the Owner except in emergency to prevent or minimize damage.

C. Within 10 days after award of Contract, submit for approval a critical path type schedule.
   1. Account for schedule of Subcontracts.
   2. Include proper sequence of construction, various crafts, purchasing time, Shop Drawing approval, material delivery, equipment fabrication, startup, demonstration, and similar time consuming factors.
   3. Show on schedule as a minimum, earliest starting, earliest completion, latest starting, latest finish, and free and total float for each task or item.

D. Evaluate schedule no less than monthly.
   1. Update, correct, and rerun schedule and submit to Owner's Representative in triplicate with pay application to show rescheduling necessary to reflect true job conditions.
   2. When shortening of various time intervals is necessary to correct for behind schedule conditions, indicate actions to implement to accomplish work in shorter duration.
   3. Information shall be submitted to Owner's Representative in writing with revised schedule.

E. If Contractor does not take necessary action to accomplish work according to schedule, Contractor may be ordered by Owner in writing to take necessary and timely action to improve work progress.
   1. Owner may require increased work forces, extra equipment, extra shifts or other action as necessary.
   2. Should Contractor refuse or neglect to take such action authorized, under provisions of this contract, Owner may take necessary actions including, but not necessarily limited to, withholding of payment and termination of contract.

F. Upon receipt of approved "Work Schedule," within 10 days, submit to Owner's Representative an estimated payment schedule by each month of project duration.
   1. Include a composite curve to show estimated value of work complete and stored materials less specified retainage.
   2. Establish key months when work will be 50, 80, 90, and 100 percent complete.
   3. During the course of work, update with new composite curves at key months or whenever variation is expected to be more than plus or minus 10 percent.
   4. Retain original or previous composite curves as dashed curves on all updates.
   5. Include a heavy plotted curve to show ACTUAL payment curve on all updates.

1.4 PROJECT MEETINGS

A. Construction Meetings:
   1. The Owner's Representative will conduct construction meetings involving:
      a. Contractor's project manager.
      b. Contractor's project superintendent.
      c. Owner's designated representative(s).
      d. Engineer's designated representative(s).
      e. Contractor's subcontractors as appropriate to the work in progress.
      f. Owner's Construction Quality Control Consultant.
   2. Meetings will be conducted monthly.
   3. The Owner's Representative will take meeting minutes and submit copies of meeting minutes to participants and designated recipients identified at the Preconstruction Conference.
      a. Corrections, additions or deletions to the minutes shall be noted and addressed at the following meeting.
   4. The Owner's Representative will schedule meetings for most convenient time frame.
   5. The Owner's Representative will have available at each meeting full chronological files of all previous meeting minutes.
   6. The Contractor shall have available at each meeting up-to-date Record Drawings.

B. Pre-Installation Conferences:
   1. Coordinate and schedule with Owner's Representative for each material, product or system specified.
      a. Conferences to be held prior to initiating installation, but not more than two (2) weeks before scheduled initiation of installation.
         1) Conferences may be combined if installation schedule of multiple components occurs within the same two (2) week interval.
         2) Review manufacturer's recommendations and Contract Documents Specifications.
   2. Contractor's Superintendent and individual who will actually act as foreman of the installation crew (installer), if other than the Superintendent, shall attend.

1.5 SPECIAL CONSIDERATIONS

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

B. No water supply or treatment equipment or processes shall be taken out of service without written approval of the owner.

C. The following requirements shall be completed prior to start-up of the WRT Equipment.
   1. New Water Treatment Equipment shall be installed, pressure tested, flushed, and disinfected.
   2. Wells shall be operational with system start-ups completed and checked by the manufacturer.
   3. WRT Site Preparation Validation Form W000214 completed and signed by the Contractor. See attachment 01060A.

1.6 PROJECT PHOTOGRAPHS

A. Pre Existing Conditions
   1. Prior to commencing with construction, existing condition of project site roadway pavement shall be documented with photographs.
      a. Highlight all apparent pavement defects.
      b. Furnish photographs on CD, with all rights of reproduction to Owner.

B. Prior to commencing with construction, at least once each month during construction of the Work, and after construction is complete, provide a photographer to take progress pictures as directed by Engineer.
   1. Furnish electronic photos copied to a compact disc, with all rights of reproduction, to Owner.
   2. Provide number of photographs as follows:
      a. Twenty-four (24) ground level color photos per month.
      b. Contractor shall schedule and coordinate photographer with Engineer's Field Representative.

1.7 SALVAGE OF MATERIALS AND EQUIPMENT

A. Existing materials and equipment removed by Contractor shall not be reused in the Work except where so specified or indicated.
   1. Existing materials and equipment removed, which are not reused as a part of the Work and which are not to remain the property of the Owner, shall become Contractor's property.

1.8 UTILITY WORK

A. Portions of the Work at the site may require the temporary support or relocation, or bypassing of mains or utility services, including poles, junction boxes, and traffic controllers, whether or not indicated on the Drawings.

B. Utility Notification:
   1. Contractor shall notify utilities as specified in the Notice to Owners and Authorities paragraph in this Section.

C. Utility Locates:
   1. Contractor shall be responsible for locating and verifying all utility elevations in the project area.

D. Emergency Response Plan:
   1. The Contractor shall prepare and submit to the Engineer a utility emergency response plan for each utility prior to beginning Work.
      a. The plan shall cover the emergency procedures to be followed in the event of striking the utility.
      b. The plan shall include the emergency telephone number and contact name, the potential hazards and issues that need to be addressed for developing response procedures, the locations of emergency facilities, communication procedures, and recommended actions to be taken to address each specific hazard.
      c. The plan shall be updated as required during the progress of the Work.

1.9 NOTICES TO OWNERS AND AUTHORITIES

A. Contractor shall, as provided in the General Conditions, notify regulating agencies, owners of adjacent property, local utilities, and pipeline companies when prosecution of the Work may affect them.
   1. The following utilities and companies and their telephone numbers are provided to assist the Contractor in notifying the utility or company.
      a. Owner and Engineer disclaim responsibility for the accuracy or completeness thereof.

Type of Utility or Agency	Utility or Comapany
Utility Members	Digger's Hotline of Nebraska 1-800-331-5666
Electricity	Platte Generating Station Mr. Lynn Mayhew (1-308-385-5492)
Water	Platte Generating Station Mr. Lynn Mayhew (1-308-385-5492)
Telephone and Fiber Optic	Platte Generating Station Mr. Lynn Mayhew (1-308-385-5492)

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SECTION)

END OF SECTION

1

Site Preparation Validation
WRT Project: W000214

This document shall serve as verification to Water Remediation Technology (WRT) that the customer's system installation responsibilities have been fulfilled per the contract. The customer (or customer's agent) shall sign in the spaces provided and return this document to WRT, certifying that the treatment system has been properly installed and the site has been readied for WRT personnel to proceed with media loading and/or system start-up.

TASK	COMPLETED	CUSTOMER SIGNATURE
Mechanical		
Piping installation per IFC drawings (latest revision) provided by WRT		
Well pump working and operational to design specifications		
Pressure and leak test system, not to exceed PRV set point		
Disinfection/sampling of contractor installation per AWWA recommendations		
Raw water provided at design basis pressure and flow per contract and WRT Provided Design Basis		
Electrical/Controls		
Service power connected to control panel		
Control panel wiring and connections installed per drawings, including well pump run status and well pump run permissive connections		
Facilities		
Building erection completed per engineering plans (as needed) per contract		
Building ambient temperature can be maintained above 40-degrees F.		
Verify tractor trailer access provided for WRT mobile service equipment		

Notes:

- Two weeks after the above items are complete and the form is signed and sent to WRT, WRT will schedule the system startup beginning on the next Monday. Alternatively, the customer may complete the form two weeks before the desired arrival date for the startup crew, guaranteeing the items to be complete by the crew's arrival. WRT will charge the client for expenses incurred due to incomplete or improperly performed work that causes WRT delays. The delays will be charged on an hourly basis for the crew. Delays causing additional days on site will be charged at full crew travel costs (crew time, lodging, meals, equipment rentals, flight changes, etc.). Longer delays incurred after the startup crew's arrival, which require demobilization and re-mobilization will result in charges to the customer to cover the additional costs.
- WRT requires a minimum of two (2) weeks notification of readiness in order to reschedule if initial start-up schedule is not met.

WRT Project Manager Initials_____ Validation Acceptance Date_____

Operations Initials_____

Rev 1 changes included highlighting contract info and adding pump operational information. Also added were sign-offs for Operations and Engineering VPs.
Rev 2 – Added pump run status and pump run permissive to Electrical; added detail and clarification to charges for delays.

Water Remediation Technology, LLC
9500 W. 49th Avenue, Suite D100, Wheat Ridge, Colorado 80033 · tel 303.424.5355 · fax 303.425.7497
email: info@wrtnet.com · web: www.wrtnet.com

2011/12/15

SECTION 01340
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Miscellaneous submittals.
      d. Operation and Maintenance Manuals.
   2. General content requirements for Shop Drawings.
   3. Content requirements for Operation and Maintenance Manuals.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Sections in Divisions 2 through 16 identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See General Conditions.
   2. Product data and samples are Shop Drawing information.

B. Operation and Maintenance (O&M) Manuals:
   1. Contain the information required for proper installation and maintenance of building materials and finishes.
   2. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

C. Miscellaneous Submittals:
   1. Submittals other than Shop Drawings and O&M Manuals.
   2. Representative types of miscellaneous submittal items include but are not limited to:
      a. Construction schedule.
      b. Concrete, soil compaction, and pressure test reports.
      c. HVAC test and balance reports.
      d. Installed equipment and systems performance test reports.
      e. Manufacturer's installation certification letters.
      f. Instrumentation and control commissioning reports.
      g. Warranties.
      h. Service agreements.
      i. Construction photographs.
      j. Survey data.
      k. Cost breakdown (Schedule of Values).

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted and approved within 20 days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

B. Shop Drawings: Submittal and approval prior to 50 percent completion.

C. Operation and Maintenance Manuals and Completed Equipment Record Sheets: Initial submittal within 60 days after date Shop Drawings are approved.

1.4 PREPARATION OF SUBMITTALS

A. General:
1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without review.

B. Shop Drawings:
1. Scope of any submittal and letter of transmittal:
a. Limited to one (1) Specification Section.
b. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Section.
2. Numbering letter of transmittal:
a. Include as prefix the Specification Section number followed by a series number, "-xx", beginning with "01" and increasing sequentially with each additional transmittal.
b. If more than one (1) submittal under any Specification Section, assign consecutive series numbers to subsequent transmittal letters.
3. Describing transmittal contents:
a. Provide listing of each component or item in submittal capable of receiving an independent review action.
b. Identify for each item:
1) Manufacturer and Manufacturer's Drawing or data number.
2) Contract Document tag number(s).
3) Contract Drawing Section or detail number if appropriate.
4) Specification Article/Paragraph number if appropriate.
5) Unique page numbers for each page of each separate item.
c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
4. Contractor stamping:
a. General:
1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
a) Contractor's signature and date shall be wet ink signature.
b) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated under General Conditions Paragraph 6.17D."
c) Letters of transmittal may be stamped only when the scope of the submittal is one (1) item.
2) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.
a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.
b. Electronic stamps:
1) Contractor may electronically embed Contractor's review and approval stamp to either the letter of transmittal or a separate index sheet preceding each independent item in the submittal.
2) Contractor's signature and date on electronically applied stamps shall be wet ink signature.

5. Resubmittals:
    a. Number with original root number and a suffix letter starting with "A" on a (new) duplicate transmittal form.
    b. Do not increase the scope of any prior transmittal.
    c. Account for all components of prior transmittal.
        1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
            a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
        2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
            a) Obtain Engineer's approval to exclude items.
6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide three (3) copies of each page for Engineer plus the number required by the Contractor.
    a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed four (4).
    b. All other size sheets:
        1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
        2) Utilize mailing tube; do not fold.
        3) The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.
7. Provide clear space (3 IN SQ) for Engineer stamping of each component defined in PREPARATION OF SUBMITTALS – Contractor Stamping.
8. Contractor shall not use red color for marks on transmittals.
    a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
    b. Outline Contractor marks on reproducible transparencies with a rectangular box.
9. Transmittal contents:
    a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
    b. Identify equipment or material use, tag number, Drawing detail reference, weight, and other Project specific information.
    c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    d. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
        1) Indicate exact item or model and all options proposed.
    e. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
        1) Arrange data and performance information in format similar to that provided in Contract Documents.
        2) Provide, at minimum, the detail specified in the Contract Documents.
    f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.
10. Samples:
    a. Identification:
        1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, standard Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.

2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.

b. Include application specific brochures, and installation instructions.

c. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.

d. Resubmit samples of rejected items.

C. Miscellaneous Submittals:

1. Prepare in the format and detail specified in Specification requiring the miscellaneous submittal.

D. Operation and Maintenance Manuals:

1. Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.
   a. Identify resubmittals with the original number plus a suffix letter starting with "A."
2. Submittal format:
   a. Interim submittals: Submit one (1) paper copy and one (1) electronic copy until manual is approved.
   b. Final submittals:
      1) Within 30 days of receipt of approval, submit two (2) additional paper copies and two (2) additional electronic copies.
3. Paper copy submittals:
   a. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.
      1) Provide binders with titles inserted under clear overlay on front and on spine of each binder.
         a) As space allows, binder titles shall include, but not necessarily be limited to, Project Name, related Specification Number, Equipment Name(s) and Project Equipment Tag Numbers.
      2) Provide a Cover Page for each manual with the following information:
         a) Manufacturer(s).
         b) Date.
         c) Project Owner and Project Name.
         d) Specification Section.
         e) Project Equipment Tag Numbers.
         f) Model Numbers.
         g) Engineer.
         h) Contractor.
      3) Provide a Table of Contents or Index for each manual.
      4) Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.
      5) Provide plastic sheet lifters prior to first page and following last page.
   b. Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size.
      1) Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
      2) Identify vinyl envelopes with Drawing numbers.
   c. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.
      1) Delete or cross out information that does not specifically apply to the Project.
4. Operation and Maintenance Manuals for Equipment and Systems:
   a. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:
      1) Major equipment.
      2) Equipment powered by electrical, pneumatic or hydraulic systems.

3) Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.
4) Valves and water control gates.

b. Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:
1) Fully completed type-written copies of the associated Equipment Record(s), Exhibits C1, C2 and C3, shall be included under the first tab following the Table of Contents of each Operation and Maintenance Manual.
a) Each section of the Equipment Record must be completed in detail.
(1) Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.
b) For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.
c) Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.
d) Electronic copies of the Exhibits may be obtained by contacting the Project Manager.
2) Equipment function, normal operating characteristics, limiting operations.
3) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
4) Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
5) Lubrication and maintenance instructions.
6) Troubleshooting guide.
7) Parts lists:
a) Comprehensive parts and parts price lists.
b) A list of recommended spare parts.
c) List of spare parts provided as specified in the associated Specification Section.
8) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
9) Test data and performance curves.
10) As-constructed fabrication or layout Drawings and wiring diagrams.
11) Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.
12) Additional information as specified in the associated equipment or system Specification Section.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Samples and Operation and Maintenance Manuals:
1. Transmit all submittals to:

HDR
301 S 13th Street, Cornhusker Plaza, Suite 601
Lincoln, NE 68508-2532
Attn: Kent Prior

2. Utilize two (2) copies of attached Exhibit "A" to transmit all Shop Drawings and samples.
3. Utilize two (2) copies of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.
4. All submittals must be from Contractor.
a. Submittals will not be received from or returned to subcontractors.

b. Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.

5. Provide submittal information defining specific equipment or materials utilized on the Project.
   a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

B. Miscellaneous Submittals:
1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual Specification Section.
3. Transmit to:

HDR
301 S 13th Street, Cornhusker Plaza, Suite 601
Lincoln, NE 68508-2532
Attn: Kent Prior

4. Provide copy of letter of transmittal without attachments to Engineer's Resident Project Representative.
   a. Exception for concrete, soils compaction and pressure test reports.
      1) Transmit one (1) copy of test reports to Resident Project Engineer.
      2) Transmit one (1) copy of test reports to location and individual indicated above for other miscellaneous submittals.

C. Expedited Return Delivery:
1. Include prepaid express envelope or airbill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
2. Inclusion of prepaid express envelope or airbill does not obligate Engineer to conduct expedited review of submittal.

D. Electronic submittals will not be accepted.

E. Fax Transmittals:
1. Permitted on a case-by-case basis to expedite review when approved by Engineer.
2. Requires hard copy transmittal to immediately follow.
   a. Engineer will proceed with review of fax transmittal.
   b. Engineer's approval or rejection comments will be recorded and returned on hard copy transmittal.
3. Provisions apply to both:
   a. Initial transmittal contents.
   b. Supplemental information required to make initial transmittal contents complete.

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:
1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
   a. A - FURNISH AS SUBMITTED.
   b. B - FURNISH AS NOTED (BY ENGINEER).
   c. C - REVISE AND RESUBMIT.
   d. D - REJECTED.
   e. E - ENGINEER'S REVIEW NOT REQUIRED.
2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
   a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.

3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
    a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
        1) Review and approval will be limited to the single item described on the transmittal letter.
        2) Other items identified in the submittal will:
            a) Not be logged as received by the Engineer.
            b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
            c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
    b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.
        1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
    a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
    b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
    a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
        1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
            a) Correct and resubmit items so marked.
    b. Items marked "A" or "B" will be fully distributed.
    c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
        1) This is at the sole discretion of the Engineer.
        2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
        3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been performed by individuals meeting specified qualifications, and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
8. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Engineer's Review Not Required."
9. Samples may be retained for comparison purposes.
    a. Remove samples when directed.

b. Include in bid all costs of furnishing and removing samples.

10. Approved samples submitted or constructed, constitute criteria for judging completed work.
    a. Finished work or items not equal to samples will be rejected.

B. Operation and Maintenance Manuals:
1. Engineer will review and indicate one of the following review actions:
    a. A - ACCEPTABLE.
    b. B - ~~FURNISH AS NOTED~~ - Not Used.
    c. C - REVISE AND RESUBMIT.
    d. D - ~~REJECTED~~ - Not Used.
2. Acceptable paper copy submittal will be retained with the transmittal form returned with a request for two (2) additional paper copies.
3. Deficient submittals (paper copy and/or electronic copy) will be returned along with the transmittal form which will be marked to indicate deficient areas.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

END OF SECTION

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other |

(Jun 1990; Revised Jun 1997; Revised Oct 2001, Revised Nov 2007)

EXHIBIT B

O&M Manual Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:
Project Owner:		Checked By:
Contractor:	Owner:	Log Page:
Address:	Address:	HDR No.:
Attn:	Attn:	1st. Sub. ReSub.

Date Transmitted: Previous Transmittal Date:

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To: From:

HDR Engineering, Inc.

Date:

* The Action designated above is in accordance with the following legend:

A - Acceptable, provide one (1) additional paper copy and two (2) electronic copies on CD-ROM for final review.

B - ~~Furnish as Noted~~ - Not Used

C - Revise and Resubmit
This Operation and Maintenance Manual Submittal is deficient in the following area:

1. Equipment Records.
2. Functional description.
3. Assembly, disassembly, installation, alignment, adjustment & checkout instructions.
4. Operating instructions.
5. Lubrication & maintenance instructions.
6. Troubleshooting guide.
7. Parts list and ordering instructions.
8. Organization (binder, binder titles, index & tabbing).
9. Wiring diagrams & schematics specific to installation.
10. Outline, cross section & assembly diagrams.
11. Test data & performance curves.
12. Tag or equipment identification numbers.
13. Inclusion of all components & subcomponents.
14. Other - see comments.

D - ~~Rejected~~ - Not Used

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

EXHIBIT C1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name	Specification Section:
Equipment Name	Year Installed:
Project Equipment Tag No(s).	
Equipment Manufacturer	Project/ Order No.
Address	Phone
Fax / Web Site / E-mail	
Local Vendor/Service Center	
Address	Phone
Fax / Web Site / E-mail	

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.			Serial No.					
Make			Model No.					
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

EXHIBIT C2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP						
	D	W	M	Q	S	A	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *						
	D	W	M	Q	S	A	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours = Run Time Interval

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

1

HDR

EXHIBIT C3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

(Feb 1991; Revised Oct 2001, Revised Nov 2007)

1

2011/12/29

SECTION 01600
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery.
   2. Packaging of products for delivery.
   3. Protection of products against damage from:
      a. Handling.
      b. Exposure to elements or harsh environments.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

C. Payment:
   1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved Shop Drawings.
      a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.2 DELIVERY

A. Scheduling: Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

B. Packaging: Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

C. Identification: Clearly and fully mark and identify as to manufacturer, item, and installation location.

D. Protection and Handling: Provide manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

A. Manufacturer's Instruction:
   1. Protect all products or equipment in accordance with manufacturer's written directions.
      a. Store products or equipment in location to avoid physical damage to items while in storage.
      b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
   2. Protect equipment from exposure to elements and keep thoroughly dry.
   3. Store pumps, motors, electrical equipment, and other equipment having antifriction or sleeve bearings in weathertight storage areas which are maintained at a temperature of at least 50 DegF.

4. When space heaters are provided in equipment, connect and operate heaters during storage until equipment is placed in service.

3.2 FIELD QUALITY CONTROL

A. Inspect Deliveries:
   1. Inspect all products or equipment delivered to the site prior to unloading.
      a. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

B. Monitor Storage Area: Monitor storage area to ensure suitable temperature and moisture conditions are maintained as required by manufacturer or as appropriate for particular items.

END OF SECTION

2011/12/29

SECTION 01650
FACILITY START-UP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures and actions, required of the Contractor, which are necessary to achieve and demonstrate Substantial Completion.
   2. Requirements for Substantial Completion Submittals.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.

1.2 DEFINITIONS

A. Pre-Demonstration Period: The period of time, of unspecified duration after initial construction and installation activities during which Contractor, with assistance from manufacturer's representatives, performs in the following sequence:
   1. Finishing type construction work to ensure the Project has reached a state of Substantial Completion.
   2. Equipment start-up.
   3. Personnel training.

B. Demonstration Period: A period of time, of specified duration, following the Pre-Demonstration Period, during which the Contractor initiates process flow through the facility and starts up and operates the facility, without exceeding specified downtime limitations, to prove the functional integrity of the mechanical and electrical equipment and components and the control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.

C. Substantial Completion: See Division 0, General Conditions.

1.3 SUBMITTALS

A. See Section 01340 for requirements for the mechanics and administration of the submittal process.

B. Submit in the chronological order listed below prior to the completion of the Pre-Demonstration Period.
   1. Master operation and maintenance training schedule:
      a. Submit 30 days (minimum) prior to first training session for Owner's personnel.
      b. Schedule to include:
         1) Target date and time for Owner witnessing of each system initial start-up.
         2) Target date and time for Operation and Maintenance training for each system, both field and classroom.
         3) Target date for initiation of Demonstration Period.
      c. Submit for review and approval by Owner.
      d. Include holidays observed by Owner.
      e. Owner reserves the right to insist on a minimum 7 days' notice of rescheduled training session not conducted on master schedule target date for any reason.
      f. Schedule to be resubmitted until approved.

2. Substantial Completion Submittal:
    a. File Contractor's Notice of Substantial Completion and Request for Inspection.
    b. Approved Operation and Maintenance manuals received by Engineer minimum 1 week prior to scheduled training.
    c. Written request for Owner to witness each system pre-demonstration start-up. Request to be received by Owner minimum 1 week before scheduled training of Owner's personnel on that system.
    d. Equipment installation and pre-demonstration start-up certifications.
    e. Letter verifying completion of all pre-demonstration start-up activities including receipt of all specified items from manufacturers or suppliers as final item prior to initiation of Demonstration Period.

1.4 COST OF START-UP

A. Contractor to pay all costs associated with Facility start-up.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 GENERAL

A. Facility Start-up Divided into Two Periods:
    1. Pre-Demonstration Period including:
        a. Completion of construction work to bring Project to a state of Substantial Completion.
        b. Start-up of Equipment.
        c. Training of Personnel.
        d. Completion of the filing of all required submittals.
        e. Filing of Contractor's Notice of Substantial Completion and Request for Inspection.
    2. Demonstration Period including:
        a. Demonstration of functional integrity of facility.

3.2 PRE-DEMONSTRATION PERIOD

A. Completion of Construction Work:
    1. Complete the work to bring the Project to a state of substantial completion.

B. Equipment Start-up:
    1. Requirements for individual items of equipment are included in Divisions 2 through 16 of these Specifications.
    2. Prepare the equipment so it will operate properly and safely and be ready to demonstrate functional integrity during the Demonstration Period.
    3. Perform Equipment Start-up to extent possible without introducing water flow.
    4. Test tanks, pumping and similar equipment requiring a fluid, using clean water supplied at Contractor's expense.
    5. Dispose of water used for Equipment Start-up to an approved location by the Owner.
    6. Introduce water flow to complete Equipment Start-up for the following equipment:
        a. WRT Treatment Equipment.
    7. Procedures include but are not necessarily limited to the following:
        a. Test or check and correct deficiencies of:
            1) Power, control, and monitoring circuits for continuity prior to connection to power source.
            2) Voltage of all circuits.
            3) Phase sequence.
            4) Cleanliness of connecting piping systems.
            5) Alignment of connected machinery.

6) Vacuum and pressure of all closed systems.
7) Lubrication.
8) Valve orientation and position status for manual operating mode.
9) Instrumentation and control signal generation, transmission, reception, and response.
10) Tagging and identification systems.
11) All equipment: Proper connections, alignment, calibration and adjustment.

b. Calibrate all safety equipment.
c. Manually rotate or move moving parts to assure freedom of movement.
d. "Bump" start electric motors to verify proper rotation.
e. Perform other tests, checks, and activities required to make the equipment ready for Demonstration Period.
f. Documentation:
1) Prepare a log showing each equipment item subject to this paragraph and listing what is to be accomplished during Equipment Start-up. Provide a place for the Contractor to record date and person accomplishing required work. Submit completed document before requesting inspection for Substantial Completion certification.

8. Obtain certifications, without restrictions or qualifications, and deliver to Engineer:
a. Manufacturer's equipment installation check letters.
b. Instrumentation Supplier's Instrumentation Installation Certificate.

C. Personnel Training:
1. See individual equipment specification sections.
2. Conduct all personnel training after completion of Equipment Start-up for the equipment for which training is being conducted.
a. Personnel training on individual equipment or systems will not be considered completed unless:
1) All pretraining deliverables are received and approved before commencement of training on the individual equipment or system.
2) No system malfunctions occur during training.
3) All provisions of field and classroom training specifications are met.
b. Training not in compliance with the above will be performed again in its entirety by the manufacturer at no additional cost to Owner.
3. Field and classroom training requirements:
a. Hold classroom training on-site.
b. Notify each manufacturer specified for on-site training that the Owner reserves the right to video record any or all training sessions. Organize each training session in a format compatible with video recording.
c. Training instructor: Factory trained and familiar with giving both classroom and "hands-on" instructions.
d. Training instructors: Be at classes on time. Session beginning and ending times to be coordinated with the Owner and indicated on the master schedule. Normal time lengths for class periods can vary, but brief rest breaks should be scheduled and taken.
e. Organize training sessions into maintenance verses operation topics and identify on schedule.
f. Plan for minimum class attendance of six (6) people at each session and provide sufficient classroom materials, samples, and handouts for those in attendance.
g. Instructors to have a typed agenda and well prepared instructional material. The use of visual aids, e.g., films, pictures, and slides is recommended for use during the classroom training programs. Deliver agendas to the Engineer a minimum of 7 days prior to the classroom training. Provide equipment required for presentation of films, slides, and other visual aids.

h. In the on-site training sessions, cover the information required in the Operation and Maintenance manuals submitted according to Section 01340 and the following areas as applicable.
    1) Operation of equipment.
    2) Lubrication of equipment.
    3) Maintenance and repair of equipment.
    4) Troubleshooting of equipment.
    5) Preventive maintenance procedures.
    6) Adjustments to equipment.
    7) Inventory of spare parts.
    8) Optimizing equipment performance.
    9) Capabilities.
    10) Operational safety.
    11) Emergency situation response.
    12) Takedown procedures (disassembly and assembly).
i. Address above Paragraphs 1), 2), 8), 9), 10), and 11) in the operation sessions. Address above Paragraphs 3), 4), 5), 6), 7), and 12) in the maintenance sessions.
j. Maintain a log of classroom training provided including: Instructors, topics, dates, time, and attendance.

D. Complete the filing of all required submittals:
1. Shop Drawings.
2. Operation and Maintenance Manuals.
3. Training material.

E. Filing of Contractor's Notice of Substantial Completion and Request for Inspection of Project:
1. File the notice when the following have been completed:
    a. Construction work (brought to state of Substantial Completion).
    b. Equipment Start-up.
    c. Personnel Training.
    d. Submittal of required documents.
2. Engineer will review required submittals for completeness within 5 calendar days of Contractor's notice. If complete, Engineer will complete inspection of the Work, within 10 calendar days of Contractor's notice.
3. Engineer will inform Contractor in writing of the status of the Work reviewed, within 14 calendar days of Contractor's notice.
    a. Work determined not meeting state of Substantial Completion:
        1) Contractor: Correct deficiencies noted or submit plan of action for correction within 5 days of Engineer's determination.
        2) Engineer: Reinspect work within 5 days of Contractor's notice of correction of deficiencies.
        3) Reinspection costs incurred by Engineer will be billed to Owner who will deduct them from final payment due Contractor.
    b. Work determined to be in state of tentative Substantial Completion: Engineer to prepare tentative "Engineer's Certificate of Substantial Completion."
    c. Engineer's Certificate of Substantial Completion:
        1) Certificate tentatively issued subject to successful Demonstration of functional integrity.
        2) Issued for Project as a whole.
        3) Issued subject to completion or correction of items cited in the certificate (punch list).
        4) Issued with responsibilities of Owner and Contractor cited.
        5) Executed by Engineer.
        6) Accepted by Owner.
        7) Accepted by Contractor.

d. Upon successful completion of Demonstration Period, Engineer will endorse certificate attesting to the successful demonstration, and citing the hour and date of ending the successful Demonstration Period of functional integrity as the effective date of Substantial Completion.

3.3 DEMONSTRATION PERIOD

A. General:
1. Demonstrate the functional integrity of the mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility as evidence of Substantial Completion.
2. Duration of Demonstration Period: 40 HRS of normal operation.
3. If, during the Demonstration Period, the aggregate amount of time used for repair, alteration, or unscheduled adjustments to any equipment or systems that renders the affected equipment or system inoperative exceed 10 percent of the Demonstration Period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Demonstration Period will recommence after correction of the cause of failure. The new Demonstration Period shall have the same requirements and duration as the Demonstration Period previously conducted.
4. Conduct the demonstration of functional integrity under full operational conditions.
5. Owner will provide operational personnel to provide process decisions affecting plant performance. Owner's assistance will be available only for process decisions. Contractor will perform all other functions including but not limited to equipment operation and maintenance until successful completion of the Demonstration Period.
6. Owner reserves the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc., to verify the functional integrity of automatic and manual backup systems and alternate operating modes.
7. Time of beginning and ending any Demonstration Period shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Demonstration Period.
8. Throughout the Demonstration Period, provide knowledgeable personnel to answer Owner's questions, provide final field instruction on select systems and to respond to any system problems or failures which may occur.
   a. Provide final field instruction on the following systems:
9. Provide all labor, supervision, utilities, chemicals, maintenance, equipment, vehicles or any other item necessary to operate and demonstrate all systems being demonstrated.

END OF SECTION

1

2011/12/29

SECTION 01710
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Intermediate and final cleaning of Work not including special cleaning of closed systems specified elsewhere.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 STORAGE AND HANDLING

A. Store cleaning products and cleaning wastes in containers specifically designed for those materials.

1.3 SCHEDULING

A. Schedule cleaning operations so that dust and other contaminants disturbed by cleaning process will not fall on newly painted surfaces.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents:
   1. Compatible with surface being cleaned.
   2. New and uncontaminated.
   3. For Manufactured Surfaces: Material recommended by manufacturer.

PART 3 - EXECUTION

3.1 CLEANING - GENERAL

A. Prevent accumulation of wastes that create hazardous conditions.

B. Conduct cleaning and disposal operations to comply with laws and safety orders of governing authorities.

C. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or sewers.

D. Dispose of degradable debris at an approved solid waste disposal site.

E. Dispose of nondegradable debris at an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.

F. Handle materials in a controlled manner with as few handlings as possible.

G. Do not drop or throw materials from heights greater than 4 FT or less than 4 FT if conditions warrant greater care.

H. On completion of work, leave area in a clean, natural looking condition.
    1. Remove all signs of temporary construction and activities incidental to construction of required permanent Work.

I. Do not burn on-site.

3.2 INTERIOR CLEANING

A. Cleaning During Construction:
    1. Keep work areas clean so as not to hinder health, safety or convenience of personnel in existing facility operations.
    2. At maximum weekly intervals, dispose of waste materials, debris, and rubbish.
    3. Vacuum clean interior areas when ready to receive finish painting.
        a. Continue vacuum cleaning on an as-needed basis, until substantial completion.

B. Final Cleaning:
    1. Complete immediately prior to Demonstration Period.
    2. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed surfaces.
    3. Wipe all lighting fixture reflectors, lenses, lamps and trims clean.
    4. Wash and shine glazing and mirrors.
    5. Polish glossy surfaces to a clear shine.
    6. Ventilating systems:
        a. Clean permanent filters and replace disposable filters if units were operated during construction.
        b. Clean ducts, blowers and coils if units were operated without filters during construction.
    7. Replace all burned out lamps.
    8. Broom clean process area floors.
    9. Mop office and control room floors.

3.3 EXTERIOR (SITE) CLEANING

A. Cleaning During Construction:
    1. Construction debris:
        a. Confine in strategically located container(s):
            1) Cover to prevent blowing by wind.
            2) Haul from site minimum once a week.
        b. Remove from work area to container daily.
    2. Vegetation: Keep weeds and other vegetation trimmed to 3 IN maximum height.
    3. Soils, sand, and gravel deposited on paved areas and walks:
        a. Remove as required to prevent muddy or dusty conditions.
        b. Do not flush into storm sewer system.

B. Final Cleaning:
    1. Remove trash and debris containers from site.
        a. Re-seed areas disturbed by location of trash and debris containers.
    2. Clean paved roadways.

3.4 FIELD QUALITY CONTROL

A. Immediately prior to Demonstration Period, conduct an inspection with Engineer to verify condition of all work areas.

END OF SECTION

2012/01/10

SECTION 01733
CLEANING AND DISINFECTION OF FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for cleaning and disinfection of Pipelines, Storage and Treatment Facilities.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.
   4. Section 11006 – Pre-Purchased.
   5. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
      a. B300, Hypochlorites.
      b. B301, Liquid Chlorine.
      c. C651, Disinfection Water Mains.
      d. C653, Disinfection of Water Treatment Plants.
   2. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF):
      a. 60, Drinking Water Treatment Chemicals-Health Effects
      b. 61, Drinking Water System Components-Health Effects.
   3. American Public Health Association (APHA)/American Water Works Association (AWWA)/Water Environment Federation (WEF):
      a. Standard Methods for the Examination of Water and Wastewater.
   4. Nebraska Department of Health and Human Services:
      a. Title 179, Public Water Supply Systems.

B. Qualifications:
   1. Provide qualified person to supervise use of liquid chlorine as defined in PART 2.

1.3 SUBMITTALS

A. See Section 01340.

B. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Product data for disinfectants to be used.
      c. Disinfection Plan:
         1) Provide at least 60 days prior to disinfection.
         2) Include the following:
            a) Schedule for activities.
            b) Procedure and plan for cleaning and flushing system.
            c) Procedure and plan for disinfection and verification testing.
            d) Proposed locations where samples are to be taken.
            e) Proposed sampling intervals.
            f) Schedule of samples to be tested by Owner.

g) Type of disinfecting solution and method of preparation.
h) Method of disposal of highly chlorinated water.

C. Miscellaneous Submittals:
1. Qualifications of supervising personnel for use of liquid chlorine.
2. Certified bacteriological verification test results.

1.4 SEQUENCING AND SCHEDULING

A. See Section 01650 for requirements regarding sequencing of disinfection work with Facility Demonstration.

B. Commence disinfection after completion of the following:
1. Completion and acceptance of internal coatings systems.
2. Hydrostatic and pneumatic testing, pressure testing, leak testing, functional and performance testing and acceptance of pipelines, structures, and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Water for Disinfection and Flushing:
1. Clean, uncontaminated, and meeting the requirements outlined in Section 01650 for management of water during start-up and demonstration.
2. Coordinate with Owner on supply of water.

B. Equipment:
1. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
2. Provide protection as required by AWWA for cross-connection to previously disinfected sources.

C. Disinfectants:
1. Liquid chlorine:
a. Conforming to requirements of ANSI/AWWA B301.
b. Certified for potable water application per ANSI/NSF 60 or ANSI/NSF 61 as applicable.
c. May be used only if following conditions are met:
1) Used in combination with appropriate gas-flow chlorination equipment to provide controlled high-concentration solution feed to the water to be chlorinated.
2) Used under direct supervision of a person familiar and experienced with the physiological, chemical and physical properties of liquid chlorine and who is trained and equipped to handle emergency situations that may arise.
a) Owner must approve qualifications of supervising person designated by Contractor.
3) When appropriate safety practices are observed to protect working personnel and the public.
2. Sodium hypochlorite:
a. Conforming to requirements of ANSI/AWWA B300.
b. Certified for potable water application per ANSI/NSF 60 or ANSI/NSF 61 as applicable.
3. Calcium hypochlorite:
a. Conforming to requirements of ANSI/AWWA B300.
b. Certified for potable water application per ANSI/NSF 60 or ANSI/NSF 61 as applicable.
c. Sequestered calcium hypochlorite intended for swimming pool disinfection may not be used.

PART 3 - EXECUTION

3.1 GENERAL

A. All facilities covered by this Section shall be protected, cleaned, and flushed in accordance with the requirements herein.
   1. The specific facilities to be disinfected are also listed herein.

B. Protection During Construction Period:
   1. Observe Preventive and Corrective Measures During Construction as defined in ANSI/AWWA C651.
   2. Keep pipes clean and dry during storage and installation.
   3. Protect pipes during wet-trench installation and provide protection from flooding or storm events.
   4. In the event of contamination, clean and swab pipe in accordance with ANSI/AWWA C651.

C. Disinfection procedures shall conform to ANSI/AWWA, Nebraska Department of Health Regulations, and this Specification.
   1. Disinfect surfaces of materials that will contact finished water, both during and following construction, using one of the methods specified in this Section.
   2. Take care to avoid recontamination following disinfection.
   3. Allow water and disinfectant solution to flow into pipe or vessel at a measured rate so that chlorinated water is mixed and at a consistent concentration meeting or exceeding the required solution strength.
   4. Do not place concentrated commercial disinfectant in pipeline or other facilities to be disinfected before it is filled with water.

D. Facilities to be Disinfected:
   1. Disinfection is required for all elements of the new water treatment facilities that contact raw or finished water.
   2. Items to be disinfected include:
      a. All potable water piping.
      b. All process water piping upstream and downstream of the WRT vessels including but not limited to the following:
         1) Influent piping from wells 6, 7, and 8.
         2) Equipment provided by WRT including piping, fittings and valves.
      c. All water treatment process units including the following:
         1) WRT vessels.
      d. Pumps for Wells 6, 7, and 8 and associated piping.
      e. Any other associated piping, appurtenances, or treatment process units.

3.2 PREPARATION

A. Cleaning and Flushing for all Facilities:
   1. Thoroughly clean and flush piping systems including supply, source and any appurtenant devices before performing disinfection.
   2. Cleaning agents used shall not contain hazardous substances or deleterious compounds that would cause a violation of water quality standards or cause health effects is subsequently introduced into the water supply during any disinfection or filling operations.
   3. Clean piping in accordance with requirements of Section 15060.

B. Cleaning and Flushing of Piping and In-line Equipment:
   1. Flush all foreign matter from pipe in accordance with ANSI/AWWA C651.
   2. Provide hoses, temporary connections, ditches, and other conduits as necessary to dispose of flushing water without damage to adjacent structures or terrain.
   3. Use water suitable for disinfection.
   4. Operate valves during flushing process at least twice during each flush.

C. Cleaning of New Treatment Equipment:
   1. Remove all materials not part of the operating facilities including temporary works, tools, and debris.
   2. Remove all fouled water, dirt, paint chips, sediment, or foreign material by rinsing, vacuuming, or other removal techniques.
   3. Thoroughly clean walls, floors, exposed piping and attached structures with high-pressure water jet and by sweeping, scrubbing, or other similar means.
   4. Cleaning shall:
      a. Remove all deposits of foreign nature.
      b. Remove biological growths.
      c. Clean all surfaces including slopes, walls, tops, and bottom.
      d. Avoid damage to the structure.
      e. Remove and avoid pollution or oil deposits by workers and equipment.

3.3 DISINFECTION

A. Piping and In-Line Equipment:
   1. Applies to piping and inline equipment such as pumps and valves that are not covered under other disinfection provisions.
   2. Disinfect in accordance with ANSI/AWWA C651.
   3. Utilize any of the three (3) disinfection procedures.
      a. Tablet Method.
      b. Continuous Feed Method.
      c. Slug Method.
   4. Provide signage and tagging at all outlets from the piping being disinfected to prevent discharge of highly chlorinated water.
   5. After applicable retention period, flush piping at a velocity of not less than 1.5 feet per second.
      a. Flush water shall be as made available by the Owner.

B. Water Treatment and Storage Facilities - New Treatment Equipment:
   1. Disinfect in accordance with ANSI/AWWA C652.
   2. Utilize one of the following disinfection procedures from ANSI/AWWA C652:
      a. Method 1.
      b. Method 2.
      c. Method 3.
   3. Parts of structures, such as ceilings or overflows that cannot be immersed, shall be spray or brush disinfected.
   4. Provide signage and tagging at all outlets from the tank being disinfected to prevent discharge of highly chlorinated water.
   5. After applicable retention period, flush basins with finished water with a minimum free chlorine residual of 0.5 milligram per liter to remove heavily chlorinated water.

3.4 DISPOSAL OF FLUSHING AND DISINFECTION WATER

A. Disposal of flushing and disinfection water is the responsibility of the Contractor.
   1. Contractor to pay all costs associated with disposal of flushing and disinfection water.

B. Dispose of flushing water into the drainage ditch located to the northeast of the water treatment building. If flushing water used is chlorinated, de-chlorinate to acceptable disposal limits per NPDES permit.

C. Heavily chlorinated water must be dechlorinated in accordance with ANSI/AWWA C651, ANSI/AWWA C652, and ANSI/AWWA C653 prior to release.
   1. See appendix of ANSI/AWWA standards for additional information.

3.5 VERIFICATION TESTING

A. Upon completion of flushing, provide verification in the form of bacteriological sampling meeting the requirements of applicable ANSI/AWWA standard.

B. Collection of Samples:
   1. Owner shall collect samples and deliver to State certified laboratory for laboratory analysis.
   2. Coordinate activities to allow samples to be taken by Owner in accordance with this Section.
   3. Provide valves at sampling points.
   4. Provide access to sampling points.

C. Testing Equipment:
   1. Clean containers, equipment, and connections used in sampling to make sure they are free of contamination.
   2. Obtain laboratory sampling bottles with instructions for handling from laboratory.

D. Chlorine Sampling and Analysis:
   1. Collect samples in accordance with applicable ANSI/AWWA standard.
   2. Samples of disinfecting solution:
      a. One (1) sample per batch of disinfecting solution mixed and injected into pipe or vessel.
      b. If mixed solution not used, sample structure or pipe being disinfected during or immediately after filling.
   3. Free chlorine residual samples:
      a. As required to establish concentrations at the beginning and end of retention period.
   4. Sampling locations and intervals:
      a. Sampling points shall be representative and acceptable to Owner and Engineer.
   5. Samples will be analyzed for disinfectant residual concentration.
   6. If chlorine concentration testing results in disinfection concentrations not meeting the required standard, disinfecting procedures and verification testing shall be repeated until specified limits are met.

E. Bacteriological Sampling and Analysis:
   1. Collect samples in accordance with applicable ANSI/AWWA standard.
   2. Sampling locations and intervals:
      a. In accordance with applicable ANSI/AWWA Standard.
      b. Sampling points shall be representative and accepted by Owner.
      c. If ANSI/AWWA Standard is not applicable or does not fully describe sampling procedure, utilize the following minimum requirements:
         1) A minimum of two (2) samples on two (2) consecutive days from each separable structure and every line segment between structures of pipeline.
   3. Samples will be analyzed for disinfectant residual and coliform concentrations using methods as described in the latest edition of Standard Methods for Examination of Water and Wastewater.
   4. If verification testing results in bacterially positive samples or disinfection concentrations not meeting the required standard, disinfecting procedures and verification testing shall be repeated until specified limits are met.
      a. Contractor shall be responsible for all costs associated with re-disinfection and testing.

F. Documentation:
   1. Secure from laboratory and submit certified bacteriological reports on samples taken from system. Certify that sampling and testing procedures/results are in full compliance with ANSI/AWWA standards and Nebraska Department of Health & Human Services regulations.

END OF SECTION

1

DIVISION 3

CONCRETE

2011/12/29

SECTION 03308
CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete materials, strengths and proportioning for concrete work.
   2. Grouting:
      a. Base plates for columns and equipment.
      b. Dowels and anchors into concrete.
      c. Patching cavities in concrete.
      d. As specified and indicated in the Contract Document.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
      b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
      c. 212.3R, Chemical Admixtures for Concrete.
      d. 318, Building Code Requirements for Structural Concrete.
   2. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. C94, Standard Specification for Ready-Mixed Concrete.
      d. C150, Standard Specification for Portland Cement.
      e. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
      f. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
      g. C494, Standard Specification for Chemical Admixtures for Concrete.
      h. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   3. Corps of Engineers (COE):
      a. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (NonShrink).
   4. State of Nebraska Department of Roads (NDOR):
      a. Standard Specification for Highway Construction.

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.

2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's instructions.
    c. Concrete mix designs as required.
    d. Manufacturer and type of proposed admixtures.
    e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.
3. Certifications:
    a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
    b. Certification that the fly ash meets the quality requirements stated in this Section, and fly ash supplier's certified test reports for each shipment of fly ash delivered to concrete supplier.
    c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.
    d. Certification of aggregate gradation.
4. Test reports: Cement mill reports for all cement to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:
1. Store cement and pozzolan in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
4. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.
    a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.
    b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Non-shrink grout:
    a. BASF Admixtures, Inc.
    b. Euclid Chemical Company.
    c. U. S. Grout.
    d. Upco.
    e. Set Products, Inc.
    f. L & M Construction Chemicals, Inc.
    g. Sika Corporation
2. Epoxy grout:
    a. Ceilcote.
    b. Exxon Chemical Company.
    c. Sika Corporation.
    d. U. S. Grout.
    e. Euclid Chemical Company.

2.2 MATERIALS

A. Cement:
   1. ASTM C150, Type I or II.
   2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. Fly Ash:
   1. ASTM C618, Class F.
   2. Non-staining.
   3. Suited to provide hardened concrete of uniform light gray color.
   4. Maximum loss on ignition: 4 percent.
   5. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
   6. Produced by source approved by the State Highway Department in the state where the project is located for use in concrete for bridges.
   7. Cement and fly ash type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:
   1. Air entraining: ASTM C260.
   2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
   3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
   4. Admixtures to be chloride free.
      a. Do not use calcium chloride.
   5. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water:
   1. Potable.
   2. Clean and free from deleterious substances.
   3. Free of oils, acids and organic matter.

E. General:
   1. Fine and coarse aggregates shall be regarded as separate ingredients.
   2. Each size of coarse and fine aggregate shall conform to grading requirements of indicated specification.
   3. Fine aggregate to be natural not manufactured.

F. Aggregates for Normal Weight Concrete:
   1. 47B concrete per "Standard Specifications for Highway Construction" by NDOR.

G. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement:
   1. 0.10 for all concrete.

H. Sand Cement Grout:
   1. Approximately three (3) parts sand, one (1) part portland cement, 6 ±1 percent entrained air and water to produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
      a. Provide sand in accordance with requirements for fine aggregate for concrete.
   2. Minimum 28 day compressive strength: 3000 psi.

I. Non-shrink Grout:
   1. Non-shrink, non-metallic, non-corrosive, and non-staining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion.
      a. Mass expansion shall not be created by gas liberation or by other means.

4. Minimum 28 day compressive strength: 6500 psi.
5. BASF Admixtures, Inc. "Masterflow, 713 Plus"; Euclid Chemical "NS Grout"; Sauereisen Cements "F-100 Level Fill Grout"; U. S. Grout "Five Star Grout"; Set Products, Inc. "Set Non-Shrink Grout"; The Upco Corp "Upcon"; L & M "Crystex"; Sika Corporation "Sika Grout 212"; or equal.
6. In accordance with COE CRD-C621.

J. Epoxy Grout:
1. Three-component epoxy resin system:
   a. Two (2) liquid epoxy components.
   b. One (1) inert aggregate filler component.
2. Adhesive:
   a. BASF “Masterflow 648 CP”.
   b. Exxon Chemical Company "Escoweld 2505."
   c. Sika "Sikadur Hi-Mod."
   d. U. S. Grout "Five Start Epoxy Grout."
   e. Euclid Chemical "E3-G."
   f. Or equal.
3. Aggregate:
   a. BASF “Masterflow 648 CP”.
   b. Exxon Chemical Company "Escoweld 2510."
   c. Sika aggregate.
   d. U. S. Grout aggregate.
   e. Euclid Chemical "Euclid aggregate."
   f. Or equal.
4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
5. The aggregate shall be compatible with the adhesive.
6. Each component furnished in separate package for mixing at jobsite.

2.3 MIXES

A. General:
1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
2. Ready-mixed concrete shall conform to ASTM C94.
3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Minimum 28 Day Compressive Strengths:

Normal weight concrete fill	3000 psi
Normal weight all other concrete	4000 psi

C. Air Entrainment:
1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:
   a. 1 IN maximum aggregate size: 5 to 7 percent total air content.
   b. 3/4 IN maximum aggregate size: 5 to 7 percent total air content.
   c. Interior slabs and mats with power trowel finish: Maximum 3 percent total air content.

D. Slump:
1. Walls and columns:
   a. 8 IN maximum, 4 IN minimum measured at point of discharge into the concrete member.
   b. Slump shall be obtained by use of mid-range or high-range water reducer in accordance with ASTM C494.
   c. Do not exceed specified water-cement ratio.

2. 4 IN maximum, 1 IN minimum measured at point of discharge into the concrete construction member.
3. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
4. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
    a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ration is not exceeded.
5. Slump may be adjusted in the field through the use of water reducers.
    a. Coordinate dosage and mixing requirements with concrete supplier.

E. Proportioning:
1. General:
    a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
    b. Proportion ingredients to produce proper placability, durability, strength and other required properties.
2. Normal weight concrete minimum cement contents and maximum water cement ratios:

SPECIFIED STRENGTH (PSI)	MINIMUM CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
3000	517*	0.45
4000	611*	0.45

* If fly ash is proposed for use, the weight of fly ash plus weight of portland cement shall equal these values.

3. Fly ash:
    a. For cast-in-place concrete only, a maximum of 15 percent by weight of portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
    b. If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Section.
4. Water reducing, retarding, and accelerating admixtures:
    a. Use in accordance with manufacturer's instructions.
    b. Do not use unless required by these specifications or approved for use by Engineer.
5. High range water reducers (superplasticizers):
    a. Use in accordance with manufacturer's instructions.
    b. Do not use unless required by these Specifications or approved for use by Engineer.
6. Concrete mix proportioning methods for normal weight concrete:
    a. Method 1:
        1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
        2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.
        3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
        4) For each water cement ratio or cement content, make at least three (3) compression test cylinders for specified test age, and cure in accordance with ASTM C192.
            a) Test for strength at 28 days in accordance with ASTM C39.

5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
6) From this curve select water cement ratio or cement content to be used to produce required average strength.
7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.
8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.
9) See paragraph hereafter for definition of required average strength.

b. Method 2:
1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.
2) Use of proposed concrete mix proportions based on field test records subject to approval by Engineer based on information contained in field test records and demonstrated ability to provide the required average strength.
3) Field test records to represent materials, proportions and conditions similar to those specified.
a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.
b) Field test records shall meet the requirements of ACI 318 Paragraph 5.3.1.
4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Section.

7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraphs 5.3.1 and 2 of ACI 318.

2.4 SOURCE QUALITY CONTROL

A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

B. Do not use frozen or partially frozen aggregates.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform strength test on any concrete to which water has been added at the jobsite.

END OF SECTION

2011/12/29

SECTION 03311
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 03308 - Concrete, Materials and Proportioning.
   4. Section 07900 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
      b. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
      c. 304.2R, Placing Concrete by Pumping Methods.
      d. 305R, Hot Weather Concreting.
      e. 306R, Cold Weather Concreting.
      f. 308, Standard Practice for Curing Concrete.
      g. 309R, Guide for Consolidation of Concrete.
   2. ASTM International (ASTM):
      a. C94, Standard Specification for Ready-Mixed Concrete.
      b. C156, Standard Test Method for Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete.
      c. C171, Standard Specification for Sheet Materials for Curing Concrete.
      d. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      e. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
      f. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
      g. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   3. Corps of Engineers (COE):
      a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
   4. National Ready Mixed Concrete Association (NRMCA):
      a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
   5. National Sanitation Foundation International (NSF).

B. Qualifications:
   1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.

1.3 DEFINITIONS

A. Words and terms used in this Specification Section are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
         1) Procedure for adding high-range water reducer at the jobsite.
      c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints and joint keyway dimensions.
      d. Manufacturers and types:
         1) Joint fillers.
         2) Curing agents.
         3) Waterstops.
   3. Certifications:
      a. Ready mix concrete plant certification.
      b. Waterstops: Products shipped meet or exceed the physical properties specified.

B. Miscellaneous:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Copies of concrete delivery tickets.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Concrete:
      a. Prepare a delivery ticket for each load of ready mixed concrete.
      b. Truck operator shall hand ticket to Contractor at the time of delivery.
      c. Ticket to show:
         1) Mix identification.
         2) Quantity delivered.
         3) Amount of material in each batch.
         4) Outdoor temperature in the shade.
         5) Time at which cement was added
         6) Time of delivery.
         7) Time of discharge.
         8) Amount of water that may be added at the site without exceeding the specified water-cement ratio.
         9) Amount of water added at the site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 COMPONENTS

A. Neoprene Expansion Joint Fillers:
   1. Acceptable manufacturers:
      a. Permaglaze.
      b. Rubatex.
      c. Williams Products.

2. Materials:
    a. Closed cell neoprene.
    b. ASTM D1056, Class SC, 2 to 5 psi compression deflection, Grade SCE-41.

B. Asphalt Expansion Joint Fillers:
1. Acceptable manufacturers:
    a. W R Meadows.
    b. J and P Petroleum Products.
2. Materials: ASTM D994.

C. Fiber Expansion Joint Fillers:
1. Materials: ASTM D1751.

D. Sand cement grout, non-shrink grout and epoxy grout: See Specification Section 03308.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
1. Complete formwork.
    a. Variation from plumb:
        1) In lines and surfaces of columns, piers, walls, and in risers.
            a) Maximum in any 10 FT of height: 1/4 IN.
    b. Place 3/4 IN chamfer strips in exposed to view corners of forms to produce 3/4 IN wide beveled edges.
    c. Anchor formwork to supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.
    d. No construction loads shall be supported on any part of the structure under construction except when that portion of the structure in combination with remaining forming has sufficient strength to safely support its weight and loads places thereon.
2. Secure reinforcement in place.
    a. Reinforcing Bars: ASTM A615, grade 60, deformed.
    b. Metal Chairs, Runners, Bolsters, Spacers, Hangers, and Other Rebar Supports:
        1) Plastic-coated tips in contact with forms.
    c. Tolerances for rebar placement:
        1) Clear distance to formed surfaces: +1/4 IN.
    d. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.
    e. Extend reinforcement to within 2 IN of concrete perimeter edges.
    f. Embed rebars into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
        1) Drill hole in concrete with diameter and depth as required to develop the yield strength of the bar according to manufacturer's requirements.
        2) Clean hole in accordance with manufacturer's recommendation.
        3) Place adhesive in drilled hole.
        4) Insert rebar into hole and adhesive in accordance with manufacturer's instructions.
    g. Do not place any concrete until the resident project representative inspects completed rebar placement.
3. Position expansion joint material, anchors and other embedded items.
4. Obtain approval of reinforcement erection and placement prior to placing concrete.

3.2 CONCRETE MIXING

A. General:
1. Provide all concrete from a central plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.

2. Batch, mix, and transport in accordance with ASTM C94.

B. Control of Admixtures:
   1. Charge admixtures into mixer as solutions.
      a. Measure by means of an approved mechanical dispensing device.
      b. Liquid considered a part of mixing water.
      c. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
   2. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
   3. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

C. Tempering and Control of Mixing Water:
   1. Mix concrete only in quantities for immediate use.
   2. Discard concrete which has set.
   3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94.
   4. Addition of water at the jobsite:
      a. See Specification Section 03308 for specified water cement ratio and slump.
      b. Do not exceed maximum specified water cement ratio or slump.
      c. Incorporate water by additional mixing equal to at least half of total mixing required.

3.3 PLACING OF CONCRETE

A. General:
   1. Comply with ACI 304R and ACI 304.2R.
   2. Deposit concrete:
      a. Continuously to avoid cold joints.
      b. In layers of 12 to 18 IN.
   3. Locate construction joints at locations approved by Engineer.
      a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
   4. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still workable.
   5. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
   6. Spreaders:
      a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
      b. Embedded:
         1) Obtain approval of Engineer.
         2) Materials: Concrete or metal.
         3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
   7. Deposit concrete as nearly as practicable in its final position to avoid segregation.
      a. Maximum free fall: 4 FT.
      b. Free fall exceeding 4 FT: Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
   8. Perform the following operations before bleeding water has an opportunity to collect on surface:
      a. Spread.
      b. Consolidate.
      c. Straightedge.
      d. Darby or bull float.

B. Admixtures:
   1. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.

C. Cold Weather Concrete Placement:
   1. Comply with ACI 306R.
   2. Do not place concrete on substrates that are below 32 DegF or contain frozen material.
   3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
   4. Temperature of concrete when discharged at site:

AIR TEMPERATURE DEGF	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION LESS THAN 12 IN	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION 12 IN OR GREATER
30 to 45	60	55
0 to 30	65	55
below 0	70	60

   5. Heat subgrade, forms, and reinforcement so the temperature of the subgrade, forms, and reinforcement will be between 45 and 70 DegF, when temperature of surrounding air is 40 DegF or below at time concrete is placed.
      a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
   6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DegF.
   7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DegF.
   8. Do not place slabs on ground if temperature is below 40 DegF or if temperature surrounding the slab will be below 40 DegF before structure is enclosed and heated.

D. Hot Weather Concrete Placement:
   1. Comply with ACI 305R.
   2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
   3. Temperature of concrete when placed:
      a. Not to exceed 90 DegF.
      b. Not so high as to cause:
         1) Shrinkage cracks.
         2) Difficulty in placement due to loss of slump.
         3) Flash set.
   4. Temperature of forms and reinforcing when placing concrete:
      a. Not to exceed 90 DegF.
      b. May be reduced by spraying with water to cool below 90 DegF.
         1) Leave no standing water to contact concrete being placed.

E. Consolidating:
   1. Consolidate in accordance with ACI 309R except as modified herein.
   2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
      a. Eliminate:
         1) Air or stone pockets.
         2) Honeycombing or pitting.
         3) Planes of weakness.
      b. Repair any void or surface defect in the face of the concrete deeper than 1/8 IN.

3.4 INSTALLATION OF GROUT

A. Grout Schedule of Use:
   1. Non-shrinking non-metallic grout:
      a. Filling form tie holes.
      b. Other uses indicated on the Drawings.
   2. Epoxy grout:
      a. Grouting of dowels and anchor bolts into existing concrete.
      b. Other uses indicated on the Drawings.

B. Grout Installation:
   1. Non-shrink non-metallic grout:
      a. Clean concrete surface to receive grout.
      b. Saturate concrete with water for 24 HRS prior to grouting.
      c. Mix in a mechanical mixer.
      d. Use no more water than necessary to produce flowable grout.
      e. Place in accordance with manufacturer's instructions.
      f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
      g. Completely fill all spaces and cavities below the top of base plates.
      h. Provide forms where base plates and bed plates do not confine grout.
      i. Where exposed to view, finish grout edges smooth.
      j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
      k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
   2. Epoxy grout:
      a. Mix and place in accordance with manufacturer's instructions.
      b. Apply only to clean, dry, sound surface.
      c. Completely fill all cavities and spaces around dowels and anchors without voids.
      d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
      e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.5 FIELD QUALITY CONTROL

A. Tests in accordance with ASTM and ACI Standards.
   1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
      a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

END OF SECTION

DIVISION 5

METALS

2011/12/29

SECTION 05505
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
   2. Design of all temporary bracing not indicated on Drawings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Division 3 - Concrete.
   4. Section 09905 - Painting and Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
   2. American Institute of Steel Construction (AISC):
      a. Manual of Steel Construction - Allowable Stress Design (ASD).
      b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
   3. ASTM International (ASTM):
      a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
      b. A36, Standard Specification for Carbon Structural Steel.
      c. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      d. A108, Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
      e. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      f. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      g. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
      h. A276, Standard Specification for Stainless Steel Bars and Shapes.
      i. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      j. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      k. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
      l. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
      m. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
      n. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
      o. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
      p. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

q. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
r. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
s. A786, Standard Specification for Hot-Rolled Carbon, Low-.Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
t. A992, Standard Specification for Steel for Structural Shapes.
u. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
v. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
w. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
x. F467, Standard Specification for Nonferrous Nuts for General Use.
y. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
z. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
aa. F1553, Standard Guide for Specifying Chain Link Fence.

4. American Welding Society (AWS):
   a. A5.1, Standard Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   b. D1.1, Structural Welding Code Steel.
   c. D1.2, Structural Welding Code Aluminum.
5. National Association of Architectural Metal Manufacturers (NAAMM):
   a. AMP 510, Metal Stairs Manual.
   b. MBG 531, Metal Bar Grating Manual.
6. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, 2006 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
1. Qualify welding procedures and welding operators in accordance with AWS.
2. Fabricator shall have minimum of 10 years experience in fabrication of metal items specified.
3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Nebraska.

1.3 DEFINITIONS

A. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Hardware: As defined in ASTM A153.

C. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout Drawings and details:
   a. Submit drawings for all fabrications and assemblies.
      1) Include erection Drawings, Plans, Sections, details and connection details.

b. Identify materials of construction, shop coatings and third party accessories.
3. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Provide manufacturer's standard allowable load tables for the following:
1) Grating and checkered plate.
2) Expansion anchor bolts.
3) Adhesive anchor bolts.
4) Castings, trench covers and accessories.
4. Contractor designed systems and components:
a. Certification that manufactured units meet all design loads specified.
b. Shop Drawings and engineering design calculations:
1) Indicate design live loads.
2) Sealed by a Professional Structural Engineer.
3) Engineer will review for general compliance with Contract Documents.

B. Miscellaneous Submittals:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Certification of welders and welding processes.
a. Indicate compliance with AWS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Headed studs and deformed bar anchors:
a. Nelson Stud Welding Div., TRW Inc.
b. Stud Welding Products, Inc.
2. Expansion anchor bolts:
a. Hilti Inc.
b. ITW Ramset/Red Head.
c. Simpson Strongtie.
3. Adhesive anchor bolts:
a. Hilti Inc.
b. ITW Ramset/Red Head.
c. Simpson Strongtie.
4. Castings, trench covers and accessories:
a. Neenah Foundry Co.
b. Deeter Foundry Co.
c. Barry Craft Construction Casting Co.
d. McKinley Iron Works.
5. Galvanizing repair paint:
a. ZRC Products.

2.2 MATERIALS

A. Steel:
   1. Structural:
      a. W-shapes and WT-shapes: ASTM A992, Grade 50.
      b. All other plates and rolled sections: ASTM A36.
      c. Painted unless otherwise noted on Drawings.
   2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
   3. Structural tubing:
      a. ASTM A500, Grade B (46 ksi minimum yield).
      b. Painted unless otherwise noted on Drawings.
   4. Bolts, nuts and washers, high strength:
      a. ASTM A325.
      b. Galvanized, ASTM A153 unless noted otherwise on Drawings.
      c. Provide two (2) washers with all bolts.
   5. Bolts and nuts:
      a. ASTM A307, Grade A.
      b. Galvanized, ASTM A153 unless noted otherwise on Drawings.
   6. Welding electrodes: AWS D1.1, E70 Series.

B. Stainless Steel:
   1. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
      a. Bars, shapes: ASTM A276, Type 304.
      b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
      c. Strip, plate and flat bars: ASTM A666, Type 304 or 316, Grade A.
      d. Bolts and nuts: ASTM F593, Type 303, 304 or 316.
   2. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
      a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
   3. Welding electrodes: In accordance with AWS for metal alloy being welded.

C. Aluminum:
   1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
      a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
   2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
      a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
   3. ASTM F468, alloy 2024 T4 for bolts.
   4. ASTM F467, alloy 2024 T4 for nuts.
   5. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

D. Washers: Same material and alloy as found in accompanying bolts and nuts.

E. Embedded Anchor Bolts:
   1. Building anchor bolts: ASTM A36, ASTM A307, or ASTM F1553, Grade 36, Galvanized.
   2. All other anchor bolts: Type 304 or 316 stainless steel with matching nut and washer.

F. Expansion Anchor Bolts and Adhesive Anchor Bolts:
   1. Stainless steel, Type 304, 314 or 316.
   2. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as indicated on Drawings whichever is larger.
      a. Minimum embedment as recommended by manufacturer or eight (8) diameters of bolt, whichever is larger.
      b. Notify Engineer if required depth of embedment cannot be achieved at a particular anchor bolt location.
      c. Follow manufacturer's recommendations for installation and torque.

3. Submit manufacturer's load test data to verify at least the anchor bolt capacities at the following embedment depths:
   a. Data must be based on actual tests performed in unreinforced mass of concrete of not more than 4000 psi compressive strength.
   b. Capacity must be at a concrete temperature of at least 130 DegF.

ANCHOR BOLT DIAMETER (IN)	EMBEDMENT (IN)	MINIMUM ULTIMATE TENSION CAPACITY (KIP)*, **
3/8	3	4.8
1/2	4	8.1
5/8	5	11.4
3/4	6	15.4
7/8	7	20.0
1	8	24.7
1-1/4	10	34.3

* Data must be based on actual tests preformed in unreinforced mass concrete of not more than 4000 psi compressive strength.

** Capacity must be at a concrete temperature of at least 130 DegF.

4. Expansion anchor bolts:
   a. Kwik Bolt by Hilti, Inc.
   b. Trubolt by ITW Ramset/Red Head.
   c. Wedge-All: By Simpson Strong-Tie.
5. Adhesive anchor bolts:
   a. HVA Adhesive Anchor System by Hilti.
   b. HIT HY 150 Adhesive Anchor by Hilti.
   c. EPCON Ceramic 6 Epoxy by ITW Ramset/Red Head.
   d. Acrylic-Tie by Simpson Strong-Tie.
6. Epoxy adhesive anchor bolts:
   a. HIT RE 500 Epoxy Adhesive Anchors by Hilti.
   b. ET Epoxy-Tie Adhesive by Simpson Strong-Tie.
   c. EPCON Ceramic 6 Epoxy Adhesive by ITW Ramset/Red Head.

G. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

H. Deformed Bar Anchors: ASTM A496 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

I. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be galvanized.

J. Galvanizing Repair Paint:
1. High zinc dust content paint for regalvanizing welds and abrasions.
2. Dried film shall contain not less than 93 percent zinc dust by weight.
3. Similar to ZRC by ZRC Products.
4. VOC: 0 LBS per GAL.

K. Dissimilar Materials Protection: See Specification Section 09905.

2.3 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
1. Grind smooth all rough welds and sharp edges.
   a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.

C. Provide drilled or punched holes with smooth edges.
   1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Permanent Shop Connections:
   1. Welds to be continuous fillet type unless indicated otherwise.
   2. Full penetration butt weld at bends in stair stringers and ladder side rails.
   3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1.
   4. Weld aluminum in accordance with AWS D1.2.
   5. All headed studs to be welded using automatically timed stud welding equipment.
   6. Grind smooth welds that will be exposed.

E. Conceal fastenings where practicable.

F. Fabricate work in shop in as large assemblies as is practicable.

2.4 SOURCE QUALITY CONTROL

A. Surface Preparation:
   1. Refer to Specification Section 09905 for surface preparation requirements.

B. Shop Applied Paint Coating Application:
   1. Refer to Specification Section 09905 for painting requirements.

C. Contractor responsible for testing to qualify shop and field welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.

D. Contractor provides sufficient notification and access so inspection and testing can be accomplished.

E. Contractor pays for retesting of failed tests and for additional testing required when defects are discovered.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set metal work level, true to line, plumb.
   1. Shim and grout as necessary.

B. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.
   1. Contractor shall be responsible for the design of the temporary bracing system.

C. Welding:
   1. Conform to AWS D1.1 and requirements of Article 2.4.
   2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.

D. Clean stored material of all foreign matter accumulated during erection period.

E. Bolt Field Connections: Where practicable, conceal fastenings.

F. Grind welds smooth where field welding is required.

G. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

H. Unless noted or specified otherwise:
   1. Provide washers for all bolted connections.

2. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top nut.
    a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

I. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

3.2 CLEANING

A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09905.

END OF SECTION

1

HDR

DIVISION 7

THERMAL AND MOISTURE PROTECTION

2011/12/29

SECTION 07900
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealant work.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.

C. Work included consists of but is not necessarily limited to:
   1. Sealing all joints which will permit penetration of dust, air or moisture, unless sealing work is specifically required under other Specification Sections.
      a. Work may include the following:
         1) Flashing reglets and retainers.
         2) Flooring joints.
         3) Isolation joints.
         4) Concrete construction, control and expansion joints, exterior and interior.
         5) Sawed joints in interior concrete slabs.
         6) Joints at penetrations of walls, floors and decks by piping and other services and equipment.
         7) Sealing around piping, duct or conduit penetrations through roof, floors, interior and exterior walls.
         8) Other joints where sealant, expanding foam sealant or compressible sealant is indicated.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      a. C834, Standard Specification for Latex Sealants.
      b. C920, Standard Specification for Elastomeric Joint Sealants.
      c. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
   3. NSF International (NSF):
      a. 61, Drinking Water System Components -- Health Effects.
   4. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products specified on projects with similar scope.

1.3 DEFINITIONS

A. Defect(ive): Failure of watertightness or airtightness.

B. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

C. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

D. "Interior wet areas": Entire area is considered wet.

E. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
   3. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
   4. Certification of applicator qualification.

B. Samples:
   1. Cured sample of each color for Engineer's color selection.
   2. Color chart not acceptable.

C. Miscellaneous Submittals: See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Compressible sealant:
      a. Polytite Manufacturing Corporation.
      b. Emseal.
      c. Norton.
      d. Sandell.
   2. Expanding foam sealant:
      a. Macklanburg Duncan.
      b. Convenience Products.
      c. FAI International, Inc.
   3. Polyether sealants:
      a. BASF Sonneborn.
      b. ChemLink, Inc.
   4. Polysulfide rubber sealant:
      a. Pecora.
      b. BASF Sonneborn.
      c. PolySpec.

5. Polyurea joint filler:
    a. Dayton Superior Specialty Chemical Corporation.
    b. Euclid Chemical Co.
    c. L&M Construction Chemicals, Inc.
    d. BASF Sonneborn.
6. Polyurethane sealants:
    a. Pecora.
    b. Sika Chemical Corp.
    c. BASF Sonneborn.
    d. Tremco.
7. Silicone sealants:
    a. ChemLink.
    b. GE Construction Sealants.
    c. Dow Corning.
    d. Tremco.
8. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.

2.2 MATERIALS

A. Sealants - General:
1. Provide colors matching materials being sealed.
2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
3. Nonsagging sealant for vertical and overhead horizontal joints.
4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
6. Sealant backer rod and/or compressible filler:
    a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
        1) Control joint depth.
        2) Break bond of sealant at bottom of joint.
        3) Provide proper shape of sealant bead.
        4) Serve as expansion joint filler.

B. Compressible Sealant:
1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
    a. Polytite Manufacturing Corp. "Polytite-B."
2. Adhesive: As recommended by sealant manufacturer.

C. Expanding Foam Sealant:
1. One (1) or two (2) component fire rated moisture cured expanding urethane.
2. Shall not contain formaldehyde.
3. Density: Minimum 1.5 pcf.
4. Closed cell content: Minimum 70 percent.
5. R-value: Minimum 5.0/IN.
6. Flame spread: Less than 25.
7. Smoke developed: Less than 25.

D. Polyether Sealant:
1. Silyl-terminated polyether polymer.
2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
    a. BASF Sonneborn Sonolastic 150 with VLM Technology.
    b. ChemLink DuraLink.

E. Polysulfide Rubber Sealant:
1. One (1) or two (2) component.

2. Meet ASTM C920.
    a. Pecora Synthacalk GC2+.
    b. BASF Sonneborn - Sonolastic Polysulfide Sealant.
    c. PolySpec THIOKOL 2235.

F. Polyurea Joint Filler:
1. Two (2) component, semi-rigid material for filling formed or saw-cut control joints in interior concrete slabs.
    a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
    b. Euclid Chemical Co. "EUCO QWIK" joint.
    c. L&M Construction Chemicals, Inc. "Joint Tite 750".
    d. BASF Sonneborn "TF-100" control joint filler.
2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
3. Color: Gray.

G. Polyurethane Sealant:
1. One (1) or two (2) components.
2. Paintable.
3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
    a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
    b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
    c. BASF Sonneborn Sonolastic NP-1, NP-II, SL-1 SL-2.
    d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

H. Silicone Sealant:
1. One (1) component.
2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
    a. ChemLink: DuraSil.
    b. General Electric: Silpruf, Silglaze II.
    c. General Electric: Sanitary 1700 sealant for sealing around plumbing fixtures.
    d. Dow Corning: 786 for sealing around plumbing fixtures.
    e. Dow Corning: 790, 795.
    f. Tremco: Spectrem 1, Spectrem 3, Tremsil 600.
3. Mildew resistant for sealing around plumbing fixtures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.
1. Limit application to surfaces to receive sealant.
2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

E. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

F. Apply bond breaker where required.

G. Tool sealants using sufficient pressure to fill all voids.

H. Upon completion, leave sealant with smooth, even, neat finish.

I. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

J. Install compressible sealant to position at indicated depth.
   1. Size so that width of material is twice joint width.
   2. Take care to avoid contamination of sides of joint.
   3. Protect side walls of joint (to depth of finish sealant).
   4. Install with adhesive faces in contact with joint sides.
   5. Install finish sealant where indicated.

K. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on Drawings.
   1. Provide adequate fire rated backing material as required.
   2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
      a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
   3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 SCHEDULE

A. Furnish sealant as indicated for the following areas:
   1. Exterior areas:
      a. Above grade: Polyether Polyurethane, Silicone.
      b. Below grade: Polyurethane.
   2. Interior areas:
      a. Noncorrosive areas:
         1) Wet exposure: Polyether Polyurethane, Silicone.
            a) Toilet rooms, locker rooms, janitor closets or similar areas: Mildew resistant silicone.
         2) Dry exposure: Polyether Polyurethane, Silicone, unless noted otherwise.
   3. Compressible sealant: Where indicated.
   4. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
      a. Finish sealant:
         1) Exterior side:
            a) Above grade: Polyether.
            b) Below grade: Polyurethane.
         2) Interior side:
            a) Noncorrosive area:
               (1) Wet exposure: Polyether Polyurethane, Silicone.
               (2) Dry exposure: Polyether Polyurethane, Silicone, unless noted otherwise.

END OF SECTION

1

DIVISION 9

FINISHES

2012/01/12

SECTION 09905
PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. High performance industrial coatings (HPIC).
   2. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Section.
   3. Minimum surface preparation requirements.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 05505 - Metal Fabrications.
   4. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM).
   2. American Water Works Association (AWWA).
      a. ANSI/AWWA C210 Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
      b. ANSI/AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   3. Environmental Protection Agency (EPA).
   4. National Bureau of Standards (NBS):
      a. Certified Coating Thickness Calibration Standards.
   5. National Sanitation Foundation International (NSF).
   6. The Society for Protective Coatings (SSPC):
      a. PA 2, Measurement of Dry Paint Thickness with Magnetic Gages.
      b. SP 1, Solvent Cleaning.
      c. SP 2, Hand Tool Cleaning.
      d. SP 3, Power Tool Cleaning.
   7. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 6/NACE No. 3, Commercial Blast Cleaning.
      b. SP 10/NACE No. 2, Near-White Blast Cleaning.
      c. SP 12/NACE No. 5, Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating.

B. Qualifications:
   1. Coating manufacturer's authorized representative shall provide written statement attesting that applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.
   2. Applicators shall have minimum of 10 years experience in application of similar products on similar project.
      a. Provide references for minimum of three (3) different projects completed in the last year with similar scope of work.
      b. Include name and address of project, size of project in value (painting) and contact person.

C. Miscellaneous:
   1. Furnish paint through one (1) manufacturer unless noted otherwise.

D. Deviation from specified mil thickness or product type is not allowed without written authorization of Engineer.

E. Material shall not be thinned unless approved, in writing, by paint manufacturer's authorized representative and approved by Owner.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in Part 3 – Execution of this Section.

C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to frequent condensation, spillage or splash of a corrosive material such as water, wastewater, or chemical solution; or chronic exposure to corrosive, caustic or acidic agent, chemicals, chemical fumes, chemical mixture, or solutions with pH range of 5 to 9.

D. Exposed Exterior Surface:
   1. Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.
   2. Exterior surfaces are considered corrosive environment.

E. Finished Area: One that has finish called for on Room Finish Schedule or is indicated, on Drawings, to be painted.

F. Paint includes the following:
   1. High performance industrial coatings (HPIC) include: Epoxies, urethanes, vinyl ester, waterborne vinyl acrylic emulsions, acrylates, silicones, alkyds, acrylic emulsions and any other coating listed as a HPIC.

G. Surface Hidden from View: Surfaces such as those within pipe chases, and between bottom side of grating floors and top of floor structure below.

H. HPIC: High performance industrial coatings.

I. VOC: Volatile organic compounds.

J. Water level for purposes of painting: See Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's application instructions.
      c. Manufacturer's surface preparation instructions.
      d. If products being used are manufactured by Company other than listed in Article 2.2, provide complete individual data sheet comparison of proposed products with specified products including application procedure, coverage rates and verification that product is designed for intended use.
      e. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
      f. Coating manufacturer's recommendation on abrasive blasting.

g. Manufacturer's recommendation for universal barrier coat.
h. Manufacturer’s recommendation for providing temporary or supplemental heat or dehumidification or other environmental control measures.

3. Manufacturer's statement regarding applicator instruction on product use.
4. Applicator experience qualifications.
   a. No submittal information will be reviewed until Engineer has received and approved applicator qualifications.
5. Certification that coating systems proposed for use have been reviewed and approved by Senior Corrosion Specification Specialist employed by the coating manufacturer.

B. Samples:
1. Manufacturer's full line of colors for Engineer's color selection.
2. After initial color selection by Engineer provide two 3 x 5 IN samples of each color selected.

C. Miscellaneous Submittals:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Approval of application equipment.
3. Applicator's daily record:
   a. Submit daily record at end of each week in which painting work is performed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:
1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:
1. High performance industrial coatings:
   a. Tnemec.
   b. Ameron Protective Coatings Div.
   c. ICI Devoe.
   d. Or approved equal.

2.2 MATERIALS

A. All materials used must contain not more than 0.80 LBS/GAL VOC unless noted otherwise.

B. For unspecified materials such as thinner, provide manufacturer's recommended products.

C. Paint Systems - General:
1. P = prime coat.
2. F1, F2 . . . Fn = first finish coat, second finish coat . . . . nth finish coat, color as selected by Engineer.
3. If two (2) finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one (1) coat equal to mil thickness of two (2) coats specified.

D. HPIC products specified are manufactured by Tnemec.

E. Paint Systems (Systems not shown are not used):
1. HPIC SYSTEM #2 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Finish Coat(s).
a. Prime coat:
1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy), VOC = 0.80.
b. Finish coat(s):
1) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
2) F2 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B.(Waterborne Acrylic Polyurethane), VOC = 0.80.
2. HPIC SYSTEM #3 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Waterborne Acrylic Polyurethane Top Coat(s).
a. Prime coat:
1) P1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
b. Finish coat(s):
1) Interior:
a) F1 = 1 coat, 5 mils, Series L69 Epoxoline (Polyamidoamine Epoxy).
2) Exterior:
a) F1 = 1 coat, 2.5 mils, Series 1080 Endura-Shield W.B. (Waterborne Acrylic Polyurethane).
3. SYSTEM #41 - Touch-up of galvanized surfaces not requiring a top coat.

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. Appurtenant surfaces include:
1. Piping, valves, and fittings.
a. All bituminous coated ductile iron pipe to have coating completely removed prior to painting.
2. Conduit, device boxes, junction boxes and covers, pull boxes and covers and supports when mounted on surface required to be painted.
3. Miscellaneous ferrous metal surfaces.
4. Outside of ferrous metal tankage.
5. Structural Steel.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in Article 3.2 unless specifically noted in the Contract Documents to be painted.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical Equipment:
1. Do not field paint electrical equipment except where painting is specifically stated elsewhere in these Contract Documents, or where the equipment is subject to a corrosive environment.

D. Surfaces Hidden from View Except:
1. Ferrous metal surfaces.
2. Piping (if the balance of the pipe is painted).
3. Equipment (if the balance of the equipment is painted).

E. Other Items:
1. Stainless steel surfaces.
2. Aluminum surfaces.
3. Fiberglass surfaces.

4. Interior of pipe, ductwork, and conduits.
5. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.
6. Code labels and equipment identification and rating plates.
7. Exterior concrete or precast concrete surfaces.
8. Face brick except where specifically shown to be painted on the Drawings.
9. Pipe jacketing.
10. Prefinished metal.
11. Steel deck, unless specifically noted to be painted in these Contract Documents.
12. Contact surfaces of friction-type connections.
13. Bituminous coated ductile iron pipe.
    a. See Paragraph 3.1B.
14. Galvanized steel items, unless specifically noted to be painted.

3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

A. Structural Steel:
   1. Non-immersion surfaces subject to corrosive environment: SYSTEM #2.
   2. All other (non-corrosive dry environment): SYSTEM #2.

B. Miscellaneous ferrous metals (non-corrosive dry environment): SYSTEM #2.
   1. Not for coating structural steel, steel joist, and products with approved factory finishes.

C. Ferrous metals subject to Corrosive Environment: SYSTEM #2.
   1. Includes ferrous metal components of equipment located in Corrosive Environments such as piping, pumps and similar items.

D. Steel equipment with existing paint coating or factory-applied prime or finish coating not complying with this Specification: SYSTEM #2.
   1. Includes equipment specifically indicated in the Contract Documents to be painted.
   2. Factory-applied coats to remain.

E. Pipe, Valves, and Fittings:
   1. Steel, cast-iron, and uncoated ductile iron: SYSTEM #2.

F. Galvanized Metals:
   1. Field touch-up where top coat is required: SYSTEM #3, prime and first finish coat only.
      a. Prime paint only the damaged area.
   2. Assembled galvanized steel items: SYSTEM #3.
   3. Field touch-up of galvanized surfaces not requiring a finish top coat: SYSTEM #41.
      a. Paint only damaged areas.

G. Electrical Conduit:
   1. Galvanized: SYSTEM #3.
   2. PVC coated: SYSTEM #3.

3.4 PREPARATION

A. General:
   1. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Section unless noted otherwise in the Specification.
   2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

C. Prepare and Paint Before Assembly: Where component is subject to corrosive or highly corrosive environment, prepare and paint, before assembly, all surfaces which may be subject to environment which are inaccessible after assembly.

D. Ferrous Metal:
   1. Prepare steel and ductile iron pipe in accordance with pipe manufacturer's recommendations and AWWA.
   2. Complete fabrication, welding or burning before beginning surface preparation.
      a. Chip or grind off flux, spatter, slag or other laminations left from welding.
      b. Remove mill scale.
      c. Grind smooth rough welds and other sharp projections.
   3. Solvent or water jet and detergent clean in accordance with SSPC SP 1 or SSPC SP 12/NACE No. 5 all surfaces scheduled to receive additional SSPC surface preparation.
   4. Surfaces subject to corrosive environment and all surfaces subject to immersion service:
      a. Near-white blast clean in accordance with SSPC SP 10/NACE No. 2.
         1) All piping subject to condensation are considered as being in immersion service.
   5. All interior and exterior surfaces:
      a. Minimum commercial blast clean in accordance with SSPC SP 6/NACE No. 3.

E. Preparation by Abrasive Blasting:
   1. All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of paint coatings.
      a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with these Specifications.
   2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
   3. Perform additional blasting and cleaning as required to achieve surface preparation required.
      a. Prior to painting, reblast surfaces allowed to set overnight and surfaces that show rust bloom.
      b. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected prior to paint application.
   4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
   5. Provide compressed air for blasting that is free of water and oil.
      a. Provide accessible separators and traps.
   6. Confine blast abrasives to area being blasted.
      a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
      b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.
   7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
   8. Reblast surfaces not meeting requirements of these Specifications.
   9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
   10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

3.5 APPLICATION

A. General:
   1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
      a. Application equipment must be inspected and approved in writing by coating manufacturer.

2. Temperature and weather conditions:
    a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
    b. Avoid painting surfaces exposed to hot sun.
    c. Do not paint on damp surfaces.
3. Immediately after surface has been inspected, apply structural steel, miscellaneous steel and steel joist prime coat in the factory.
    a. Finish coats shall be applied in the factory as specified in this Section. Any scratched, marred, or damaged areas to the paint surface after installation shall be repaired by the Contractor in the field.
    b. Prime coat referred to here is prime coat as indicated in this Specification.
        1) Structural steel, miscellaneous steel and steel joist prime coating applied in factory (shop) as part of Fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
4. Provide complete coverage to mil thickness specified.
    a. Thickness specified is dry mil thickness.
    b. All paint systems are "to cover."
        1) In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
    c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
6. Apply materials under adequate illumination.
7. Evenly spread to provide full, smooth coverage.
8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
    a. Clean contaminated surfaces before applying next coat.
10. Smooth out runs or sags immediately, or remove and recoat entire surface.
11. Allow preceding coats to dry before recoating.
    a. Recoat within time limits specified by coating manufacturer.
    b. If recoat time limits have expired reprepare surface in accordance with coating manufacturer's printed recommendations.
12. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
13. Coat all aluminum in contact with dissimilar materials.
14. When coating rough surfaces which cannot be backrolled sufficiently, hand brush coating to work into all recesses.

B. Prime Coat Application:
1. Prime all surfaces indicated to be painted.
    a. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Section.
2. Ensure field-applied repair coatings are compatible with factory-applied coatings.
    a. Ensure new coatings applied over existing coatings are compatible.
    b. Employ services of coating manufacturer's qualified technical representative.
        1) Certify through material data sheets.
        2) Perform test patch.
    c. If field-applied repair coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
    d. At Contractor's option, coatings may be removed, surface reprepared, and new coating applied using appropriate paint system listed in Paragraph 2.2E.
        1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.

3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Apply zinc-rich primers while under continuous agitation.
5. Ensure abrasive blasting operation does not result in embedment of abrasive particles in paint film.
6. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
7. Touch up damaged primer coats prior to applying finish coats.
    a. Restore primed surface equal to surface before damage.

C. Finish Coat Application:
1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Section; manufacturer instructions take precedent over these Specifications.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
    a. Prepare damaged area in accordance with Article 3.4.

3.6 COLOR CODING AND LABELING

A. Paint color of pipe in accordance with Article 3.9 – SCHEDULE of this Specification Section.

B. Label piping using the following criteria at 20 FT maximum centers.
1. Label the inlet piping and outlet piping at the WTP Building.
2. Use Self-Adhesive Tape Tags of vinyl tape material with a five (5) mil minimum thickness.
3. Size of tape tags per manufacturer’s recommendations for the pipe diameter.
4. Legend on tape tags to be pre-printed black lettering on white background.
5. Text for the tape tags for the inlet and outlet piping is given in Specification Section 15060.

3.7 FIELD QUALITY CONTROL

A. Maintain Daily Record:
1. Provide the following information for each coat of paint applied:
    a. Date, starting time, end time, and all breaks taken by painters.
    b. For exterior painting:
        1) Sky condition.
        2) Wind speed and direction.
    c. Air temperature.
    d. Relative humidity.
    e. Moisture content of substrate prior to each coat.
    f. Provisions utilized to maintain work area within manufacturer's recommended application parameters.
    g. Surface temperature of substrate to which paint is being applied.
2. Format for daily record to be computer generated.

B. Measure wet coating with wet film thickness gages.

C. Measure coating dry film thickness in accordance with SSPC PA 2 using Mikrotest gage calibrated against NBS "Certified Coating Thickness Calibration Standards."
1. Engineer may measure coating thickness at any time during project to assure conformance with Specifications.

D. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

E. Measure substrate humidity with humidity gage specifically designed for such.

F. Provide wet paint signs.

3.8 CLEANING

A. Clean paint spattered surfaces.

1. Use care not to damage finished surfaces.

B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

C. Remove surplus materials, scaffolding, and debris.
   1. Leave areas broom clean.

3.9 SCHEDULE

A. Piping Color Schedule (Colors based on Tnemec):
   1. Match existing piping colors.
   2. Water Treatment Plant Piping Color Schedule:
      a. Inlet Piping to the Vessels: Spruce Green SW No. MC36.
      b. Outlet Piping from the Vessels: Light Green Diamond Vogel SW No. CH-1301.

END OF SECTION

1

DIVISION 11

EQUIPMENT

2012/01/06

SECTION 11005
EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements of this Specification Section apply to all equipment provided on the Project including that found in Divisions 11, 15 and 16, even if not specifically referenced in individual "Equipment" articles of those Specification Sections.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 03308 - Concrete, Materials and Proportioning.
   4. Section 05505 - Metal Fabrications.
   5. Section 07900 - Joint Sealants.
   6. Section 09905 - Painting and Protective Coatings.
   7. Division 11 - Equipment.
   8. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.
   9. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Gear Manufacturers Association (AGMA).
   3. ASTM International (ASTM):
      a. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   4. International Electrotechnical Commission (IEC).
   5. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
   6. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 6, Enclosures for Industrial Control and System.
      c. MG 1, Motors and Generators.
   7. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 430, Motors.
   8. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
   9. Underwriters Laboratories, Inc. (UL).
      a. 508A, Standard for Safety Industrial Control Panels.

B. Miscellaneous:
   1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:
      a. More than one (1) manufacturer is listed for a given "product" in Specifications.
      b. No manufacturer is listed.
   2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations shown on Electrical Power Drawings.

3. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and insure their compatibility.

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Equipment:
   1. One (1) or more assemblies capable of performing a complete function.
   2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
   3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

C. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. General for all equipment:
      a. See Section 01340 for requirements for the mechanics and administration of the submittal process.
      b. Data sheets that include manufacturer's name and complete product model number.
         1) Clearly identify all optional accessories that are included.
      c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
      d. Manufacturer's delivery, storage, handling, and installation instructions.
      e. Equipment identification utilizing numbering system and name utilized in Drawings.
      f. Equipment installation details:
         1) Location of anchorage.
         2) Type, size, and materials of construction of anchorage.
         3) Anchorage setting templates.
         4) Manufacturer's installation instructions.
      g. Equipment area classification rating.
      h. Shipping and operating weight.
      i. Equipment physical characteristics:
         1) Dimensions (both horizontal and vertical).
         2) Materials of construction and construction details.
      j. Equipment factory primer and paint data.
      k. Manufacturer's recommended spare parts list.
      l. Equipment lining and coatings.
      m. Equipment utility requirements include air, natural gas, electricity, and water.
   2. Mechanical and process equipment:
      a. Operating characteristics:
         1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
         2) Brake horsepower requirements.
         3) Copies of equipment data plates.
      b. Piping and duct connection size, type and location.
      c. Equipment bearing life certification.
      d. Equipment foundation data:
         1) Equipment center of gravity.
         2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.

3. Electric motor:
    a. Motor manufacturer and model number.
    b. Complete motor nameplate data.
    c. Weight.
    d. NEMA design type.
    e. Enclosure type.
    f. Frame size.
    g. Winding insulation class and temperature rise.
    h. Starts per hour.
    i. Performance data:
        1) Motor speed-torque curve superimposed over driven machine speed-torque curve during start-up acceleration and at rated terminal voltage a minimum permissible or specified terminal voltage for all motors over 10 HP.
        2) Time-current plots with acceleration versus current and thermal damage curves at the operating and ambient temperatures and at rated terminal voltage and minimum permissible or specified terminal voltage for all motors over 10 HP.
        3) Guaranteed minimum efficiencies at 100 percent, 75 percent, and 50 percent of full load
        4) Guaranteed minimum power factor at 100 percent, 75 percent, and 50 percent of full load.
        5) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
        6) Starting, full load, and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
    j. Bearing data and lubrication system.
    k. Fabrication and/or layout drawings:
        1) Dimensioned outlined drawing.
        2) Connection diagrams including accessories (strip heaters, thermal protection, etc.).
    l. Electrical gear:
        1) Unless specified in a narrow-scope Specification Section, provide the following:
            a) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
        2) Control panels:
            a) Panel construction.
            b) Point-to-point ladder diagrams.
            c) Scaled panel face and subpanel layout.
            d) Technical product data on panel components.
            e) Panel and subpanel dimensions and weights.
            f) Panel access openings.
            g) Nameplate schedule.
            h) Panel anchorage.
4. Systems schematics and data:
    a. Provide system schematics where required in system specifications.
        1) Acknowledge all system components being supplied as part of the system.
        2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
        3) Provide technical data for each system component showing compliance with the Contract Document requirements.
        4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.
5. For factory painted equipment, provide paint submittals in accordance with Section 09905.

B. Operation and Maintenance Manuals:
    1. See Specification Section 01340 for:
        a. The mechanics and administration of the submittal process.
        b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittals:
   1. Sample form letter for equipment field certification.
   2. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
   3. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
   4. Field noise testing reports if such testing is specified in narrow-scope Specification Sections.
   5. Notification, at least one (1) week in advance, that motor testing will be conducted at factory.
   6. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.
   7. Motor test reports.
   8. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
   9. Provide three (3) bound final written reports documenting vibration monitoring and testing for specified equipment.
      a. Include the acceptance criteria of all equipment tested.
      b. Provide individual tabbed sections for information associated with each piece of tested equipment.
   10. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
   11. Testing and monitoring reports in accordance with PART 3 of this Specification Section.
   12. Certification that driven equipment and VFD are compatible.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Motors:
      a. Baldor.
      b. General Electric.
      c. Marathon Electric.
      d. Reliance Electric.
      e. Siemens.
      f. Teco-Westinghouse.
      g. U.S. Motors.

2.2 MANUFACTURED UNITS

A. General:
   1. Furnished equipment manufacturer’s field quality control services and testing as specified in the individual equipment Specifications.
   2. Execute pre-demonstration requirements in accordance with Specification Section 01650.
   3. Perform and report on all tests required by the equipment manufacturer’s Operation and Maintenance Manual.
   4. Provide testing of electrical equipment and connections in accordance with Division 16.
   5. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
      a. Contract Drawings and Specifications.

b. Related construction change documentation.
c. Approved Shop Drawings.
d. Approved Operation and Maintenance Manuals.
e. Other pertinent information as required.

B. Testing and Monitoring Program Documentation:
1. Provide reports with tabbed sections for each piece of equipment tested.
2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
a. Include legible copies of all forms used to record field test information.
3. Prior to start of testing, submit one (1) copy of preliminary report format for Engineer review and comment
a. Include data gathering and sample test report forms that will be utilized.
4. In the final report, include as a minimum, the following information for all equipment tested:
a. Equipment identification, including:
1) Name and tag numbers identified in the Contract Documents.
2) Manufacturer's serial numbers.
3) Other pertinent manufacturer identification,
b. Date and time of each test.
c. Ambient conditions including temperature, humidity, and precipitation.
d. Visual inspection report.
e. Description of test and referenced standards, if any, followed while conducting tests.
f. Results of initial and all retesting.
g. Acceptance criteria.
h. "As found" and "as left" conditions.
i. Corrective action, if required, taken to meet acceptance.
j. Verification of corrective action signed by the Contractor, equipment supplier, and Owner's representative.
k. Instrument calibration dates of all instruments used in testing.
5. Provide three (3) bound final reports prior to Project final completion.

C. Other Testing:
1. Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.
2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.
a. The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.

D. Electric Motors:
1. Where used in conjunction with adjustable speed AC or DC drives, provide motors that are fully compatible with the speed controllers.
2. Design for frequent starting duty equivalent to duty service required by driven equipment.
3. Design for full voltage starting.
4. Design bearing life based upon actual operating load conditions imposed by driven equipment.
5. Size for altitude of Project.
6. Furnish with stainless steel nameplates which include all data required by NEC Article 430.
7. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
8. AC electric motors less than 1/3 HP:
a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
b. Permanently lubricated sealed bearings conforming to ABMA standards.

c. Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.

9. AC electric motors 1/3 to 1 HP:
   a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
      1) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.
10. AC electric motors 1-1/2 to 10 HP:
   a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Permanently lubricated sealed bearings conforming to ABMA standards.
   c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
11. AC electric motors greater than 10 HP:
   a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
   b. Oil or grease lubricated antifriction bearings conforming to ABMA standards.
      1) Design bearing life for 90 percent survival rating at 50,000 HRS of operation for motors up to and including 100 HP.
   c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.

E. NEMA Design Squirrel Cage Induction Motors:
1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
2. Motors to meet NEMA MG 1 (NEMA Premium) efficiencies.
3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
4. For use on variable frequency type adjustable speed drives, provide induction motors that are in compliance with NEMA MG 1, Part 31.
5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 DegC ambient.
6. Design motors for continuous duty.
7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15 percent greater than the maximum HP requirements of the driven equipment over its entire operating range.
   a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.
8. Motor enclosure and winding insulation application:
   a. The following shall apply unless modified by specific Specification Sections:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	DPFG (for horizontal motors), WP-I (for vertical motors), Standard Insulation
Wet indoor Areas	TEFC, extra dip and bake for moisture, WP-II (for vertical motors)
Wet outdoor Areas	TEFC, Extra Dip and Bake for Moisture, WP-II (for vertical motors)

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.

F. V-Belt Drive:
1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
3. Provide staticproof belts.

2.3 COMPONENTS

A. Gear Drives and Drive Components:
   1. Size drive equipment capable of supporting full load including losses in speed reducers and power transmission.
   2. Provide nominal input horsepower rating of each gear or speed reducer at least equal to nameplate horsepower of drive motor.
   3. Design drive units for 24 HR continuous service, constructed so oil leakage around shafts is precluded.
   4. Utilize gears, gear lubrication systems, gear drives, speed reducers, speed increasers and flexible couplings meeting applicable standards of AGMA.
   5. Gear reducers:
      a. Provide gear reducer totally enclosed and oil lubricated.
      b. Utilize antifriction bearings throughout.
      c. Provide worm gear reducers having a service factor of at least 1.20.
      d. Furnish other helical, spiral bevel, and combination bevel-helical gear reducers with a service factor of at least 1.50.

2.4 ACCESSORIES

A. Guards:
   1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
   2. Interior applications:
      a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
      b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
      c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
   3. Exterior applications:
      a. Construct from 16 GA stainless steel or aluminum.
      b. Construct to preclude entrance of rain, snow, or moisture.
      c. Roll to conform to shaft or coupling surface.
      d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:
   1. Cast-in-place anchorage:
      a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
      b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
      c. Provide two (2) nuts for each bolt.
   2. Drilled anchorage:
      a. Adhesive anchors per Specification Section 05505.
      b. Epoxy grout per Specification Section 03308.
      c. Threaded rods same as cast-in-place.

C. Data Plate:
   1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
   2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Lifting Eye Bolts or Lugs:
   1. Provide on all equipment 50 LBS or greater.
   2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

E. Platforms and Ladders:
   1. Design and fabricate in accordance with OSHA Standards.
   2. Fabricate components from materials described in narrow-scope sections.

3. Provide platform surface: Non-skid grating, unless specified in narrow-scope Specification Sections.

2.5 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.

D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
   1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
   1. Provide drain connection for 3/4 IN PVC tubing.

G. Machine the mounting feet of rotating equipment.

H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.
   1. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
   2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Specification Section 07900.

I. Critical Speed:
   1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
   2. Excessive vibration is sufficient cause for equipment rejection.
   3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.

J. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
   1. Manufacturer’s standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
   2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer’s standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
   3. Affix entire assembly with a UL 508A label “Listed Enclosed Industrial Control Panel prior to delivery.
      a. Control panels without an affixed UL 508A label shall be rejected.

2.6 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:
   1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Specification Section 09905 to receive field painting.
      a. Field painted equipment: See Specification Section 09905 for factory applied primer/field paint compatibility requirements.

B. Field paint other equipment in accordance with Specification Section 09905.
   1. See Specification Section 09905 for factory applied primer/field paint compatibility requirements.

2.7 SOURCE QUALITY CONTROL

A. Motor Tests:
   1. Test motors in accordance with NEMA and IEEE standards.
   2. Provide routine test for all motors.
   3. The Owner reserves the right to select and have tested, either routine or complete, any motor included in the project.
      a. The Owner will pay all costs, including shipping and handling, for all motors successfully passing the tests.
      b. The Contractor shall pay all costs, including shipping and handling, for all motors failing the tests.
      c. If two (2) successive motors of the same manufacturer fail testing, the Owner has the right to reject all motors from that manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as seal water, provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
   1. Route clear of major traffic areas and as approved by Engineer.

D. DO NOT construct foundations until major equipment supports are approved.

E. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

F. Equipment Base:
   1. Construct level in both directions.
   2. Take particular care at anchor bolt locations so these areas are flat and level.

G. Machine Base:
   1. Mount machine base of rotating equipment on equipment base.
      a. Level in both directions, using a machinist level, according to machined surfaces on base.
   2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
      a. Size blocks and shims to provide solid support at each mounting bolt location.
         1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
      b. Provide blocks and shims at each mounting bolt.
         1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
      c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.

H. Couplings:
   1. Align in the annular and parallel positions.
      a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 IN size and smaller.
         1) Couplings larger than 4 IN size: Increase tolerance 0.0005 IN per inches of coupling diameter, i.e., allow 6 IN coupling 0.002 IN tolerance, and allow a 10 IN coupling 0.004 IN tolerance.
      b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 IN per inch coupling diameter.

2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

I. Grouting:
1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
   a. Extend dam or formwork to cover leveling shims and blocks.
   b. Do not use nuts below the machine base to level the unit.
2. Saturate top of roughened concrete subbase with water before grouting.
   a. Add grout until entire space under machine base is filled to the top of the base underside.
   b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
   a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
   b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
   c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.

B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
1. Has been properly installed and lubricated.
2. Is in accurate alignment.
3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load conditions and that it operated satisfactorily.
   a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

C. No separate payment shall be made for installation checks.
1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 FIELD PAINTING AND PROTECTIVE COATINGS

A. For required field painting and protective coatings, comply with Specification Section 09905.

3.4 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.

B. Coat connection with oxidation eliminating compound for aluminum wire.

C. Terminate motor circuit conductors with copper lugs bolted to motor leads.

D. Tape stripped ends of conductors and associated connectors with electrical tape.
1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.

E. Connections to carry full ampacity of conductors without temperature rise.

F. Terminate spare conductors with electrical tape.

3.5 FIELD QUALITY CONTROL

A. Furnish equipment manufacturer services as specified in the individual equipment Specifications.

B. Inspect wire and connections for physical damage and proper connection.

C. Bump motor to check for correct rotation:
   1. Ensure motor has been lubricated.
   2. Check prior to connection to driven equipment.

D. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs and cross member that are cast welded or bolted, shall be tested for a natural frequency of vibration after equipment is mounted.
   1. Keep the ratio of the natural frequency of the structure to the frequency of the disturbing force out of the range from 0.5 to 1.5.

3.6 DEMONSTRATION

A. Demonstrate equipment in accordance with Section 01650.

END OF SECTION

1

2012/01/12

SECTION 11006
PRE-PURCHASED EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements/responsibilities of Contractor for receiving, unloading, storage, installation and coordination of Special Services associated with pre-purchased equipment.

B. Related Sections include:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 09905 - Painting and High Performance Industrial Coatings.
   4. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Coordinate Special Services required for the startup, testing and demonstration of WRT equipment.

1.3 DEFINITIONS

A. Special Services: Services associated with the pre-purchased equipment.

1.4 SUBMITTALS

A. WRT Equipment Submittal:
   1. For WRT equipment see Shop Drawing Transmittal No. 11301-01.
      a. Contractor will include in his Bid all costs for the responsibilities of installation, testing and disinfection of equipment.
      b. Contractor will be provided an electronic copy of Shop Drawing 11301-01.
   2. Submit the following form after the identified tasks have been completed and the form has been signed by the Contractor:
      a. Site Preparation Validation WRT Project: W000214. See Specification Section 01060A for a copy of this form.
   3. Submit all submittals associated with pre-purchased equipment in accordance with Section 01340.

1.5 DELIVERY, STORAGE AND HANDLING

A. Receive pre-purchased equipment and inventory quantities and condition of materials.
   1. Engineer will be provided with copies of all received inventory documentation including remedying missing or damaged materials.

B. Provide all labor and equipment to unload and store materials in accordance with manufacturer's recommendations.

C. Store maintenance materials in a secure, separate area.
   1. Turn over maintenance materials to Owner prior to final project closeout.

D. See Section 01600.

PART 2 - PRODUCTS

2.1 PRE-PURCHASED EQUIPMENT

A. See Specification Section 11301.

2.2 EQUIPMENT ANCHORAGE AND ANCILLARY HARDWARE

A. Provide all anchorage and ancillary hardware required for pre-purchased equipment installation if not provided by WRT.

B. See Section 05505.

C. See Section 11005.

PART 3 - EXECUTION

3.1 SPECIAL SERVICES

A. Where defined in pre-purchased equipment/procurement contracts, utilize equipment manufacturer's field representatives for Special Services including inspection, adjustment, field testing, startup and demonstration.

3.2 INSTALLATION

A. See Section 11005 for general equipment installation requirements.

B. See Section 11060 for general pumping equipment installation requirements.

C. See Section 11072 and Division 16 for additional requirements.

3.3 FIELD QUALITY CONTROL

A. WRT Equipment: Site Preparation Validation WRT Project: W000214 Form. See Section 01060A.

3.4 PAINTING

A. For pre-purchased equipment arriving at the site and having damaged factory coatings, field repair coatings in accordance with Section 09905.

B. For pre-purchased equipment requiring field coatings, provide coatings in accordance with Section 09905.

3.5 DEMONSTRATION

A. Coordinate with WRT for the demonstration of the pre-purchased equipment.

3.6 TRAINING

A. Coordinate training of pre-purchased equipment with WRT and the Owner.

END OF SECTION

2011/12/19

SECTION 11060
PUMPING EQUIPMENT: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pumping equipment.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 11005 - Equipment: Basic Requirements.
   5. Section 11072 - Pumping Equipment: Vertical Turbine (Line Shaft).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Hydraulic Institute (HI):
      a. Standards for Centrifugal, Rotary and Reciprocating Pumps.

B. Fully coordinate all mechanical seal systems specified to ensure pump and seal compatibility.

C. Pump/motor and VFD coordination: See Section 11005.

1.3 DEFINITIONS

A. The abbreviations are defined as follows:
   1. IPS: Iron Pipe Size.
   2. NPSHR: Net Positive Suction Head Required.
   3. TDH: Total Differential Head.
   4. TEFC: Totally Enclosed Fan Cooled.
   5. VFD: Variable Frequency Drive.

B. Pump Service Category: Pump or pumps having identical names (not tag numbers) used for specific pumping service.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 11005.
   3. Product technical data including:
      a. Performance data and curves with flow (gpm), head (FT), horsepower, efficiency, NPSH requirements, submergence requirement.
      b. Pump accessory data.
      c. Bearing supports, shafting details and lubrication provisions.
      d. Solids passage information.
   4. Certifications:
      a. Certified pump performance curves as described in Article 2.5.
   5. Test reports:
      a. Factory hydrostatic test.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Miscellaneous:
   1. Certifications:
      a. Provide a written statement that manufacturer's equipment has been installed properly, started up and is ready for operation by Owner's personnel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pumps:
      a. See individual pump Specification Sections.
   2. Mechanical seals:
      a. Chesterton.
      b. Garlock.

2.2 ACCESSORIES

A. See Specification Section 11005.

B. Each Unit:
   1. Lifting eye bolts or lugs.
   2. Plugged gage cock connection at suction and discharge nozzles.
   3. Tapped and plugged openings for casing and bearing housing vents and drains.
   4. Fittings for properly adding flushing lubricant.
   5. Pressure relief fittings for grease lubrication.

C. Packing Seal:
   1. Provide packing unless mechanical seal is specified in narrow-scope pump sections.
   2. Minimum of five (5) rings graphite impregnated synthetic packing.
   3. Provide minimum 1/4 IN DIA supply tap and 1/2 IN DIA minimum drain tap.
   4. Provide split Teflon or bronze water seal ring.
   5. Adjustable split follower cast iron or bronze gland.

D. Mechanical Seals:
   1. Provide as specified in the narrow-scope pump sections.
   2. Materials:
      a. Metal parts except springs: 316 stainless steel.
      b. Springs: Hastelloy C.
      c. Seal faces: Unfilled carbon graphite versus silica-free Grade 99.5 ceramic.
      d. Elastomers: Viton.

2.3 FABRICATION

A. Pump Support:
   1. Design base to support weight of drive, shafting and pump.
   2. Comply with HI vibration limitations.
   3. Mount horizontal pump, motor and coupling on single piece drip lip type baseplate.
   4. Mount vertical pumps on single piece pedestal baseplate.
   5. Fabricate to withstand all operating loads transmitted from the pump and drive.

2.4 SOURCE QUALITY CONTROL

A. If specifically required in the individual pump specification sections, provide factory tests:
   1. All units:
      a. Hydrostatic test at 150 percent of shutoff head for a minimum of 5 minutes.
   2. Adjustable speed units:
      a. Head (FT) verses flow (gpm) pump curves:
         1) Maximum, minimum and two (2) equally spaced intermittent speeds.
         2) Efficiencies along each curve.
         3) Brake horsepower along each curve.
   3. Constant speed units:
      a. Head (FT) versus flow (gpm) pump curves:
         1) Efficiencies along curve.
         2) Brake horsepower along each curve.
   4. Results certified by a registered professional engineer.
   5. Test shall be non-witnessed.

B. Statically and dynamically balance each pump per HI standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 11005.

B. Floor or Pad-Mounted Units (Non-Submersible):
   1. Align vertically and horizontally level, wedge and plumb units to match piping interfaces.
   2. Assure no unnecessary stresses are transmitted to equipment flanges.
   3. Tighten flange bolts at uniform rate and manufacturer's recommended torque for uniform gasket compression.
   4. Support and match flange faces to uniform contact over entire face area prior to bolting pipe flange and equipment.
   5. Permit piping connecting to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
   6. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
   7. Assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
      a. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
      b. Realign as necessary, install flange bolts and make equipment connection.
   8. Field paint units as defined in Section 09905.
   9. Provide pressure gage on discharge of all pumps and on suction and discharge of all non-submersible units.

3.2 FIELD QUALITY CONTROL

A. Provide services of equipment manufacturer's field service representative(s) to:
   1. Inspect equipment covered by these Specifications.
   2. Supervise pre-start adjustments and installation checks.
   3. Conduct initial startup of equipment and perform operational checks.
   4. Instruct Owner's personnel for the specified minimum number of hours at jobsite per Specification Section 01060 on operation and maintenance of each of following pumping equipment:
      a. Section 11072 - Pumping Equipment: Vertical Turbine, 8 HRS.

END OF SECTION

1

2012/01/05

SECTION 11072

PUMPING EQUIPMENT: VERTICAL TURBINE (LINE SHAFT)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vertical turbine pumps.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.
   4. Section 11060 - Pump Equipment: Basic Requirements.
   5. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings - Classes 25, 125 and 250.
   2. ASTM International (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      d. B505, Standard Specification for Copper Alloy Continuous Castings.
   3. Society of Automotive Engineers (SAE).

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. See Section 15060.

B. Operation and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Goulds.

2.2 MATERIALS

A. Bowl: Cast iron, ASTM A48.

B. Bowl Bearings: Bronze.

C. Shaft: Stainless steel, 416 or 410.

D. Impeller: Bronze.

E. Impeller Wear Rings: Bronze, ASTM B505.

F. Discharge Head: Steel or cast iron.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Raw Water Pump-Well No. 8:
   1. Primary design conditions: 1500 gpm at 116 FT TDH and 80 percent efficiency at maximum speed.
   2. Secondary design conditions: 400 gpm at 172 FT TDH at minimum speed.
   3. Maximum speed: 1770 rpm.
   4. Minimum speed: 1600 rpm.
   5. Maximum horsepower: 75 HP motor.
   6. Shutoff condition: 0 gpm at 192 FT.
   7. Column size: 8 IN. Reuse existing Column.
   8. Discharge flange: 8 IN. Reuse existing discharge flange.
   9. Type of discharge head: Above ground flanged. Reuse existing discharge head.
   10. No. stages: Two (2).
   11. Drive: VFD.

B. Raw Water Pump-Well No. 6:
   1. Add an additional stage to the existing pump.
   2. Existing Pump Information:
      a. Goulds Pump.
      b. Model: 14RJLC.
      c. Maximum speed: 1770 rpm.
   3. Maximum horsepower: 75 HP motor.
   4. Column size: 8 IN. Reuse existing Column.
   5. Discharge flange: 8 IN. Reuse existing discharge flange.
   6. Type of discharge head: Above ground flanged. Reuse existing discharge head.
   7. Drive: VFD.

C. Raw Water Pump-Well No. 7:
   1. Add an additional stage to the existing pump.
   2. Existing Pump Information:
      a. Goulds Pump.
      b. Model: 14RJLC.
      c. Maximum speed: 1770 rpm.
   3. Maximum horsepower: 75 HP.
   4. Column size: 8 IN. Reuse existing Column.
   5. Discharge flange: 8 IN. Reuse existing discharge flange.
   6. Type of discharge head: Above ground flanged. Reuse existing discharge head.
   7. Drive: VFD.

D. Provide pumps with increasing head characteristics from secondary design conditions to shutoff condition.
   1. Provide pumps with net positive suction head requirements (NPSHR) less than the net positive suction head available (NPSHA) at all operating conditions.

2.4 ACCESSORIES

A. See Section 11005.

2.5 COMPONENTS

A. General:
   1. Furnish units consisting of a vertical shaft turbine, direct connected to a vertical hollow shaft motor. Design unit with non-reversing ratchets.
   2. Weight of revolving parts of pump including unbalanced hydraulic thrust of impeller is carried by thrust bearing in driver.
   3. Make provision at driver shaft for adjusting impeller with reference to bowls.

B. Column:
   1. Reuse existing column.

C. Open Line Shaft:
   1. Reuse existing line shaft.

D. Pump Bowl and Suction Bell:
   1. Reuse as applicable.
   2. Provide bowl and suction bell constructed of close grained cast iron, free from imperfections and accurately machined and fitted.
   3. Coat pump bowl water passages with an abrasion-resistant baked enamel, phenolic or epoxy.
   4. Provide coating suitable for potable water service.
   5. Design to ensure easy removal of bearings and impeller.
   6. Furnish suction bell with flared end to reduce entrance losses and with a sufficient number of vanes to support lower guide bearings and weight of impeller and pump shaft when dismantling pump.

E. Bearings:
   1. Provide units with sleeve bearings of SAE 600 bronze in each bowl and in suction bell.
   2. In bowl, provide main bronze bearing immediately above impeller and a lower bronze bearing immediately below impeller.
   3. Provide for lubrication of bowl bearings with pumped liquid.
   4. Furnish suction bell bearing having minimum length equal to five (5) shaft diameters.
   5. Ensure bell bearing is permanently packed type with packing to be a nonsoluble grease.
   6. Provide SAE 40 bronze collar for bell bearing to prevent abrasives from entering bearing.

F. Pump Shaft and Impeller:
   1. Provide pump unit shaft constructed of rolled and ground 416 or 410 stainless steel.
   2. Furnish enclosed type impellers constructed of bronze and securely attached to impeller shaft.
   3. Ensure impeller is accurately fitted and statically and dynamically balanced.
   4. Provide bronze replacement wear rings in each bowl to prevent wear on bowls.

G. Discharge Head Assemblies:
   1. Reuse existing discharge head assemblies.

H. Suction Strainer:
   1. Reuse existing suction strainer.

I. Data Plates:
   1. Provide stainless steel data plate securely attached to pump.
   2. Include manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, and other pertinent data.

J. Motors:
   1. Reduced voltage starting, vertical hollow shaft, squirrel cage, induction type.
   2. 460 V, 60 HZ, 3 PH.

3. Size motor to drive pump continuously over the complete head - capacity range without the load exceeding the nameplate rating.
4. Comply with Section 16220.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. See Section 11060.

END OF SECTION

2012/01/11

SECTION 11301
URANIUM REMOVAL SYSTEM
(PRE-PURCHASED)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Uranium Removal System (URS) with Adsorptive Media for treatment of groundwater, equipment service and maintenance, treatment media replacement and disposal services and radioactive materials licensing for a period of 10 years.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11302 - Performance Pilot Testing of Adsorptive Media Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Society of Mechanical Engineers (ASME):
      a. Boiler and Pressure Vessel Code.
   3. American Welding Society (AWS).
   4. Institute of Electrical and Electronic Engineers (IEEE).
   5. National Electric Code (NEC).
   6. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
   7. National Sanitation Foundation (NSF).
      a. NSF 61, Drinking Water System Components-Health Affects.
   8. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. SP 5/NACE No. 1, White Metal Blast Cleaning.
      b. SP 6/NACE No. 3, Commercial Blast Cleaning.
      c. SP 10/NACE No. 2, Near-White Blast Cleaning.
   9. Underwriters Laboratory (UL):
      a. UL 508A.

B. Referenced Tables:
   1. The following tables are included at the end of Part 3:
      a. Table 1: Historical Raw Water Quality.

C. Miscellaneous:
   1. Perform all welding in accordance with the latest applicable codes of the AWS (or CWS) and/or ASME Boiler Code.
   2. A building to house the uranium adsorptive media system will be provided by Others and should be taken into account when preparing applicable submittals.

1.3 DEFINITIONS

A. Finished Water: A blend of the water treated from the URS System plus water bypassed around the URS System.

B. Firm Capacity: The amount of water required to be treated by the URS - 5 MGD or 3500 GPM.

C. System Supplier: System Supplier of URS equipment.

D. Raw Water:
   1. The source of raw water will be from wells 6, 7 and 8 of the City's well field which has a total of 21 wells.

E. 90-Day Pilot Study:
   1. The pilot study where URS will be tested to fulfill City's requirements.
      a. See Section 11302.

1.4 SCOPE OF SUPPLY

A. Because of variations in system design and configuration offered by the prospective System Supplier, all components listed may not apply to all System Suppliers. Should components be missing or not identified under this Scope of Supply but are required because of overall system integrity and operability, the System Supplier shall include those in its scope of supply.

B. All requests for clarification shall be submitted to the Engineer.

C. The system supplier shall provide a complete URS suitable for the removal of uranium at a continuous flow rate of 3,500 gpm. The influent Uranium concentration shall be assumed to be 35.1 ug/l. The URS will treat water from three of the twenty one wells in the City's well field. The URS shall be specifically designed to successfully reduce the uranium level in the treated water by 85 percent at all times. The complete system shall include but not be limited to:
   1. Vessels constructed of lined carbon steel or stainless steel to ASME code with the appropriate code stamp rated for a minimum of 100 psi working pressure.
   2. All piping, valves, fittings, and internal distribution to provide a fully functional system.
   3. All instrumentation and sampling ports to provide system monitoring and interlocks with the Owner's water system.
   4. Media removal nozzles for removal of spent media and fresh media replacement.
   5. Mechanical screening to prevent the migration of treatment media from the treatment system

D. The URS supplier shall be in the business of radionuclide removal from water sources. Descriptive literature and drawings for the equipment being furnished under this section shall include schematic drawings illustrating all components and electrical and electronic connections and all field connections as well as equipment specifications, outline dimension drawings, wiring, and piping diagrams for each item of equipment being furnished. Upon complete approval, the URS supplier shall submit four (4) copies of all descriptive matter and instructions in separate indexed binders to the engineer for use by the owner. The submission shall include, in addition to detailed equipment data and instruction, a complete system operation and maintenance instruction manual, coordinated with the specified equipment as furnished and installed.

1.5 SUBMITTALS

A. Equipment System Supplier Qualifications
   1. The URS supplier shall submit, with their bid, the following to the Engineer to evaluate their experience in radionuclide removal. The URS supplier shall be a single System Supplier experienced in the design, fabrication, delivery, and startup of radionuclide removal equipment and must provide information demonstrating such ability. Submit the below information for a minimum of five (5) projects where the selected System Supplier has furnished comparable radionuclide (radium or uranium) removal equipment for municipal groundwater treatment, and those systems have been in operation for a minimum of three (3) years.
   2. The URS supplier shall submit the following information exhibiting their ability to provide on-going support to the owner to insure an effective operation of the system.
      a. Number of years in water treatment business.
      b. Reference information for the last five (5) comparable projects including design basis, length of time in service and contact references for the Owner, consulting engineer and radioactive materials licensing agency for each project.

B. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Submit detailed submittal.
      a. Resubmit until either an “A” or “B” action is obtained per Section 01340.
   3. Submittal format:
      a. Submit Drawings in both electronic (AutoCad) and hard copy form.
      b. Submit cut sheets, calculations, etc. in electronic PDF format and in hard copy form.
   4. Submittal content:
      a. P&IDs of the URS system:
         1) Process and instrumentation drawings detailing the system proposed by the System Supplier.
         2) Show interfaces between System Supplier’s equipment and equipment supplied by Others which directly interfaces with the URS System (i.e. utilities, I/O, etc.).
         3) Include as a minimum:
            a) Equipment and valves list for the major components with reference tag numbers and brief description of each item.
            b) Equipment detail.
            c) Manual and automatic valves detail.
            d) Interconnecting piping including size (if piping size is related to System Supplier equipment sizing or system integrity).
            e) Instrumentation.
            f) All I/O at the PLC and operator interface levels including alarms, indications of measured values and equipment status, control functions, and primary interlocks.
            g) Clear definition of what is provided in System Supplier’s scope of supply.
      b. URS System General Arrangement Drawings:
         1) Submit an arrangement drawing for the URS.
         2) Scaled plans and elevations of the URS system.
         3) Once submitted and approved, the location and physical confines of the System Supplier supplied equipment or termination points shall not change without approval of the Engineer.
         4) Identify clearly the termination points and physical location of hydraulic, pneumatic and electrical connections where interfacing of the System Supplier supplied equipment and equipment supplied by Others exists.
         5) Identify recommended areas around equipment needed to allow for maintenance.
      c. Pressure Vessels: Technical information including materials of construction, construction details, vessel pressure rating and certifications and scaled drawings for vessels.
      d. Piping Fabrication and Assembly Drawings for all URS System Piping:
         1) Provide scaled drawings showing all fittings, valves, instruments and supports.
         2) Identify piping materials and fabrication details.
         3) Identify each equipment, pipe, and skid support by catalog number or Shop Drawing detail number.
         4) Identify piping materials and requirements for contractor supplied connections or welds and interconnecting piping including piping materials, size, and installation details.
      e. PLC/Control System Documentation:
         1) Submit a list of I/O that are required for operation of the URS System that are not available from System Supplier’s equipment.
         2) Arrangement drawings for PLC system components.
         3) Panel and enclosure plans, sections and details.
            a) Panel exterior layout drawings to scale indicating the following:
               (1) Panel materials of construction, dimensions, and total assembled weight.
               (2) Panel access openings.
               (3) Conduit access locations.
               (4) Front panel device layout.
               (5) Nameplate location and schedule.

b) Panel interior layout drawings shall be drawn to scale and shall indicate the following:
(1) Sub-panel or mounting pan dimensions.
(2) Interior device layouts.
(3) PLC general arrangement layouts.
(4) Wire-way locations, purpose, and dimensions.
(5) Terminal strip designations.
(6) Location of external wiring and/or piping connections.
(7) Location of lighting fixtures, switches and receptacles.
c) Catalog cut sheets containing information on PLC and all related modules and components to be submitted as part of these Specification Section submittals.

f. Summary of equipment requiring electrical power, including equipment identification, loads and voltages.
g. Summary of equipment requiring pneumatic supply including equipment identification, cfm and pressure.
h. Provide description of source quality control program.
i. System Supplier's delivery, storage, and handling instructions.
j. Installation details including location of anchorage, type and size of anchorage, anchorage setting templates and System Supplier's installation instructions.
k. Equipment area classification rating.
l. Shipping and operating weights.
m. Factory coating and primer information.
n. Minimum dimensions required for removal of treatment vessels for maintenance.
o. Electrical interconnect and schematic wiring diagrams including motor horsepower and other electrical load information and identification of external wiring (panel) connections for coordination with the Construction Contractor.
p. Bill of materials for all components supplied with the URS System including identification used on P&IDs.
1) For all tagged devices supplied, develop a Cross-Reference Schedule that matches the equipment identification used on the technical information submitted for that device.
a) Include Manufacturer's tag number, project tag number as identified in this Section and device name or description.

C. Operation and Maintenance Manuals:
1. See Section 01340 for requirements on the following:
a. The mechanics and administration of the submittal process.
b. The general content of Operation and Maintenance Manuals.
c. URS System:
1) Provide standard operating and maintenance instructions. URS supplier shall handle all long term maintenance and warranty of the system for the term of the contract.
2) Applicable Material Safety Data Sheets (MSDS).
3) Names, functional title, and phone numbers of maintenance personnel available for on-going support.

D. Miscellaneous Submittals:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.

1.6 DELIVERY, STORAGE AND HANDLING

A. Schedule delivery of Goods as required to allow timely installation by the Construction Contractor.

B. Package and tag equipment in a manner that will protect the Goods from damage and facilitate the final assembly in the field.

C. Include weight and dimensions of major Goods, handling instructions for all Goods, storage requirements and instructions for protective maintenance during storage with each shipment.

D. Construction Contractor will provide labor, equipment, and facilities to unload and store Goods.

1.7 SITE CONDITIONS

A. Raw Water Quality:
   1. Anticipated raw water quality data is included in Table 1 provided at the end of Part 3 of this Specification.
      a. **Note that limited water quality data is currently available.**
      b. System Supplier shall be responsible for designing URS System to meet specified performance criteria of removing at least 85% of uranium concentration at all times. Media will need to be changed when the removal rates are expected to fall below the specified level.

B. Preliminary Treatment Plant Layout:
   1. The URS System will be installed within a new water treatment building located in the well field. The building will be constructed by the Owner under separate construction contract.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEM SUPPLIERS

A. Subject to compliance with these Procurement Documents, the following System Suppliers are acceptable:
   1. URS System:
      a. Water Remediation Technology, LLC (WRT).
      b. Approved Equals will be acceptable only after Pilot Testing (See section 11302)

2.2 SYSTEM DESIGN OVERVIEW AND PERFORMANCE CRITERIA

A. General:
   1. Year round firm Finished Water Capacity: 3500 gpm or 5.0 MGD.
   2. Raw water temperature: 50-60 DegF.
   3. For designs using multiple trains or units, provide “identical” Units.
      a. “Identical” shall mean each train/unit is of the same hydraulic capacity.
   4. Hydraulic Capacity:
      a. Supply pumps and piping sized such that the URS System provides 5.0 MGD of Finished Water.

B. Finished Water Quality:
   1. Maximum Total Uranium (ug/L): 15 percent of influent.
   2. Maximum Total Gross Alpha (pCi/L): 15 percent of influent.

2.3 URS SYSTEM

A. Treatment Vessels:
   1. The URS shall be comprised of at least two parallel treatment trains to maintain redundancy with a total treatment capacity of 3,500 gpm.
   2. The vessels shall be constructed of lined carbon or 304 stainless steel and shall be suitable for installation onto a concrete foundation.
   3. The vessels are to include media transfer, media sample, water transfer, and vacuum transfer ports. All such ports shall be equipped with the necessary valves. The media transfer ports shall be used for media service operations and will not normally be used by the owner’s personnel. The URS supplier may choose to remove the valve handles of such valves to limit access to the uranium removal media to authorized personnel.
   4. Each vessel shall have at least one manway access port. Each vessel shall be fitted with air and vacuum release valves and a pressure relief valve.
   5. The flow inlet to each vessel shall be through the bottom and be internally directed through a header / lateral distribution system designed to promote an even fluid distribution. The inlet piping at each vessel shall include a check valve suitable for preventing Uranium Removal Media escape from the vessel.

6. The URS discharge shall be a header / lateral system at the top of each vessel.

B. Piping and Valves:
   1. The URS shall include schedule 10, type 304 stainless steel piping designed to permit feed, discharge, and bypass piping connections to be integrated into Owners distribution system. Such piping shall be flanged and welded and be fabricated into spool pieces for field installation by the construction contractor. Pipe field welds are permitted to final pipe sections where cut-to-fit pieces are necessary for final fit up. Welds shall be performed by a certified welder and utilize only materials and brushes that are compatible with the pipe and weld material and will not contaminate the stainless steel welds. The use of carbon steel welding rod and brushes that have been in contact with carbon steel welds shall not be permitted when welding stainless steel.
   2. The URS shall include a bypass pipe path and necessary valves that permit the entire system to be isolated from the customer's water system. The Owner's personnel shall have full access to the feed, discharge, and bypass valves. The valves shall be manually operated.
   3. The piping system components shall include feed and discharge valves, bypass valves, water transfer valves, air release, a hydraulically actuated slow-opening check valve, and y- type or basket strainers.
   4. Butterfly Valves: All butterfly valves shall be manually operated, one piece lug or wafer style with cast iron or ductile iron bodies and lined discs that meet ANSI 150 pressure ratings for hydrostatic shell test requirements. No metal-to-metal seating surfaces shall be permitted. The seat shall be tongue-and-groove design with primary hub seal and a molded O-ring. Valves smaller than 6 IN DIA shall be lever actuated and valves 6 IN DIA and larger shall be gear-operator actuated. All butterfly valves shall be series 30/31 as manufactured by Bray or approved equal. Valves or all wetted parts shall be NSF 61 approved.
   5. Air Relief/Vacuum Relief Valves: All air/vacuum relief valves shall be D-060 and D-040 series as manufactured by A.R.I. USA, Inc. or approved equal. Valves or all wetted parts shall be NSF 61 approved.
   6. Ball Valves: All ball valves shall be suitable for one-hundred fifty (150) psi working pressure. All ball valves shall be stainless steel NPT threaded ends, series 100 valves as manufactured by AVCO or approved equal. Valves or all wetted parts shall be NSF 61 approved.
   7. Check Valves: Inlet check valves shall be slow-opening as manufactured by OCV or ClaVal or approved equal. Outlet check valves shall be wafer check valves as manufactured by Milliken or approved equal. Valves or all wetted parts shall be NSF 61 approved.
   8. Instrument tubing shall be 1/4 IN polyethylene. Sample port tubing shall be 1/8 IN 304 stainless steel.

C. Instrumentation and Flow Meter:
   1. The URS shall include a magnetic type totalizing flow meter with field display and remote readout. Differential pressure shall be displayed on the HMI by use of pressure transducers with accompanying transmitters capable of sending a 4 - 20 mA signal. Pressure and differential pressure shall be provided for the system feed, the treatment vessel discharge, and the system discharge. In addition, differential pressure shall be provided across each y-strainer or conical strainer. At each pressure transducer location, a pressure gage shall be installed as well as a 1/4 IN isolation ball valve and a sample or bleed ball valve

D. Controls:
   1. Furnish control panel(s) with a single point for electrical power connection.
   2. Generate all sub voltages needed inside the control panel(s).
   3. 480 V powered control panel(s) shall have a fused or circuit breaker style disconnect assembly with a locking, door mounted operator.
   4. Build panels in conformance with the provisions of UL 508A.
   5. Affix assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

6. The URS shall be fully automatic in operation and require no operator activity to effectively remove uranium as designed. The URS shall include a control panel complete with a programmable logic controller (PLC) and the necessary software for automatic monitoring and operation of the system. The panel will display flow and pressure data, log gallons treated, and provide an electrical interface with owner's well control circuit or SCADA system. The panel will have an interconnect data capability or wireless monitoring modem for remote monitoring by the URS supplier. The operating sequence shall be as follows:
    a. The deep well pump(s) is/are started from the control system panel or the owner's SCADA system, causing water to flow through pipe network. Entrained air is bled through an automatic vent valve. The control panel is notified and pump run-confirm is shown
    b. The slow-opening check valve begins to open based on the system hydraulic pressure allowing flow to enter the treatment vessels.
    c. The Uranium Removal Media bed lifts as flow is established in treatment vessels.
    d. Uranium is removed in the treatment vessels.
    e. The flow meter records the amount of gallons treated and then communicates back to the control panel.
    f. The Uranium Removal Media maintenance service shall be performed by the URS supplier's service personnel, not the owner.

E. Media:
    1. The URS shall only use Uranium Removal Media. The treatment media shall be NSF Standard 61 certified for use in potable water. The customer shall not handle nor be responsible for the Uranium Removal Media. The Uranium Removal Media replacement, transportation, and disposal to a licensed facility shall be provided by the URS supplier.

F. Miscellaneous:
    1. Materials of Construction:
        a. Bolts, nuts, washers, flange backing rings, and other miscellaneous metal components not specifically addressed elsewhere in these Specifications shall be Type 304 or 316 stainless steel.

2.4 PROTECTIVE COATINGS

A. Provide coatings as specified below:
    1. Non Immersed Skid Steel
        a. Cleaning: SSPC SP 6/NACE No.3 Commercial Blast Cleaning
        b. Primer: Tnemec 66-1211 Polyamide Epoxy Coating. 3 – 6 mils DFT.
        c. Top Coat:
    2. Exterior Steel Tank and Piping
        a. Cleaning: SSPC SP 6/NACE No. 3 Commercial Blast Cleaning
        b. Primer: Tnemec 66-1211 Polyamide Epoxy Coating. 3 – 6 mils DFT.
        c. Top Coat:
    3. Interior Steel Tank
        a. Cleaning: SSPC SP 10/NACE No. 2 Near-White Metal Blast Cleaning to achieve a 4 mil profile anchor pattern. If profile is not achieved, clean per SSPC SP 5/NACE No. 1 White Metal Blast for the same 4 mil profile anchor pattern.
        b. Coating: Plasite "Plasguard" 4110 Vinyl Ester Lining. Two - three multi-pass spray coats for 35 to 45 mils DFT per manufacturer's specifications. Application must be pinhole free. Self priming.

B. Provide coatings for adsorptive media system skid mounted elements such that no protective coatings need be provided in the field.

C. Provide System Supplier's standard exterior protective coating for all automatic valve operators.

D. For remaining valves, and appurtenances, provide two exterior coats and finish coat with high performance industrial grade, 2-3 mill DFT epoxy prime equal to Tnemec Series 20 Pota-Pox.

E. No exterior protective coatings are required for PVC, CPVC, aluminum or 304/316 stainless steel components.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Owner/Construction Contractor shall be responsible for the installation of the treatment system.

3.2 FIELD SUPERVISION, START-UP SERVICES, TRAINING AND OPERATION

A. The URS System Supplier shall provide the following:
   1. Provide Uranium Removal Media as required, delivered to the jobsite.
   2. Conduct onsite inspection of the treatment system and installation prior to operation.
   3. Supervisory service of a factory-trained service engineer, who is specifically trained in the type of equipment herein specified, shall be provided for a period of three (3) 8 HR man days for inspection of erected URS, and training of Owner's personnel.
   4. Before placing the system into operation, the system shall be disinfected by introducing a sodium hypochlorite solution into the system and piping in accordance with AWWA C653, AWWA Standard for Disinfection of Water Treatment Plants.
   5. Flush the system to waste.
   6. After completion of the inspection, the URS service engineer shall initiate a trial performance run, ascertain any adjustments required, and place the system into operation.
   7. Remotely assist the system installer with technical advice on the installation of the major components of the treatment equipment.
   8. Operator training shall be provided to the Owner for the operation of the equipment as well as radiation safety awareness. Radiation safety awareness training shall also be provided for local first responders as requested.
   9. No form of energy shall be turned on to any part of the system prior to receipt by the engineer of a certified statement of approval of the installation from the URS supplier.

3.3 LONG TERM SERVICES

A. As part of the total scope of supply, the following services shall be provided by the URS supplier. The system supplier shall furnish all labor, materials and supplies to perform all work called for in connection with the media removal, exchange, proper disposal and replacement with new media as specified below for the term of the services agreement on a guaranteed cost per 1,000 gallons treated basis for the term of the contract. The system supplier shall take ownership of the uranium as accumulates onto the treatment media and shall provide a guarantee for the performance of the entire treatment system for the term of the contract.

B. System Operating Criteria:
   1. The stated average raw water uranium level to be treated is 35.1ug/L.
   2. The Long Term Services contract will be based upon treating 1,500,000,000 gallons per year.

C. Process Performance Requirements:
   1. Guarantee the performance of the URS provided under the section above to successfully reduce the uranium level in the treated water to less than 15% of the influent concentration at all times.

D. Qualifications:
   1. The system supplier shall carry workmen's compensation and liability insurance. The certificates of insurance will be supplied to the Owner for review.
   2. The system supplier must have at least five (5) years of experience as a treatment media and service agreement system supplier, and shall provide at least five (5) references of other Owners with similar scopes of work.

3. The maintenance and service of the equipment must be undertaken only by qualified personnel directly employed by the system supplier. Proper care, procedures, and tools must be used in handling, lifting, installing, operating, maintaining and repairing equipment to prevent personnel injury and or property damage.
4. The Long Term Services supplier shall be the same as the Uranium Removal System Supplier.

E. Treatment System Operation and Maintenance:
1. The system supplier shall maintain the treatment equipment in proper operating condition for the term of the contract.
2. The system supplier shall perform periodic inspection of the treatment system to detect early signs of deteriorating performance and to anticipate potential equipment failures.
3. The system supply shall perform periodic water analysis to monitor system performance as deemed necessary for proper operation of system.
4. The system supplier shall perform periodic media analysis to monitor system performance as deemed necessary for proper operation of system.
5. The Owner shall be responsible for the daily operation and monitoring of the URS.
6. The Owner shall perform all compliance tests as required by the State of Nebraska, and shall provide a copy of any test results to the system supplier upon receipt.

F. Media Services:
1. The system supplier shall be responsible for obtaining and maintaining any licenses specifically related to radioactive materials that may be required for the operation of the URS, and the handling and disposal of radioactive treatment residuals. The cost of any such license fees applicable to this specific treatment system shall be submitted to the Owner for payment.
2. At such time the treatment media becomes ineffective, and requires replacement, the system supplier shall be responsible for the removal, packaging, shipment and proper disposal of the spent media. Once the spent media is removed, it shall be replaced with new Uranium Removal Media, and placed back into service by the system supplier.
3. The spent media including all uranium loaded onto the media will become the property of the system supplier, which will be responsible for its proper removal and disposal.

G. Radiation Safety Services:
1. The URS supplier shall be responsible for obtaining and maintaining a radioactive materials license as required for the system operation and the handling and disposal of radioactive treatment residuals.
2. The URS supplier shall provide Radiation Safety Awareness Training for the Owner when the system begins operation.
    a. Annual refresher training shall be provided as required.
3. The URS supplier shall provide radiation exposure badges for treatment site, and will be responsible for the collection and maintenance of the exposure data for this site.
4. The URS supplier shall assign a qualified, on staff, Radiation Safety Officer for this project that will be accessible at all times.
5. After each media exchange, the system supplier shall survey the treatment site facility for contamination and decontaminate as needed.
6. After each media exchange, the system supplier shall provide documentation showing receipt and acceptance of the spent media by the disposal facility.

H. Decommissioning of Uranium Removal System:
1. Upon the expiration or termination of the Long Term Services Agreement, the system supplier will be responsible for decommissioning the system. This will include the removal and proper disposal of all treatment media, cleaning of the treatment equipment so as to comply with the licensing requirements for decommissioning the system. A radiological site survey will be completed by the system supplier as documentation that the decommissioning is complete.

I. Term of Contract:
1. The length of the Long Term Services Agreement shall be 10 years, commencing when the treatment system is placed into operation.

J. Payment:
   1. The services described in this section shall be priced on a cost per thousand gallons treated, for treatment of the minimum annual gallons specified above. The annual total cost will be invoiced in equal monthly installments.
   2. Additional gallons treated will be invoiced at the end of the calendar year at the same cost per thousand gallons.
   3. Reasonable adjustment to the cost for these services may be made on an annual basis. The amount of adjustment will be based upon the Inflation Index which will be calculated as the sum of 85 percent of the CPI-U and 15 percent of the CPT-TR. The U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index ("CPI") incorporates the following elements.
      a. All Urban Consumers ("CPI-U").
      b. Transportation Category (CPI-Tr").
      c. Not Seasonally Adjusted.
      d. U.S. City Average.
      e. All Items, Base Period: 1982 – 84 = 100.

K. Form of Agreement:
   1. The City's standard Contract Agreement will be used. The system supplier shall provide to the Owner a completed form of the System supplier's terms of agreement to be included in the contract agreement. The terms of agreement will be included in the Contract Agreement if acceptable to the City.

END OF SECTION

Table 1: City of Grand Island – Wells 6,7 and 8 - Historical Raw Water Quality

Parameter (Units)	Value	Parameter (Units)	Value
Uranium, ug/L	35.1	Gross Alpha, pCi/L	45
Alkalinity, mg/L as CaCO3	220	Radium 226+228, pCi/L	1.1
Barium, mg/L	0.101	Sulfate, mg/L	250
Iron (total), mg/L	0.147	Phosphorous, mg/L	0.679
Strontium, mg/L	0.6	Calcium, mg/L	240
Magnesium, mg/L	21.1	Manganese, mg/L	0.01
pH	7.67	Total Dissolved Solids, mg/L	600
NTU	1.7	Alkalinity, mg/L	220

1

DIVISION 15

MECHANICAL

2012/01/12

SECTION 15060
PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Process piping systems.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B16.3, Malleable Iron Threaded Fittings.
      b. B16.5, Pipe Flanges and Flanged Fittings.
      c. B40.100, Pressure Gauges and Gauge Attachments.
      d. B16.42, Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
   2. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
      d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      e. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
      f. A536, Standard Specification for Ductile Iron Castings.
      g. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
      h. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
      i. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
      j. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
      k. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
      l. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   3. American Water Works Association (AWWA):
      a. B300, Standard for Hypochlorites.
      b. B301, Standard for Liquid Chlorine.
      c. C200, Steel Water Pipe 6 IN and Larger.
      d. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.

e. C606, Standard for Grooved and Shouldered Joints.
f. C208, Dimensions for Fabricated Steel Water Pipe Fittings.
g. C651, Standard for Disinfecting Water Mains.

4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings for Water.
   b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
5. Chlorine Institute, Inc. (CI):
   a. Pamphlet 6, Piping Systems for Dry Chlorine.
6. Underwriters Laboratories, Inc. (UL).

B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Fabrication and/or layout drawings:
   a. Interior piping drawings (minimum scale 1/8 IN equals 1 FT) with information including:
      1) Dimensions of piping from column lines or wall surfaces.
      2) Invert dimensions of piping.
      3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
      4) Location and type of pipe supports and anchors.
      5) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
      6) Provisions for expansion and contraction.
   b. Schedule of interconnections to existing piping and method of connection.
   c. All dimensions will be field verified by the Contractor.
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   c. Separate schedule sheet for each piping system scheduled in this Section showing compliance of all system components.
      1) Attach technical product data on gaskets, pipe, fittings, and other components.

B. Miscellaneous Submittals:
1. Qualifications of lab performing disinfection analysis on water systems.
2. Test reports:
   a. Copies of pressure test results on all piping systems.
   b. Disinfection test report.
   c. Notification of time and date of piping pressure tests.

C. Operation and Maintenance Manuals:
1. See Section 01340 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.
   1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.
   1. Repair abrasions, scars, and blemishes.
   2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pipe saddles (for gage installation):
      a. Dresser Style 91 (steel and ductile iron systems).
      b. Dresser Style 194 (non-metallic systems).

2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Section.

2.3 COMPONENTS AND ACCESSORIES

A. Reducers:
   1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
   2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

B. Protective Coating and Lining:
   1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
   2. Field paint pipe in accordance with Section 09905.

PART 3 - EXECUTION

3.1 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 IN may not be shown; however, install according to Drawing intent and with clearance and allowance for:
   1. Expansion and contraction.
   2. Operation and access to equipment, doors, windows, hoists, moving equipment.
   3. Headroom and walking space for working areas and aisles.
   4. System drainage and air removal.

C. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

D. Pipe Support:
   1. Use methods of piping support as shown on Drawings.
   2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common pipe supports.
      a. The pipe in the group requiring the least maximum distance between supports shall set the distance between supports.

3. Size pipe supports with consideration to specific gravity of liquid being piped.

E. Locate and size sleeves and castings required for piping system.
   1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

F. Use reducing fittings throughout piping systems.
   1. Bushings will not be allowed unless specifically approved.

G. Equipment Drainage and Miscellaneous Piping:
   1. Provide drip pans and piping at equipment where condensation may occur.
   2. Hard pipe stuffing box leakage to nearest floor drain.
   3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
      a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
      b. Hard pipe drainage to nearest floor drain.
   4. Collect system condensate at drip pockets, traps and blowoff valves.
   5. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category in PART 1, provide 304 stainless steel piping and fittings.
      a. Size to handle application with 3/4 IN being minimum size provided.

H. Install expansion devices as necessary to allow expansion/contraction movement.

I. Provide full face gaskets on all systems.

J. Anchorage and Blocking:
   1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

K. Equipment Pipe Connections:
   1. Equipment - General:
      a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
      b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
      c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
         1) Provide tightening torque in accordance with manufacturer's recommendations.
      d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
      e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
      f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
      g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
      h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened.
         1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
         2) Realign as necessary, install flange bolts and make equipment connection.
      i. Provide utility connections to equipment shown on Drawings, scheduled or specified.

L. Provide insulating components where dissimilar metals are joined together.

M. Instrument Connections:
   1. See drawing details.

3.2 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in these Specifications.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.3 FIELD QUALITY CONTROL

A. Pipe Testing - General:
   1. Test piping systems as follows:
      a. Test exposed, non-insulated piping systems upon completion of system.
   2. Utilize pressures, media and pressure test durations as specified on Piping Specification Schedules.
   3. Isolate equipment which may be damaged by the specified pressure test conditions.
   4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
      a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
      b. Notify the Resident Project Representative 24 HRS prior to each test.
   5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
   6. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
   7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:
   1. Testing medium: Unless otherwise specified in the Piping Specification Schedules, utilize the following test media.
      a. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
All sizes	Pumped	125 psig	Water

   2. Allowable leakage rates:
      a. Hazardous gas systems, all exposed piping systems, all pressure piping systems and all buried, piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.
   3. Hydrostatic pressure testing methodology:
      a. General:
         1) All joints, including welds, are to be left exposed for examination during the test.

2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
3) Provide temporary restraints for expansion joints for additional pressure load under test.
4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
5) Do not paint or insulate exposed piping until successful performance of pressure test.

3.4 CLEANING, DISINFECTION AND PURGING

A. Cleaning:
1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
   a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
   b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
6. Clean chlorine piping in accordance with CI Pamphlet 6.

B. Disinfection of Potable Water Systems:
1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. See requirements for disinfection in Section 01733.

3.5 SCHEDULES

A. SPECIFICATION SCHEDULE:
1. General:
   a. Service:
      1) Inlet Piping: Raw Water.
      2) Outlet Piping: Treated Water.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 125 psig.
      3) Duration: 6 HRS.
   c. Gaskets:
      1) Flanged, push-on, and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
2. System components:
   a. Pipe size 3 IN through 24 IN:
      1) Exposed service:
         a) Material:
            (1) Flanged: Ductile iron, Class 53.
            (2) Flanged: Steel Water Pipe, AWWA C200.
         b) References: AWWA/ANSI C115/A21.15.

c) Lining: Cement.
d) Coating: Paint.
e) Fittings: (1) AWWA/ANSI C110/A21.10 ductile iron *or AWWA/ANSI C153/A21.53 ductile iron compact fittings*. (2) AWWA C208.
f) Joints: AWWA/ANSI C115/A21.15 flanged joints.

END OF SECTION

1

2011/12/19

SECTION 15061
PIPE: STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 09905 - Painting and Protective Coatings.
   4. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
      b. B1.2, Gages and Gaging for Unified Inch Screw Threads.
      c. B16.5, Pipe Flanges and Flanged Fittings.
      d. B16.9, Standard Specification for Welded Nickel and Nickel-Cobalt Alloy Pipe.
      e. Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   2. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A181, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
      d. A283, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
      e. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
      f. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      g. B6, Standard Specification for Zinc.
      h. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. American Water Works Association (AWWA):
      a. C200, Standard for Steel Water Pipe - 6 IN and Larger.
      b. C205, Standard for Cement-Mortar Lining and Coating for Steel Water Pipe - 4 IN and Larger - Shop Applied.
      c. C206, Standard for Field Welding of Steel Water Pipe.
      d. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN.
      e. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
      f. C606, Standard for Grooved and Shouldered Joints.
      g. M11, Steel Pipe - A Guide for Design and Installation.

B. Qualifications:
   1. Use only certified welders meeting procedures and performance outlined in ASME Section IX, AWWA C200 Section 3.3.3 and other codes and requirements per local building and utility requirements.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Section 15060.
   3. Factory test reports.
   4. If mechanical grooved type coupling system is used, submit piping, fittings, and appurtenant items which will be utilized.
   5. Coating manufacturer's qualifications.
   6. Welders certificates.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Flanged adaptors:
      a. Rockwell (Style 913 (steel)).
      b. Dresser (Style 128 (steel)).
   2. Transition coupling:
      a. Rockwell (Style 413).
      b. Dresser (Style 62).
   3. Compression sleeve coupling:
      a. Rockwell (Style 411 (steel)).
      b. Dresser (Style 38 (steel)).

2.2 MATERIALS

A. All materials used in steel piping systems defined in Section 15060 shall meet or exceed pressure test requirements specified for each respective system.

B. Steel Pipe (Fabricated Type):
   1. AWWA C200:
      a. ASTM A36, Grade C steel plate.
      b. ASTM A283, Grade D steel plate.
      c. ASTM A572, steel plate.
      d. ASTM A1011, steel sheet.

C. Steel Pipe (Mill Type): ASTM A53, Type E or S.

D. Fittings (For Fabricated Pipe): AWWA C208.

E. Flanges (Fabricated Pipe):
   1. Flange material: ASTM A283, Grade C or D, ASTM A181, Grade 1.
   2. Flange finish: Flat faced.

F. Flanges (Mill Type Pipe):
   1. ASME B16.5.
   2. Flat faced.
   3. Slip-on flanges.

G. Nuts and Bolts:
   1. Buried: Cadmium-plated meeting SAE AMS-QQ-P-416, Type 1, Class 2 (Cor-Ten) for buried application.
   2. Exposed: Mechanical galvanized ASTM B695, Class 40.
   3. Heads and dimensions per ASME B1.1.
   4. Threaded per ASME B1.1.
   5. Project ends 1/4 to 1/2 IN beyond nuts.

H. Gaskets: See individual piping systems in Section 15060.

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adaptors:
      a. Steel or carbon steel body sleeve, flange, followers and Grade 30 rubber gaskets.
      b. Provide units equal to those specified in Article 2.1.
      c. Flanges meeting standards of adjoining flanges.
      d. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.
   2. Compression sleeve coupling:
      a. Steel sleeve, followers Grade 30 and rubber gaskets.
      b. Provide units equal to those specified in Article 2.1.
      c. Flanges meeting standards of adjoining flanges.
      d. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.

2.4 FABRICATION

A. Provide piping (mill or fabricated) for use in this Project with minimum wall thicknesses as follows:
   1. 1/8 - 5 IN DIA pipe: Schedule 40.
   2. 6 - 10 IN DIA pipe: 3/16 IN.
   3. Sizes through 24 IN are nominal OD.
      a. Sizes greater than 24 are ID.
   4. Wall thicknesses indicated are for standard weight pipe.
      a. Design pipe in accordance with operating pressures shown in Piping Schedules for a design stress limited to 50 percent of yield.

B. Furnish cast parts with lacquer finish compatible with finish coating.

C. Furnish without outside coating of bituminous material any exposed pipe scheduled to be painted.

D. Fabricated Fittings:
   1. AWWA C208.
   2. Assure ratio of radius of bend to diameter of pipe equal to or greater than 1.0.

E. Taper cement mortar linings as required for valve interfacing.

F. Protective Coatings and Linings:
   1. Provide enamel linings and coatings in accordance with AWWA C203.
   2. Provide cement mortar lining in accordance with AWWA C205.
   3. Galvanize surface in accordance with hot dip method using any grade of zinc acceptable to ASTM B6.
   4. Field paint pipe in accordance with Section 09905.

2.5 SOURCE QUALITY CONTROL

A. Testing:
   1. Shop hydrostatic test fabricated steel pipe and fittings.
   2. Field hydrostatic test all pipe as specified in Section 15060.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Joining Methods - Flanges:
   1. Facing method:
      a. Insert slip-on flange on pipe.
      b. Assure maximum tolerances for flange faces from normal with respect to axis of pipe is 0.005 IN per foot of flange diameter.
      c. Test flanges after welding to pipe for true to face condition and reface, if necessary, to bring to specified tolerance.
   2. Joining method:
      a. Leave 1/8 to 3/8 IN of flange bolts projecting beyond face of nut after tightening.
      b. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, tank, and other interconnecting piping systems.
      c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.
         1) Allow one (1) flange free movement in any direction while bolts are being tightened.
      d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
      e. Gradually tighten flange bolts uniformly to permit even gasket compression.
      f. Do not overstress bolts to compensate for poor installation.

C. Joining Method - Welded Joints:
   1. Perform welding in accordance with AWWA C206 and this Section.
   2. For flange attachment perform in accordance with AWWA C207.
   3. Have each welding operator affix an assigned symbol to all his welds.
      a. Mark each longitudinal joint at the extent of each operator's welding.
      b. Mark each circumferential joint, nozzle, or other weld into places 180 degrees apart.
   4. Welding for all process piping shall conform with ASME B31.3.
      a. Welding of utility piping 125 psi and less shall be welded per ASME B31.9.
      b. Utility piping above 125 psi shall conform to ASME B31.1.
   5. Provide caps, tees, elbows, reducers, etc., manufactured for welded applications.
   6. Weldolets may be used for 5 IN and larger pipe provided all slag is removed from inside the pipe.
   7. Weld-in nozzles may be used for branch connections to mains and where approved by Engineer.
   8. Use all long radius welding elbows for expansion loops and bends.
   9. Use long radius reducing welding elbows 90 degree bends and size changes are required.

D. Joining Method - Couplings:
   1. Compression sleeve:
      a. Install coupling to allow space of not less than 1/4 IN but not more than 1 IN.
      b. Provide harnessed joint.
         1) Use joint harness arrangements detailed in AWWA M11.
      c. Design harness assembly with adequate number of tie rods for test pressures indicated in Section 15060 and allow for expansion of pipe.
      d. Provide ends to be joined or fitted with compression sleeve couplings of the plain end type.
      e. Grind smooth welds the length of one (1) coupling on either side of joint to be fitted with any coupling.

f. Assure that outside diameter and out-of-round tolerances are within limits required by coupling manufacturer.

2. Mechanical coupling:
   a. Arrange piping so that pipe ends are in full contact.
   b. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
   c. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Joining Method - Threaded and Coupled (T/C):
   1. Provide T/C end conditions that meet ASME B1.2 requirements.
   2. Furnish pipe with factory-made T/C ends.
   3. Field cut additional threads full and clean with sharp dies.
   4. Leave not more than three (3) pipe threads exposed at each branch connection.
   5. Ream ends of pipe after threading and before assembly to remove burrs.
   6. Use Teflon thread tape on male thread in mating joints.

F. Support exposed piping in accordance with Section 15060.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 15060.

END OF SECTION

1

2011/12/29

SECTION 15062
PIPE: DUCTILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile iron piping, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15060 - Pipe and Pipe Fittings: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
      b. B16.1, Cast Iron Pipe Flanges and Flanged Fittings - Classes 25, 125 and 250.
   2. ASTM International (ASTM):
      a. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. American Water Works Association (AWWA):
      a. C606, Standard for Grooved and Shouldered Joints.
   4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
      a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings for Water.
      b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
      c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
      d. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
      e. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
      f. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.
   5. Society of Automotive Engineers (SAE):
      a. AMS-QQ-P-416, Cadmium Plating - Electro-deposited.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Section 15060.
   3. Certification of factory hydrostatic testing.
   4. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents the following manufacturers are acceptable:
   1. Flanged adaptors:
      a. Rockwell (Style 912 (cast)).
      b. Dresser (Style 127 (cast)).
      c. Or approved equal.
   2. Compression sleeve coupling:
      a. Rockwell (Style 431 (cast)).
      b. Dresser (Style 153 (cast)).
      c. Or approved equal.
   3. Mechanical coupling:
      a. Victaulic (Style 31).
      b. Tyler.
      c. Or approved equal.
   4. Reducing couplings:
      a. Rockwell (Style 415).
      b. Dresser (Style 62).

2.2 MATERIALS

A. Ductile Iron Pipe:
   1. AWWA/ANSI C115/A21.15.
   2. AWWA/ANSI C150/A21.50.
   3. AWWA/ANSI C151/A21.51.

B. Fittings and Flanges:
   1. AWWA/ANSI C110/A21.10.
   2. AWWA/ANSI C115/A21.15.
   3. Flanges drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Nuts and Bolts:
   1. Exposed: Mechanical galvanized ASTM B695, Class 40.
   2. Heads and dimensions per ASME B1.1.
   3. Threaded per ASME B1.1.
   4. Project ends 1/4 to 1/2 IN beyond nuts.

D. Gaskets: See individual piping system requirements in Section 15060.

E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.

F. See Piping Schedules in Section 15060.

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adaptors:
      a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
      b. Provide units equal to those specified in Article 2.1.
      c. Supply flanges meeting standards of adjoining flanges.
      d. Rate entire assembly for test pressure specified on piping schedule for each respective application.
   2. Compression sleeve coupling:
      a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
      b. Provide units equal to those specified in Article 2.1.

c. Supply flanges meeting standards of adjoining flanges.
d. Entire assembly to be rated for test pressure specified on piping schedule for each respective application.

3. Mechanical couplings:
   a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 15060. Utilize units defined in Article 2.1.

2.4 FABRICATION

A. Furnish and install without outside coatings of bituminous material any exposed pipe scheduled to be painted.

B. Furnish cast parts with lacquer finish compatible with finish coat.

2.5 SOURCE QUALITY CONTROL

A. Factory Test:
   1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joining Method - Flanged Joints:
   1. Install in accordance with AWWA/ANSI C115/A21.15.
   2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
   3. Make flange faces flat and perpendicular to pipe centerline.
   4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
   5. Allow one (1) flange free movement in any direction while bolts are being tightened.
   6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
   7. Gradually tighten flange bolts uniformly to permit even gasket compression.

B. Joining Method - Mechanical Coupling Joint:
   1. Arrange piping so that pipe ends are in full contact.
   2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
   3. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

C. Flange Adaptors 12 IN and Less:
   1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
   2. Drill holes not more than 1/8 IN larger than diameter of stud projection.

D. Cutting:
   1. Do not damage interior lining material during cutting.
   2. Use abrasive wheel cutters or saws.
   3. Make square cuts.
   4. Bevel and free cut ends of sharp edges after cutting.

E. Support exposed pipe in accordance with Section 15060.

F. Install restrained joint systems where specified in Section 15060 under specific piping system.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 15060.

END OF SECTION

2012/01/12

SECTION 15605
HVAC: EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.
   4. Section 15890 - HVAC: Ductwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Air Movement and Control Association (AMCA).
   2. Air Conditioning and Refrigeration Institute (ARI).
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
      b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
      c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
   4. Canadian Standards Association (CSA).
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   7. National Roofing Contractors Association (NRCA).
   8. Underwriters Laboratories, Inc. (UL):
      a. 507, Standard for Electric Fans.
   9. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2009 Edition including all amendments, referred to herein as Building Code.

B. Miscellaneous:
   1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
   2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Fabrication and/or layout Drawings.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Wiring diagrams.
      d. Control diagrams.

e. Manufacturer's catalog cuts and technical data.
f. Corrosion-protection information.
g. Fan curves.
h. Sound data.
i. Vibration isolation.
j. Control description.
k. Performance data on all equipment.
4. Certifications:
a. Provide certification of thickness of corrosion-protection coating.

B. Operation and Maintenance Manuals:
1. See Specification Section 01340 for requirements for:
a. The mechanics and administration of the submittal process.
b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Vibration isolation assemblies:
a. Mason.
b. Vibration Mounting and Controls Co.
2. Roof-mounted centrifugal exhaust fans:
a. Loren Cook.
b. Greenheck.
c. Penn Ventilator Co., Inc.

B. All Manufactured Units:
1. Comply with Specification Section 11005.
2. Factory wired and assembled.
3. Use fasteners made of same material as unit.
4. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook 2011.

C. Indicated manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.
1. Type:
a. Corrosion-resistant materials:
1) Aluminum.
2) Stainless steel.
3) FRP.
b. Corrosion-resistant coating:
1) Phenolic-based coating:
2) 3 mil minimum dry thickness, air-dried coating, for surfaces exposed to temperatures less than 150 DegF.
3) 5 mil baked-on coating for heat transfer surfaces and surfaces exposed to temperatures greater than 150 DegF.
4) Factory applied.
5) Provide factory certification of application.

2.2 MANUFACTURED UNITS

A. Roof-Mounted Centrifugal Exhaust Fans:
1. AMCA certified.

2. Non-overloading horsepower capability.
3. Materials:
    a. Top cap: Spun aluminum.
    b. Wheel and inlet shroud: Aluminum.
    c. Baffle: Aluminum.
    d. Base: One-piece aluminum.
    e. Drive assembly supports: Steel.
    f. Drive shaft: Solid stainless steel.
4. Backward inclined blades.
5. Tapered inlet shroud.
6. Statically and dynamically balanced wheel.
7. Bearings:
    a. Permanently sealed, flange type, ball-bearings.
    b. Five-to-one load capability to actual load ratio.
    c. 200,000 HR average life.
8. Weathertight compartment for motor and drives.
    a. Separated from airstream.
9. Motor:
    a. See Specification Section 11005.
    b. Driver and driven sheaves:
        1) Keyed hub type.
        2) Drive sheaves: Fixed pitch diameter.
        3) Driver:
            a) Shipped with variable pitch diameter sheave.
            b) Fixed pitch diameter size based on approved test and balance reports.
        4) V-belt drives sized for 150 percent motor horsepower.
10. Vibration isolated drive assembly.
11. Accessories:
    a. Prefabricated insulated aluminum roof curb.
    b. Backdraft damper: Provided by manufacturer. See Specification Section 15890.
    c. Bird screen.
12. Size and capacity as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 ADJUSTING

A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

1

2012/01/12

SECTION 15890
HVAC: DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: HVAC ductwork and accessories.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. DAF 45, Designation System for Aluminum Finishes.
   2. American Architectural Manufacturers Association (AAMA):
      a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for Removing Particulate Matter.
   4. ASTM International (ASTM):
      a. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. National Fire Protection Association (NFPA).
   6. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      a. Ducted Electric Heat Guide for Air Handling Systems.
      b. HVAC Duct Construction Standards - Metal and Flexible.
   7. Underwriters Laboratory, Inc. (UL):
      a. 555, Standard for Safety Fire Damper and Ceiling Fire Damper.
      b. 555S, Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems.
      c. Building Materials Directory.
   8. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2009 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
   1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size required, whose products have been in use in similar service for not less than three (3) years.
   2. Installers: Firm with at least five (5) years installation experience on products similar to that required for this Project.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. See Specification Section 11005.
   3. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
   4. Scaled ductwork Drawings (1/4 IN equals 1 FT) showing duct and accessory layout and support.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittal:
   1. Documentation of qualifications for fabricators and installers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Backdraft dampers:
      a. Air Balance.
      b. Ruskin.
      c. American Warming.
   2. Air filters:
      a. American Air Filter.
      b. Farr.
      c. Continental.
   3. Temperature control and automatic dampers:
      a. Air Balance.
      b. Ruskin.
      c. American Warming.
   4. Louvers:
      a. Ruskin.
      b. Air Balance.
      c. American Warming.

2.2 COMPONENTS

A. Air Filter Enclosure:
   1. Holding frame:
      a. Galvanized steel.
      b. Multiple fastener lances.
      c. Polyurethane foam gasket.
         1) Internally.
         2) Frame sides.
      d. Accommodate nominal 24 x 24 IN or 12 x 24 IN filters without modifications to frame or housing.

B. Air Filters:
   1. Materials:
      a. Holding frame: Aluminum.

2. Fabrication:
    a. Factory built and assembled unit.
    b. Efficiency rating as per ASHRAE 52.
    c. 2 IN thickness minimum.
    d. Efficiency: 20 percent.
    e. Air velocity: 450 FPM maximum.
    f. Clean pressure drop: 0.2 IN WG maximum.
    g. Size, capacity, and type: As indicated on Drawings.

C. Temperature Control, Automatic and Manually (Volume) Operated Dampers:
1. Material:
    a. Body: 6063 T5 aluminum.
    b. Seal blade edge: Extruded vinyl.
2. Fabrication:
    a. Frame thickness: 0.125 IN minimum.
    b. Blades:
        1) Two-position damper: Parallel blade.
        2) Airfoil shape.
        3) Maximum 6 IN width.
    c. Linkage: Concealed in frame.
    d. Axles: 1/2 IN plated steel hex.
    e. Bearings: Molded synthetic.
    f. Seals:
        1) Jamb: Flexible compression type.
    g. Control shaft: Removable, 1/2 IN DIA.
    h. Air leakage (4 FT SQ damper) at 4 IN WG pressure: 99 cfm maximum.
    i. Motors for motor operated damper: See Specification Section 15970.
    j. Provide outboard support for operator linkage where damper motor is to be installed outside of duct.
    k. Provide stainless steel locking quadrants for manual (volume) dampers.
    l. Provide fold out operator mounting bracket where damper motor is to be installed on face of damper or inside duct.
    m. Finish: 215 R1 anodized.

D. Louvers:
1. Stormproof.
2. Continuous blade appearance.
3. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.125 IN thick.
4. Minimum free area: As scheduled.
5. Maximum pressure drop: 0.10 IN of water at 900 fpm at zero water penetration.
6. Bird screen:
    a. 1/2 IN SQ mesh.
    b. 16 GA aluminum.
    c. Install in standard, folded frame.
7. Anchors, fasteners, reinforcing: Aluminum or stainless steel.
8. Finish:
    a. AAMA 2605.
    b. AA-M10C22A42 dark bronze anodized finish.

2.3 MAINTENANCE MATERIALS

A. Extra Materials:
1. Furnish Owner with the following extra materials:
    a. Twelve complete filter media changes for each filter unit.
    b. Filter media used during construction is in addition to this requirement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 11005.

B. Metal Ductwork:
   1. Install with longitudinal seams sealed for zero leakage.
      a. Welded seams may be used upon acceptance of welded seam samples by Engineer.
   2. Install flexible connections at fans:
      a. Locate as close as possible to fan.
      b. Allow 1 IN of slack to prevent vibration transmission.
      c. Install thrust restraints across connectors.
   3. Install access doors where indicated on Drawings and at smoke and fire damper in accordance with NFPA requirements.

C. Dampers:
   1. Install where indicated on Drawings of sizes shown.
   2. Install fire and smoke dampers in ductwork passing through 1 HR or higher fire-rated construction.
      a. Install in wall and floor openings utilizing steel sleeves, angles and other materials following practices required to provide installation in accordance with local Building Codes.

D. Air Filters:
   1. Install where shown on Drawings of size and capacity scheduled on Drawings.
   2. Do not operate equipment during construction without filters.

END OF SECTION

2012/01/12

SECTION 15970
INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Instrumentation and control for HVAC systems.
2. Temperature control.
3. Ventilation control.
4. Cooling control.
5. Control wiring.
6. Panels and accessories.
7. Miscellaneous.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 11005 - Equipment: Basic Requirements.
4. Section 15605 - HVAC: Equipment.
5. Section 15890 - HVAC: Ductwork.
6. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. ASTM International (ASTM):
a. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
2. Instrumentation, Systems, and Automation Society (ISA):
a. S5.1, Instrumentation Symbols and Identification.
b. S5.4, Standard Instrument Loop Diagrams.
3. National Electrical Manufacturers Association (NEMA):
a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
4. National Fire Protection Association (NFPA):
a. 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL).

B. Miscellaneous:
1. Controls to be in compliance with Specification Section 16010 for NEMA and NFPA 70 enclosure class requirements unless noted or specified otherwise.
2. Unless specifically noted otherwise, components of systems shall be industrial duty suitable for moist, corrosive environments.

1.3 SYSTEM DESCRIPTION

A. Work shall be provided as an integrated operating system.

B. Provide a complete system of automatic temperature control, thermostats, relays, valves, damper operators and other associated controls and appurtenances required to maintain minimum conditions described in detail herein and on Drawings, together with thermometers, gages and other accessory equipment.
1. Assemble control system with complete system of wiring and air piping to fulfill requirements of the Contract Documents.

C. Install system using competent mechanics under direct supervision of control manufacturer.

D. Controls, as set out in "Sequence of Operation," are designed to illustrate operating functions only.
   1. Control sequence shall be considered supplementary to "Sequence of Operation."
   2. These minimum specified items, and any additional controls, not indicated but required to meet performance as outlined in the Contract Documents, shall be furnished and installed at no additional cost to Owner to make a complete system.

E. Sequence of Operation - General:
   1. Sequence of operation indicated illustrates basic operating functions only.
   2. Contractor shall review Drawings and submit complete installation data, including minor details, to provide proper operation in his proposal.
   3. Where an item differs from specifications, control manufacturer shall submit manufacturer's recommendations subject to Engineer's approval.

F. Sequence of Operation - Equipment specific:
   1. Process Building:
      a. Exhaust Fan (EF-01):
         1) Circuited from panel.
         2) Controlled by HAND-OFF-AUTO switch located by thermostat.
            a) “HAND”: Fan is “ON”.
            b) “OFF”: Fan is “OFF”.
            c) “AUTO”: Fan is controlled from end switch on MOD-01.
               (1) MOD-01 is proved open: Fan is “ON”.
               (2) MOD-01 is not proved open: Fan is “OFF”.
      b. Motor-operated damper (MOD-01):
         1) Circuited from panel.
         2) Controlled by HAND-OFF-AUTO switch located by thermostat:
            a) “HAND”: Damper is open.
            b) “OFF”: Damper is closed.
            c) “AUTO”: Damper shall be controlled by thermostat .
               (1) Room temperature above thermostat setpoint 85 deg F (adjustable): Exhaust fan is “ON” and dampers open.
               (2) Room temperature below setpoint: Exhaust fan is “OFF” and damper is closed.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Wiring diagrams showing point to point termination with auxiliary interlocks for each item in each control loop.
   3. Information on equipment proposed for use including corrosion protection.

B. Quality Control Submittals:
   1. Secure from equipment manufacturers, detailed and complete control and power wiring diagrams, word descriptions of controls provided as part of the HVAC equipment or equipment interfaced or interlocked thereto, and submit with equipment manufacturer's submittals.
      a. Provide the above information to control manufacturer.

C. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.5 SITE CONDITIONS

A. Unless stated otherwise, the environment and air streams will include varying concentrations of the following chemical components:
   1. Condensation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Manufacturer's catalog numbers hereinafter are for reference to type, style, dimension, related items and to establish a standard of quality.
      a. Reference to a manufacturer's number hereinafter does not imply full compliance to these Specifications.
   2. Instrumentation and control systems:
      a. Honeywell.
      b. Johnson Control Co.

2.2 EQUIPMENT

A. Dampers:
   1. Refer to Specification Section 15890.

B. Damper Operators:
   1. Provide operators of proper size and number to secure true throttling or two-position action as required.
   2. Furnish damper operators for installation inside ductwork and attached to frame of damper, or installed outside ductwork and connected to extended shaft as required.
   3. Provide operators for outside air, spring-loaded with sufficient power to assure tight closing of dampers on fan shutdown or in the fail safe position indicated by "Sequence of Controls."
   4. Provide pneumatic operators with aluminum bodies and stainless steel shafts, low friction non-corrosive shaft bearings, piston-type operators with rolling type neoprene diaphragm, and universal mounting bracket.
   5. Electric operators:
      a. Provide operators:
         1) Fully immersed in oil gear train.
         2) Enclosed in closed cast aluminum housing.
      b. As an alternate to 5.a.: Provide operators in NEMA 4X enclosure, Belimo ZS-300.
      c. Provide damper operators with integral spring return motor springs to make controls fail safe in position specified under "Sequence of Controls."
      d. Provide fully modulating operators from proportional electric controllers.
      e. Provide end switches or proportioning controllers permitting simultaneous operation or interlocking with other equipment.
      f. Provide separate electrical circuits for damper operators with no more than four (4) operators on a circuit.
   6. Coordinate with dampers provided:
      a. Provide damper operators that are rated for the required torque.
      b. If single damper operator can not meet torque requirement, provide sectional dampers to match operator torque.
   7. Provide pneumatic operators wherever a pneumatic source can be provided.
      a. Provide for conversion of electric signals for control of pneumatic operators.
   8. Use of electric operators shall be limited to small dampers in those applications where it is impractical to provide pneumatic operators and are to be approved by the Engineer.

9. Ensure coordination to provide for the installation of tight closing dampers low leakage type (6 cfm per square foot at 4 IN WC pressure across damper) with compatible dampers, damper operators and related controls.

C. Electric Control Instruments:
   1. Thermostat:
      a. Line voltage.
      b. External tin-plated sensing element.
      c. Minimum 3.5 DegF differential.
      d. Single stage.
         1) Snap switch.
         2) 1 HP rating.
      e. Range: 35 to 100 DegF.
      f. External setpoint adjustment.
      g. Unit illustrated.
         1) Honeywell, Model T631F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Division 16.

B. Connect control devices to perform functions indicated and perform in required sequence.

C. In general, locate thermostats for room control immediately inside door, above light switch, unless shown otherwise.
   1. Where light switch is in an entryway to room, locate thermostat on wall within room so it is capable of sensing true space conditions.
   2. Prior to installation, coordinate thermostat location with Engineer.

END OF SECTION

DIVISION 16

ELECTRICAL

2011/08/26

SECTION 16010
ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ETL Testing Laboratories (ETL).
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL).

B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
   2. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
   3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of submittal process.
   2. See individual specification sections for submittal requirements for products defined as equipment.
   3. General requirements:
      a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.

b. Include data sheets that include manufacturer's name and product model number.
   1) Clearly identify all optional accessories.
c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
d. Manufacturer's delivery, storage, handling and installation instructions.
e. Product installation details.
f. See individual specification sections for any additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. As required by manufacturer.

B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
   1. Outdoor areas:
      a. Wet.
   2. Indoor areas:
      a. Dry, except 6 IN above floor and under process piping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Division 16 Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
   1. Approved manufacturers:
      a. Modular strut:
         1) Unistrut Building Systems.
         2) B-Line.
         3) Globe Strut.
   2. Material requirements:
      a. Modular strut:
         1) Galvanized steel: ASTM A123 or ASTM A153.
      b. Mounting hardware:
         1) Galvanized steel.

B. Field touch-up of galvanized surfaces.
   1. Zinc-rich primer.
      a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
   1. NFPA 70.
   2. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.
   1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
   2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:
   1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
   2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
   3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
   4. See Specification Section 16120 for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.

I. Device Mounting Schedule:
   1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
      a. Light switch (to center): 48 IN.
      b. Receptacle on exterior wall of building (to center): 18 IN.
      c. Receptacle in non-architecturally finished areas (to center): 48 IN.
      d. Safety switch (to center of operating handle): 54 IN.
      e. Separately mounted motor starter (to center of operating handle): 54 IN.
      f. Pushbutton or selector switch control station (to center): 48 IN.
      g. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.

K. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   2. Wet areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. Do not cut, or weld to, building structural members.
   2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Do not use materials that may cause the walls or roof of a building to discolor or rust.

3.2 FIELD QUALITY CONTROL

A. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair surfaces which will be inaccessible after installation prior to installation.
   4. See Specification Section 16130 for requirements for conduits and associated accessories.

END OF SECTION

2011/08/31

SECTION 16060
GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding system(s).

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16120 - Wire and Cable - 600 Volt and Below.
   5. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
         1) Article 250, Grounding and Bonding.
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
         1) Grounding clamps, terminals and connectors.
         2) Exothermic welding system.
      b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. Burndy.
      b. Harger Lightning Protection.

c. Heary Brothers.
d. Joslyn.
e. Robbins Lightning Protection.
f. Thomas & Betts (Blackburn).
g. Thompson.

2. Exothermic weld connections:
a. Erico Products Inc., Cadweld.
b. Harger Lightning Protection.
c. Thermoweld.

2.2 COMPONENTS

A. Wire and Cable:
1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
2. Insulated conductors: Color coded green, per Specification Section 16120.

B. Conduit: As specified in Specification Section 16130.

C. Ground Bars:
1. Solid copper:
a. 1/4 IN thick.
b. 2 or 4 IN wide.
c. 12 IN long minimum in main service entrance electrical rooms.
2. Predrilled grounding lug mounting holes.
3. Stainless steel or galvanized steel mounting brackets.
4. Insulated standoffs.

D. Ground Rods:
1. 3/4 IN x 10 FT.
2. Copperclad:
a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
b. Corrosion resistant bond between the copper and steel.
c. Hard drawn for a scar-resistant surface.

E. Grounding Clamps, Connectors and Terminals:
1. Mechanical type:
a. Standards: UL 467.
b. High copper alloy content.
2. Compression type for interior locations:
a. Standards: UL 467.
b. High copper alloy content.
c. Non-reversible.
d. Terminals for connection to bus bars shall have two bolt holes.
3. Compression type suitable for direct burial in earth or concrete:
a. Standards: UL 467, IEEE 837.
b. High copper alloy content.
c. Non-reversible.

F. Exothermic Weld Connections:
1. Copper oxide reduction by aluminum process.
2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.

2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves.
5. Do not splice grounding conductors except at ground rods.
6. Install ground rods and grounding conductors in undisturbed, firm soil.
    a. Provide excavation required for installation of ground rods and ground conductors.
    b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
    c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors or exothermic weld.
    d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
    e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:
1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
2. Grounding conductor terminations:
    a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
    b. Piping systems use mechanical type connections.
    c. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
3. Single ground rod grounding system:
    a. Single ground rod system consists of a single ground rod.
    b. Place ground rod a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
    c. Grounding conductor: Bare conductor, sized as indicated on the Drawings.

C. Raceway Bonding/Grounding:
1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

END OF SECTION

1

2012/01/04

SECTION 16120
WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Building wire.
      b. Control cable.
      c. Instrumentation cable.
      d. Wire connectors.
      e. Insulating tape.
      f. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
      a. WC 57/S-73-532, Standard for Control Cables.
      b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
      b. 467, Standard for Safety Grounding and Bonding Equipment.
      c. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
      d. 486C, Standard for Safety Splicing Wire Connections.
      e. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      f. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
      g. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
      h. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. The following are specific types of instrumentation cables:
      a. Analog signal cable:
         1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller conductors.

2) Commonly used types are defined in the following:
a) UTP: Unshielded twisted pair.
b) TSP: Twisted shielded pair.
c) TST: Twisted shielded triad.

C. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

D. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data:
a. Provide submittal data for all products specified in Part 2 of this specification except:
1) Wire connectors.
2) Insulating tape.
3) Cable lubricant.
b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Building wire and control cable:
a. American Insulated Wire Corporation.
b. General Cable.
c. Manhattan/CDT.
d. Southwire Company.
2. Instrumentation cable:
a. Analog cable:
1) Alpha Wire Corporation.
2) American Insulated Wire Corporation.
3) Belden CDT Inc.
4) General Cable.
5) Manhattan/CDT.
3. Wire connectors:
a. Burndy Corporation.
b. Buchanan.
c. Ideal.
d. Ilsco.
e. 3M Co.
f. Teledyne Penn Union.
g. Thomas and Betts.
h. Phoenix Contact.
4. Insulating and color coding tape:
a. 3M Co.
b. Plymouth Bishop Tapes.
c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

A. Building Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
   3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.

B. Control Cable:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
   4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
      a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
   5. Individual conductor color coding:
      a. NEMA/ICEA Method 1, Table E-2.
      b. See Part 3 of this Specification for additional requirements.
   6. Conform to NFPA 70 Type TC.

C. Instrumentation Cable:
   1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   2. Analog cable:
      a. Tinned copper conductors.
      b. 300 V or 600 V PVC insulation with PVC jacket.
      c. Twisted with 100 percent foil shield coverage with drain wire.
      d. Six (6) twists per foot minimum.
      e. When direct buried, UL listed and marked as suitable for direct bury.
      f. When exposed to sunlight, UL listed and marked as sunlight resistant.
      g. Individual conductor color coding: ICEA Method 1, Table K-2.
      h. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
      i. Basis of design: Belden 9316 or 9342.

D. Wire Connectors:
   1. Twist/screw on type:
      a. Insulated pressure or spring type solderless connector.
      b. 600 V rated.
      c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
      d. Phase and neutral conductors: Conform to UL 486C.
   2. Compression and mechanical screw type:
      a. 600 V rated.
      b. Ground conductors: Conform to UL 467.
      c. Phase and neutral conductors: Conform to UL 486A.

E. Insulating and Color Coding Tape:
   1. Pressure sensitive vinyl.
   2. Premium grade.
   3. Heat, cold, moisture, and sunlight resistant.
   4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.

5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
   a. Insulating tape: Black.
   b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

F. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:
   1. Type THHN/THWN and THHN/THWN-2:
      a. Building wire and control cable in non-architectural finished areas.

B. Conductor Size Limitations:
   1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
   2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:
   1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

      a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
      b. Conductors larger than No. 6 AWG:
         1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
            a) Continuous colored outer finish along its entire length.
            b) 3 IN of colored tape applied at the termination.
         2) Insulated grounding conductor shall be identified by one (1) of the following methods:
            a) Continuous green outer finish along its entire length.
            b) Stripping the insulation from the entire exposed length.
            c) Using green tape to cover the entire exposed length.
         3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
   2. Control cables NEMA/ICEA Method 1, Table E-2:
      a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
      b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
   1. Where specifically indicated on the Drawings.
   2. Where field conditions dictate and written permission is obtained from the Engineer.
   3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
   4. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
      a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
         1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
         2) The neutral conductors may not be shared.
         3) Up sizing raceway size for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
   1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
   1. Feeder and branch power circuits:
      a. Device outlet boxes:
         1) Twist/screw on type connectors.
      b. Junction and pull boxes and wireways:
         1) Twist/screw on type connectors for use on No. 8 and smaller wire.
         2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
      c. Motor terminal boxes:
         1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
         2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
   2. Control circuits:
      a. Junction and pull boxes: Terminal block type connector.
      b. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.

H. Insulating Tape Usage:
   1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
   2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
   3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

I. Color Coding Tape Usage: For color coding of conductors.

END OF SECTION

1

2012/01/12

SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Outlet boxes.
      e. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      c. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C80.3, Steel Electrical Metallic Tubing (EMT).
      b. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      b. 360, Standard for Liquid-Tight Flexible Steel Conduit.
      c. 467, Grounding and Bonding Equipment.
      d. 514A, Metallic Outlet Boxes.
      e. 514B, Conduit, Tubing, and Cable Fittings.
      f. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
      g. 797, Electrical Metallic Tubing - Steel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Rigid non-metallic conduit:
      a. Carlon.
      b. Cantex.
      c. Osburn Associates.
   2. Flexible conduit:
      a. AFC Cable Systems.
      b. Anamet, Inc.
      c. Electri-Flex.
      d. Flexible Metal Hose Company.
      e. International Metal Hose Company.
      f. Triangle PWC Inc.
      g. LTV Steel Company.
   3. Conduit fittings and accessories:
      a. Appleton.
      b. Carlon.
      c. Cantex.
      d. Crouse-Hinds.
      e. Killark.
      f. Osburn Associates.
      g. OZ Gedney Company.
      h. RACO.
      i. Steel City.
      j. Thomas and Betts.
   4. Support systems:
      a. Unistrut Building Systems.
      b. B-Line Systems Inc.
      c. Kindorf.
      d. Minerallac Fastening Systems.
      e. Caddy.
   5. Outlet, pull and junction boxes:
      a. Appleton Electric Co.
      b. Crouse-Hinds.
      c. Killark.
      d. O-Z/Gedney.
      e. Steel City.
      f. Raco.
      g. Bell.
      h. Hoffman Engineering Co.
      i. Wiegmann.
      j. B-Line Circle AW.
      k. Adalet.
      l. Rittal.

2.2 RIGID METALLIC CONDUITS

A. Electrical Metallic Tubing (EMT):
   1. Mild steel with continuous welded seam.
   2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
   3. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
   4. Standards: NEMA/ANSI C80.3, UL 797.

2.3 RIGID NON-METALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
   1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
   2. Rated for direct sunlight exposure.
   3. Fire retardant and low smoke emission.
   4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
   5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
   1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
   2. Extruded PVC outer jacket positively locked to the steel core.
   3. Liquid and vaportight.
   4. Standard: UL 360.

2.5 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with EMT:
   1. Connectors:
      a. Straight, angle and offset types furnished with locknuts.
      b. Zinc plated steel.
      c. Insulated gland compression type.
      d. Concrete and raintight.
   2. Couplings:
      a. Zinc plated steel.
      b. Gland compression type.
      c. Concrete and raintight.
   3. Conduit bodies (ells and tees):
      a. Body: Copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. Cover:
         1) Screw down type with steel screws.
         2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
   4. Standard: UL 514B.

B. Fittings for Use with FLEX-LT:
   1. Connector:
      a. Straight or angle type.
      b. Metal construction, insulated and gasketed.
      c. Composed of locknut, grounding ferrule and gland compression nut.
      d. Liquid tight.
   2. Standards: UL 467, UL 514B.

C. Fittings for Use with Rigid Non-Metallic PVC Conduit:
   1. Coupling, adapters and conduit bodies:
      a. Same material, thickness, and construction as the conduits with which they are used.
      b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
      c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
   2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
   3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

2.6 ALL RACEWAY AND FITTINGS

A. Mark Products:
   1. Identify the nominal trade size on the product.
   2. Stamp with the name or trademark of the manufacturer.

2.7 OUTLET BOXES

A. Metallic Outlet Boxes:
   1. Hot-dip galvanized steel.
   2. Conduit knockouts and grounding pigtail.
   3. Styles:
      a. 2 IN x 3 IN rectangle.
      b. 4 IN square.
      c. 4 IN octagon.
   4. Accessories:
      a. Flat blank cover plates.
      b. Barriers.
      c. Box supporting brackets in stud walls.
      d. Adjustable bar hangers.
   5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:
   1. Zinc plated cast iron or die-cast copper free aluminum with manufacturers standard finish.
   2. Threaded hubs and grounding screw.
   3. Styles:
      a. "FS" or "FD".
      b. "Bell".
      c. Single or multiple gang and tandem.
   4. Standards: UL 514A.

2.8 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:
   1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. With or without concentric knockouts on four (4) sides.
   3. Flat cover fastened with screws.

B. NEMA 4 Rated:
   1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
   6. Cover with oil resistant gasket.

C. Standards: NEMA 250, UL 50.

2.9 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.
      a. Galvanized steel: ASTM A123 or ASTM A153.

B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Zinc plated steel.
      b. Stainless steel.

c. Malleable iron.
d. Steel protected with zinc phosphate and oil finish.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
1. NFPA 70.
2. Manufacturer instructions.

B. Size of Raceways:
1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
2. Unless specifically indicated otherwise, the minimum raceway size shall be:
a. Conduit: 3/4 IN.

C. Field Bending and Cutting of Conduits:
1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
2. Do not reduce the internal diameter of the conduit when making conduit bends.
3. Debur interior and exterior after cutting.

D. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair surfaces which will be inaccessible after installation prior to installation.

E. Remove moisture and debris from conduit before wire is pulled into place.
1. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

F. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

G. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
2. Run in straight lines parallel to or at right angles to building lines.
3. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
4. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All rigid conduits within a structure shall be installed exposed except as follows:
1. As indicated on the Drawings.
2. Buried under floor slabs where shown on the Contract Drawings or with the Engineer's permission.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
1. Between instrumentation and 600 V and less AC power or control: 6 IN.
2. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.
   1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
   1. Power wire or cables: All raceway types.
   2. Control wire or cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
   1. Dry areas:
      a. EMT.
   2. Wet areas:
      a. EMT.

C. Permitted Raceway Types Per Routing Locations:
   1. Beneath floor slab-on-grade:
      a. PVC-80.
   2. Through floor penetrations:
      a. PVC-80.
   3. Direct buried conduits and ductbanks:
      a. PVC-80.

D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
   1. The maximum length shall not exceed:
      a. 6 FT to light fixtures.
      b. 3 FT to motors.
      c. 2 FT to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.
   1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

B. Terminate Conduits:
   1. In metallic outlet boxes:
      a. EMT: Compression type connector and locknut.
   2. In NEMA 1 rated enclosures:
      a. EMT: Compression type connector and locknut.
   3. In NEMA 12 rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.
      b. Use grounding type locknut or bushing when required by NFPA 70.
   4. In NEMA 4 rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
   1. Dry or wet areas:
      a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. Dry or wet areas:
      a. Material: Zinc plated steel, stainless steel and malleable iron.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. See Specification Section 16010 and the Drawings for area classifications.
   3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
   4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
   1. Permitted uses of metallic outlet boxes:
      a. Pull or junction box:
         1) Above 10 FT in dry non-architecturally finished areas.
   2. Permitted uses of cast outlet boxes:
      a. Housing of wiring devices surface mounted in non-architecturally finished dry or wet areas.
      b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
   3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 16010.
   4. Set device outlet boxes plumb and vertical to the floor.

C. Pull and Junction Boxes:
   1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
      a. Make covers of boxes accessible.
   2. Permitted uses of NEMA 1 enclosure:
      a. Pull or junction box surface mounted in areas designated as dry in non-architecturally finished areas.
   3. Permitted uses of NEMA 4 enclosure:
      a. Pull or junction box surface mounted in areas designated as wet.

END OF SECTION

1

2012/01/12

SECTION 16220
MOTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Induction motors.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.
   4. Section 16060 - Grounding.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. National Electrical Manufacturers Association (NEMA):
      a. MG 1, Motors and Generators.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).

B. Miscellaneous:
   1. When motors are furnished with driven equipment, the driven equipment supplier shall be responsible for assembling the motor and driven equipment as a complete unit, correctly aligned and coupled with the coupling or sheave specified on the driven equipment data sheet, and designing for vibration, special, or unbalanced forces resulting from equipment operation.
      a. See Specification Section 11005 for requirements.
   2. Variable speed equipment applications: The driven equipment manufacturer shall have single source responsibility for coordination of the equipment and VFD system and sure their compatibility.

1.3 DEFINITIONS

A. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.

B. Abbreviations:
   1. DPFG - Dripproof Fully Guarded.
   2. ODP - Open Dripproof.
   3. RTD - Resistance Temperature Detector.
   4. TEFC - Totally Enclosed Fan Cooled.
   5. TENV - Totally Enclosed Non-ventilated.
   6. WP-I - Weather Protected Type I.
   7. WP-II - Weather Protected Type II.
   8. Motor controllers:
      a. FVNR - Full Voltage Non-Reversing.
      b. RVAT - Reduced Voltage Autotransformer.
      c. RVPR - Reduced Voltage Primary Reactor.
      d. RVSS - Reduced Voltage Solid State.
      e. VFD - Variable Frequency Drive.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Identify each motor by driven machine identification.
      b. Motor manufacturer and model number.
      c. Complete motor nameplate data.
      d. Weight.
      e. NEMA design type.
      f. Enclosure type.
      g. Frame size.
      h. Winding insulation class and temperature rise.
      i. Starts per hour.
      j. Performance data:
         1) Guaranteed minimum efficiencies at 100 percent, 75 percent and 50 percent of full load.
         2) Guaranteed minimum power factor at 100 percent, 75 percent and 50 percent of full load.
         3) Locked rotor and full load current at rated terminal voltage and minimum permissible or specified terminal voltage.
         4) Starting, full load and breakdown torque at rated terminal voltage and minimum permissible or specified terminal voltage.
      k. Bearing data and lubrication system.
      l. Thermal protection system including recommended alarm and trip settings.
   3. Fabrication and/or layout drawings:
      a. Dimensioned outline Drawing.
      b. Connection diagrams including accessories (strip heaters, thermal protection, etc.).
   4. Certifications:
      a. When utilized with a reduced voltage starter, certify that motor and driven equipment are compatible.
   5. Test reports:
      a. Motor test reports for all testing required in this Specification Section.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.
   2. Installation instructions.
   3. Operation and maintenance instructions.
   4. Recommended spare parts list.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 01600.

B. Protect equipment during shipment, handling, and storage by suitable boxes, crates, or other complete enclosures.
   1. Protect equipment from exposure to elements and keep thoroughly dry.

C. Protect painted surfaces against impact, abrasion, discoloration, and other damage.
   1. Repaint damaged painted surfaces to satisfaction of Engineer.

D. Store all motors in a clean and dry indoor location until final installation.

E. Where space heaters are provided in motors, provide temporary electrical power and operate heaters during storage and after motors are installed in permanent location until equipment is placed in service.

F. For storage longer than one (1) month, see manufacturers storage instructions.

1.6 SITE CONDITIONS

A. Ambient air temperature: 110 DegF.

B. Altitude: 1200 FT above sea level.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Baldor.
   2. General Electric.
   3. Marathon.
   4. Rockwell - Reliance.
   5. Siemens.
   6. TECO-Westinghouse.
   7. Toshiba U.S.
   8. U.S. Electrical Motors.
   9. WEG.

2.2 EQUIPMENT

A. General Requirements:
   1. Standards: NEMA MG 1.
   2. Identify each motor by the driven machine identification.
   3. An embossed or engraved stainless steel nameplate, with the required NFPA 70 and NEMA data, to be permanently attached to the motor.
   4. Maximum motor loading shall not exceed motor nameplate horsepower rating, exclusive of service factor.
   5. All motors shall be sized to carry continuously all loads, which may be imposed through their full range of operation.
   6. Altitude: For applications above 3300 FT, motors to be specifically designed and certified for operation at the specified altitude.
   7. NEMA MG 1, Design B (unless otherwise required), constant speed squirrel-cage induction type having normal starting torque with low starting current.
   8. Suitable for the starting method indicated (e.g., full voltage, autotransformer, solid state reduced voltage, VFD, etc.).
   9. Where frequent starting occurs, design for frequent starting duty equivalent to duty service required by driven equipment.
   10. Lifting devices: Motors weighing 265 LBS or more shall have suitable lifting eyes for installation and removal.
   11. Grounding:
      a. Lug suitable to terminate ground wire in terminal box, sized as indicated on the Drawings.
   12. Stator windings: Copper.
   13. Rotor cage: Aluminum or copper.
   14. Motor leads shall be non-wicking with permanent identifiers.
   15. Totally enclosed motor to have one-way breather drains.
   16. Efficiency:
      a. Meet NEMA MG 1 (NEMA Premium) efficiencies.
      b. If motor type, horsepower or speed is not included in the NEMA requirements for NEMA Premium, provide manufacturers "premium energy efficient" design.

17. Power factor:
    a. Minimum of 80 percent lagging at full load, except on motors with speed slower than 900 RPM.
    b. Power factor correction capacitors to be utilized when indicated on the Drawings.
18. Service factor:
    a. 100 hp or less: 1.15.
    b. Greater than 100 hp: 1.0 unless noted otherwise.
    c. Inverter duty: 1.0.
19. Standards: NEMA MG 1.

2.3 INDUCTION MOTORS, 600 VOLT AND LESS

A. Vertical Solid or Hollow Shaft:
    1. Electrical rating:
        a. Appropriate for the voltage system indicated, 3 PH, 60 Hz.
        b. Dual voltage rated motors (e.g., 230/460 V) are acceptable, provided all leads are brought out to the terminal box and permanently marked.
    2. Enclosure:
        a. Cast iron.
        b. Type: DPFG, TEFC, WP-I or WP-II as indicated in the schedule.
    3. Terminal box:
        a. Gasketed.
        b. Diagonally split.
        c. Oversized to accept the required conductors and conduits.
        d. Separate terminal box with terminal blocks for winding thermal protection devices.
    4. Bearings (Solid Shaft):
        a. Relubricatable.
        b. Antifriction.
        c. Minimum rated AMBA L-10 life of 10 years or 100,000 HRS.
    5. Bearings (Hollow Shaft):
        a. Relubricatable.
        b. Antifriction.
        c. Oil or grease lubricated thrust bearings.
        d. Grease lubricated guide bearings.
        e. Minimum rated ABMA L-10 life of 10 years or 100,000 HRS.
    6. Non-reverse ratchets.
    7. Insulation:
        a. Class F insulation with Class B temperature rise.
        b. Double dipped and baked with non-hydroscopic varnish or epoxy or two cycles of vacuum pressure impregnated (VPI) with epoxy resin.
    8. Accessories: See the ACCESSORIES Article in PART 2 and the SCHEDULES Article in PART 3.
    9. Modifications:
        a. Inverter duty:
            1) At a minimum, applied to motors connected to a VFD.
            2) Windings insulated for 1600 peak volts and voltage rise times of 0.1 microseconds.
            3) Nameplate identification of meeting NEMA MG 1 Part 31 requirements.
            4) Have the following minimum turndown ratio without the use of a blower to provide continuous supply of cooling air over the motor.
                a) Variable torque: 10:1.
                b) Constant torque: 6:1.
            5) Insulated drive end bearing.
            6) Shaft grounding ring:
                a) Factory mounted, maintenance free, circumferential bearing protecting ring with conductive micro-fiber shaft contacting material.

b) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.

2.4 ACCESSORIES

A. Thermal Protection:
   1. Thermostats:
      a. Two (2) winding thermostats per phase for alarm and shutdown.
      b. Snap action, bi-metallic, temperature-actuated switch type.
      c. Normally closed, wired in series.
      d. Automatic reset.
      e. Switch point shall be pre-calibrated by the manufacturer.

B. Space Heaters:
   1. Silicone rubber strip type, 120 V rated.
   2. Provided on:
      a. All motors 10 HP and larger mounted outdoors.
      b. Indoor motors in humid environments as indicated.

2.5 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA, IEEE and manufacturer procedures.
   1. The test shall include but not necessarily be limited to the following:
      a. Routine test:
         1) No-load current and speed at rated voltage and frequency.
         2) Locked rotor current.
         3) Winding resistance.
         4) Vibration check.
         5) High potential.
      b. Complete test (in addition to the routine tests):
         1) Rated load temperature rise.
         2) Winding resistance.
         3) Slip test, measured in percent slip.
         4) Locked rotor amperes (3 PH, full voltage).
         5) Locked rotor torque.
         6) Breakdown torque.
         7) Efficiencies tabulated at 100, 75, and 50 percent of full load.
         8) Power factor tabulated at 100, 75, and 50 percent of full load.

B. Motors to be tested:
   1. As indicated in the schedule.
   2. All motors, at a minimum, to receive a routine test.

C. The Owner reserves the right to select and have tested any motor included within the project.
   1. If motor passes testing requirements, the Owner shall be responsible for any shipping and testing costs incurred.
   2. Costs shall be determined by current freight rates and manufacturer's published rates at the time of the test.
   3. If motor fails test, Supplier shall be responsible for all costs incurred.
   4. If two (2) successive motors fail the test, the Owner has the right to reject any or all motors from that manufacturer.
   5. The Owner also reserves the right to witness any routine or complete tests at the Owner's expense.
   6. Notify the Owner a minimum of 14 days in advance of the testing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Ground all motors in accordance with Specification Section 16060.

3.2 SCHEDULES

A. Motors:

DRIVEN MACHINE ID NUMBER	Well Pump 6, 7 & 8
Starter	VFD
Horse Power	75
RPM	1800
Nominal System Voltage	480
Design Terminal Voltage at Starting	460
Shaft	Vertical Hollow
Enclosure	TEFC
Duty	Inverter
Terminal Box Location	NA
Thermal Protection	T-Stat
Space Heater	Yes
Test	Routine

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: See Specification Section 11005.

END OF SECTION

2012/01/10

SECTION 16265
VARIABLE FREQUENCY DRIVES: LOW VOLTAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Variable frequency drives (VFDs) for operation of inverter duty motors.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 11005 - Equipment: Basic Requirements.
   4. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American National Standards Institute (ANSI).
   2. ETL Testing Laboratories (ETL).
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
      b. 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
      c. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   4. National Electrical Manufacturer's Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. MG 1, Motors and Generators.
   5. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC):
         1) Article 430, Motors Motor Circuits, and Controllers..
   6. Occupational Safety and Health Administration (OSHA).
   7. Underwriters Laboratory, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.
      b. 508A, Standard for Industrial Control Panels.

B. Qualifications:
   1. Provide drives that are listed and labeled by UL, ETL, or other Nationally Recognized Testing Laboratory (NRTL) as defined by OSHA regulations, or that have been inspected and subsequent field-labeled by such NRTL.
   2. Where listed drives and other components are installed in a common enclosure, the assembly shall be listed and labeled per UL 508 and UL 508A or equivalent NRTL standard.
      a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" or equivalent NRTL label prior to shipment to the jobsite.
   3. VFD Supplier shall maintain an authorized service organization within 300 miles of the Project Site.

C. Coordination:
1. The intent of this Specification Section is to allow the VFD manufacturer to provide the best solution for the harmonic and motor protection outlined herein.
a. This solution shall include, but not be limited to, all aspects of the distribution system including standby generation, motor feeder cable type and available floor space.
2. Motor and VFD coordination: See Specification Section 11005 and Specification Section 16220.
3. VFD shall be supplied complete with all required control components.
a. Provide control as indicated:
1) On the electrical drawings.
2) As specified in this Specification Section.
b. VFD manufacturer shall review the application and provide, at no additional cost to the Owner, the hardware and software necessary to allow the VFD to control the driven equipment motor over its required operating range.
1) These may include, but are not limited to, analog and digital interface modules, communication interface modules, switches, lights and other devices.
c. Coordinate control devices with devices furnished with driven equipment such as vibration switches, thermal sensors, leak detectors, etc.
4. Verify plan dimensions with equipment space requirements as indicated on the Drawings.
a. Equipment which exceeds the allotted maximum dimensions may not be acceptable.
b. Equipment which reduces clear work space below the minimums established by the NFPA 70 will not be acceptable.

1.3 DEFINITIONS

A. Variable Torque (VT):
1. Defines a load characteristic in which the torque delivered from the motor to the load is reduced as speed is reduced below full rated.
2. This type of load permits the VFD and the motor to operate at reduced output current at reduced speed.

B. Constant Torque (CT):
1. Defines a load characteristic in which the torque delivered from the motor to the load remains constant as speed is varied.
2. This type of load requires the VFD to be able to continuously deliver rated output current over the entire speed range.

C. Constant Horsepower:
1. Defines a load characteristic in which the torque delivered from the motor to the load is reduced as the speed is increased.
2. This characteristic is required for operation of the VFD and motor above rated frequency to maintain output current within the rated value.

D. Inverter Duty Motor: An AC induction motor complying with all requirements of NEMA MG 1 Part 31 for definite-purpose inverter-fed motors.

E. Standard Motor: An AC induction motor that fails to comply with one (1) or more requirements of NEMA MG 1 Part 31.

F. Low Voltage: 600 Vac or less.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Provide a schedule for each VFD including the following information:
a. Equipment Tag Number.
b. VFD Complete Catalog Number.

c. VFD Amp Frame Size.
d. Variable or Constant Torque Rating Basis.
e. Rated Input Current.
f. Rated Continuous Output Current.
g. Rated Short Circuit Current.
h. VFD cable type installed (shielded or non-shielded).
i. VFD Maximum Motor Lead Length for the type of cable used.
j. Motor Manufacturer.
k. Motor Frame Size.
l. Motor Full Load Amps.
m. Motor Service Factor.
n. As installed motor Lead Length (estimate).
o. VFD options provided to meet harmonic or motor protection specifications.

3. Submit VFD Shop Drawings concurrently with driven equipment and motor Shop Drawings.
4. Product technical data:
   a. Complete electrical ratings and performance specifications confirming compliance with specified ratings and performance.
   b. Maximum rate of heat rejection from VFD and all related components and associated cooling requirements.
   c. Manufacturer's installation instructions.
   d. Manufacturer's programming and operating instructions.
   e. See Specification Section 16010 for additional requirements.
5. Fabrication and/or layout drawings:
   a. Top, front and side exterior views, with details showing maximum overall dimensions of enclosure, mounting provisions and conduit/cable entry provisions.
   b. Identify minimum clearances from other VFDs or electrical equipment required for proper cooling at top, bottom, side and back of enclosure.
   c. Three-line diagrams showing AC schematic of VFD, input, output and bypass devices including device ratings.
   d. Interior layout drawings showing location of all components within enclosure, field wiring terminal boards, and power and grounding connections.
   e. Field wiring diagrams showing locations and sizes of all electrical connections, ground terminations, and requirements for shielded wire usage or any other special installation considerations.
6. Certifications:
   a. Submit with Shop Drawings:
      1) Identification and location of closest authorized service organization.
   b. Submit prior to shipment:
      1) Certified factory test reports confirming compliance with specified requirements.
   c. Submit after installation:
      1) Certified field service reports showing:
         a) Each VFD is operational.
         b) Each VFD and its driven equipment motor are compatible.
         c) Each VFD responds correctly to the input control signals.
         d) Critical frequencies of the drive system and that the VFD has been set to lockout these frequencies.
         e) Measured motor terminal peak voltages per Motor Protection Requirements Article.

B. Operations and Maintenance Manuals:
1. See Specification Section 01340 for requirements for:
   a. The mechanics and administration of the submittal process.
   b. The content of Operation and Maintenance Manuals.
2. Approved copy of VFD schedule per Submittals Article.
3. Manufacturer's instruction manuals.

4. Troubleshooting procedures with a cross-reference between symptoms and corrective recommendations.
5. Connection data to permit removal and installation of recommended smallest field-replaceable parts.
6. Recommended spare parts list.
7. Commissioning sheets showing “as-left” values of all user-programmable or adjustable drive parameters.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen Bradley PowerFlex 753.

B. No like, equivalent or "or-equal" item or substitution is permitted.

2.2 GENERAL

A. VFDs shall consist of a rectifier-DC bus-inverter combination producing a sine-coded pulse-width-modulated (PWM) output voltage waveform.

B. VFDs, whether installed in motor control center (MCC) construction or separately-mounted, shall constitute a complete combination motor controller per NFPA 70, Article 430 and shall provide the following per the requirements of that article without the addition of any external components or devices.
   1. Motor control.
   2. Motor overload protection.
   3. Motor and motor branch circuit short circuit and ground fault protection.
   4. Motor and controller disconnecting means.

C. It is the intent of this Specification that VFDs shall be an “engineered” or “configured” drive package in which the VFD chassis, all input, output and bypass power devices, VFD accessories, ancillary switches, contactors, relays, and related control devices are selected, furnished, factory-assembled and -tested by the VFD manufacturer in a single enclosure requiring only connection of the power supply circuit, motor branch circuit, and external control wiring in the field.

2.3 PERFORMANCE AND DESIGN REQUIREMENTS

A. Application:
   1. VFD(s) shall be of sufficient capacity and shall provide a quality of output waveform for stepless motor control from 10 to 100 percent of base speed of the driven equipment.
   2. VFDs shall be compatible with:
      a. Inverter duty induction motors.
   3. VFDs shall be suitable for Constant Torque (CT) or Variable Torque (VT) applications.
      a. VFD manufacturer shall coordinate with the manufacturer of the driven equipment to identify CT and VT applications.
   4. VFDs shall be designed to operate successfully under the following site conditions:
      a. Ambient:
         1) Temperature: 0-50 DegC.
         2) 95 percent non-condensing relative humidity.
      b. Elevation: Less than 3,300 FT above MSL.
      c. Power supply characteristics:
         1) 480 Vac, 3 PH, 60 Hz, 3 wire, (±10 percent).
         2) Effectively grounded.

B. Ratings and Performance Specifications:
   1. Voltage rating:
      a. Nominal: 460 or 480 Vac, 3 PH, 60 Hz.
      b. Range for continuous full load operation: ±10 percent of nominal.
      c. Voltage imbalance tolerance for full load operation: 3 percent minimum.
   2. Current ratings:
      a. Continuous:
         1) Equal to or greater than the motor nameplate full load.
      b. Short-term overload:
         1) VT: 110 percent for 1 minute.
         2) CT: 150 percent for 1 minute.
         3) Permissible for 1 minute every 10 minutes continuously.
      c. Short circuit:
         1) 25 kA RMS SYM, minimum.
         2) Where a short circuit rating is not indicated or specified for individual VFDs, each VFD shall have a rating not less than indicated on the Drawings for the MCC, switchboard or panelboard the VFD is supplied from.
         3) Where specified short circuit rating indicates additional input impedance is required to protect semiconductors, provide input AC line reactors, whether required to meet harmonic performance specifications or not.
   3. Efficiency:
      a. 97 percent, minimum, at full speed and full load.
      b. 93 percent, minimum at 1/2 speed and full load.
   4. Displacement power factor:
      a. 95 percent, minimum from 50 percent to 100 percent speed and load.
   5. Efficiency and power factor criteria apply from the input terminals to the output terminals of the VFD alone, excluding losses of input and output power circuit accessories.
   6. Frequency drift:
      a. +0.5 percent of set frequency.
   7. Speed regulation (motor dependent): 3 percent.
   8. Speed range: 10:1.
   9. Control type:
      a. Volts/Hertz ratio; constant over the entire operating range of the VFD except:
         1) When operating under voltage boost.
         2) At frequencies over 60 Hz.

C. Operational Features:
   1. Insensitive to input phase sequence.
   2. Continued operation with momentary voltage dips of 25 percent of rated voltage, or single phase condition: 4 second, minimum.
   3. Controls power loss ride-through: 500 msec, minimum.
   4. Anti-windmilling: Synchronization of VFD starting frequency with spinning or coasting load, forward or reverse.
   5. Critical frequency band lockout:
      a. Minimum of three (3) settings.
      b. Adjustable bandwidth, 1 - 5 Hz.
   6. Capable of operating without the motor connected for start-up and troubleshooting.

D. The VFD shall be provided with the following minimum user-programmable parameters:
   1. Carrier frequency.
   2. Independent maximum and minimum speeds for forward and reverse operation.
   3. Start frequency and hold time.
   4. Independent linear acceleration and deceleration time.
   5. Preset “jog” speed.
   6. Three (3) critical frequency bands.
   7. One (1) preset speed selectable by logic input.
   8. Volts/Hertz ratio.

9. Voltage boost, magnitude and frequency range.
10. Process controller gain, offset and bias.
11. Current limit.
12. Overcurrent pickup.
13. Overcurrent delay.
14. Ground fault pickup.
15. DC injection level and time.

E. The VFD shall be designed such that the power circuit components are fully protected from line side disturbances and load side faults:
   1. General:
      a. Shutdown conditions associated with supply circuit conditions which can be corrected external to the VFD-motor system shall be provided with automatic reset, with shutdown cause logged in memory:
         1) Input under voltage.
         2) Input over voltage.
         3) Input under frequency.
         4) Input over frequency.
         5) Input Phase loss.
         6) DC Bus under voltage.
      b. Shutdown conditions which indicate overload or fault within the VFD, the output circuit, or the motor shall require local manual reset at the VFD, requiring operator intervention.
         1) Over temperature.
         2) Blown fuse.
         3) Component failure.
         4) Overload.
         5) Short circuit.
         6) Ground fault.
         7) DC Bus over voltage.
         8) External safety input (e.g., motor thermal protection).
         9) Logic fault.
      c. When automatic shutdown occurs, VFD shall restart only when remote run signal is removed and reapplied.
      d. VFD shall hold cause of trip data for a minimum of four (4) shutdowns in memory.
         1) Data to be accessible through the keypad, local communication link and remotely.
   2. Input protection:
      a. Input circuit breaker or current-limiting fuses with externally operable disconnect.
         1) Fault current interrupting rating equal to or greater than the specified withstand rating of the VFD.
         2) Handle padlockable in the OFF position.
      b. Provide full protection for semiconductors integral to the VFD; units requiring current-limiting fuses or circuit breakers in the supply circuit are not acceptable.
      c. Incoming line transient suppression.
         1) 6000 V peak per IEEE C62.41.
         2) Phase-to-phase and phase-to-ground protection.
      d. Sustained over voltage trip.
   3. Internal protection:
      a. Surge suppression and power device snubbers.
      b. Power devices rated at 2.5 times line voltage.
      c. Instantaneous over current trip.
      d. DC bus over voltage trip.
      e. Power device over temperature trip.
      f. Control logic circuit malfunction trip.

4. Output protection:
    a. Inverse-time overload trip:
        1) UL Class 20 characteristic.
    b. Over voltage trip.
    c. Over frequency trip.
    d. Short circuit trip.
        1) Line to line and line to ground.
    e. Ground fault trip.

2.4 OPERATOR AND REMOTE CONTROL INTERFACE

A. Drive controls shall be microprocessor-based with on-board human machine interface and both local and remote digital communications capability.
    1. All monitoring and control functions, other than those shutdowns specified to be manual reset only, shall be available both locally and remotely.

B. Control circuits shall be 120 Vac or 24 Vac or 24 Vdc.
    1. 120 Vac supplied by CPT in the VFD.
        a. CPT shall have minimum additional capacity of 60 VA greater than that required by control devices.
        b. CPT shall have two (2) fuses on the primary side and one (1) fuse on the secondary side.
        c. CPT shall have surge protection on the primary side independent of any other surge protection in the VFD.
    2. 24 Vac or 24 Vdc supplied by Class 2 power supply in the VFD.
        a. Power supply shall have minimum additional capacity of 33 percent greater than that required by control devices.
        b. Provide two (2) current-limiting fuses on the AC supply to the power supply.
        c. Power supply shall have surge protection on the primary side independent of any other surge protection in the VFD.

C. Operator Interface:
    1. Door mounted sealed keypad, membrane type with LED or LCD display.
        a. Messages shall be in English and engineering units.
        b. Drive operating parameters shall be programmable.
        c. Menu driven.
        d. Password security.
        e. Display fault and diagnostic data.
        f. Operating parameters, fault and diagnostic data maintained in non-volatile memory with historic log of fault and diagnostic data.
        g. Gold plated plug-in contacts.
    2. Provide indication and control interface, integral in the keypad, as required in the sequence of operation and Drawings.
        a. Minimum indications:
            1) Run.
            2) Stop.
            3) Ready.
            4) Alarm.
            5) Fault.
            6) Local control.
            7) Remote control.
            8) Control source local.
            9) Control source remote.
            10) Speed indication.
        b. Minimum control functions:
            1) Local/Remote switch.
            2) Stop button.

3) Start button.
4) Reset button.
5) Speed control buttons.

3. Diagnostic indicators located externally on the face of the drive shall show the type of fault responsible for drive warning, shutdown or failure.
   a. On occurrence of more than one (1) condition, each shall be recorded or indicated by the diagnostics.

D. Remote Control Interface:
1. Local portable computer interface via serial communications port:
   a. Capability to:
      1) Start-Stop VFD.
      2) Control VFD Speed.
      3) Access fault and diagnostic data.
2. Analog and discrete inputs:
   a. Speed reference (setpoint) signal 4-20 mA DC.
3. Analog and discrete outputs:
   a. 4-20 mA DC output for remote speed indication, as a function of frequency, calibrated 0 to 100 percent.
   b. Drive FAULT contacts.
   c. Drive RUNNING contacts.
   d. Drive selector switch in REMOTE status contacts.
4. Contacts:
   a. Contacts shall be rated 2 A inductive at 120 Vac.
   b. All contacts shall be wired to field wiring terminal boards.
5. Drive shutdown on external fault input:
   a. Provide isolated input for dry contact from external motor or system safety devices to cause immediate shutdown of VFD.
   b. Safety shutdown to be operable in all operating modes of drive, including local operation from keypad.
   c. Local safety switch, to driven equipment, auxiliary contact to lock-out VFD from running when safety switch is open.

2.5 HARMONIC PROTECTION REQUIREMENTS

A. All VFDs shall be capable of satisfactory operation from a source having voltage distortion and notch characteristics identified as acceptable for a “dedicated system” in IEEE 519 Table 10.2.

B. The Engineer has performed preliminary calculations based on typical VFD data which indicate that the minimum mitigation measures required to meet the harmonic criteria are one (1) of the following topologies:
1. 6-pulse rectifier topology with input line reactors or DC link reactors, minimum impedance 5 percent in drive kVA base.

2.6 MOTOR PROTECTION REQUIREMENTS

A. The VFD shall produce a quality of output waveform adequate to allow the motor to produce rated torque at rated RPM continuously without exceeding the temperature rise given in NEMA MG 1 Table 31-2.

B. Provide motor overload, short circuit and ground fault protection integral to drive electronics.

C. The VFD shall not produce voltage spikes in excess of the following values at the motor terminals when operated with the feeder types shown on the Drawings and the actual installed feeder lengths.
1. If unmitigated voltage peaks exceed the specified limits, provide output line reactors, filters, or other devices as required to meet the specified limits:
   a. Inverter duty motors: 1280 V.
   b. Rise time shall be greater than or equal to 0.1 microsecond.

c. Motor lead length and data shall be determined by the Contractor based on the actual routing of the conductors.

D. Following start-up, provide measurement of peak voltage at the terminals of each motor, unless the lead lengths are 10 percent shorter than the manufacturers published literature for maximum lead length for the type of cable installed.
   1. Values in excess of specified limits require correction by contractor and re-measurement.
   2. Provide certification of compliant measurements as part of Field Service Engineer's final report.

2.7 EQUIPMENT CONSTRUCTION

A. Fabrication and Assembly:
   1. Each VFD system shall be factory-assembled in an enclosure for remote mounting, and shall utilize interchangeable plug-in printed circuit boards and power conversion components wherever possible.
      a. Factory assembly shall be performed by the VFD manufacturer or authorized agent.
      b. Systems fabricated or assembled in whole or in part by parties other than the VFD manufacturer or authorized agent will not be acceptable.
   2. Reactors and/or filters, where required, shall be mounted within the drive enclosure, or with the Engineer's permission may be mounted in a separate enclosure.
   3. Cooling fans, as required, shall be provided to run when drive is running.
   4. Enclosures for separately mounted VFD's:
      a. NEMA Type 12 for installation in other unclassified areas.

B. Wiring:
   1. The wiring in the VFD shall be neatly installed in wire ways or with wire ties where wire ways are not practical.
      a. Where wire ties are used, the wire bundles are to be held at the back panel with a screw-mounted wire tie mounting base.
      b. Bases with a self-sticking back will not be allowed.
   2. Provide terminal boards for all field wiring and inter-unit connections, including analog signals.
      a. Provide terminals for shield continuity where required.
   3. Terminal blocks shall be complete with marking strip, covers and pressure connectors.
      a. Non-brittle, interlocking, track-mounted type.
      b. Screw terminals will not be allowed.
      c. A terminal for each conductor of external circuits plus one (1) ground for each shielded cable.
      d. For free-standing panels, 8 IN of clearance shall be provided between terminals and the panel base for conduit and wiring space.
      e. Not less than 25 percent spare terminals shall be provided.
      f. Terminals shall be labeled to agree with identification indicated on the suppliers submittal drawings.
      g. Individually fuse each control loop or system and all fuses or circuit breakers shall be clearly labeled and located for easy maintenance.
   4. All grounding wires shall be attached to the enclosure sheet metal with a ring tongue terminal.
      a. The surface of the sheet metal shall be prepared to assure good conductivity and corrosion protection.
   5. Wiring shall not be kinked or spliced and shall have markings on both ends or be color coded.
      a. Markings or color code shall match the manufacturer's drawings.
   6. With the exception of electronic circuits, all interconnecting wiring and wiring to terminals for external connection shall be stranded copper, type MTW or SIS, insulated for not less than 600 V, with a moisture-resistant and flame-retardant covering rated for not less than 90 DegC.

C. Nameplates:
1. All devices mounted on the face of the drive shall be provided with a suitable nameplate.
2. Push buttons, selector switches, and pilot lights shall have the device manufacturer's standard legend plate.
3. Relays, terminals and special devices inside the control enclosure shall have permanent markings to match identification used on manufacturer's wiring diagrams.

D. Painting: Enclosure, after being phosphate washed, shall be thoroughly cleaned and given at least one (1) coat of rust-inhibiting primer on all inner surfaces prior to fabrication.

2.8 COMPONENTS AND ACCESSORIES

A. Reactors:
1. Impedance: 5 percent.
2. Continuous current: Not less than drive rating.
3. Current overload: 150 percent for 1 minute.
4. Insulation temperature rating: 180 DegC.
5. Copper windings.
6. Saturation current rating: 3.5 to 5 times rated current.
7. Hi-potential rating: 2500 Vac line to ground and line to line, for 1 minute.
8. Noise reduction features:
a. Epoxy over cast coil.
b. Extra dips and bakes of varnish over continuous wound coil.

2.9 SOURCE QUALITY CONTROL

A. Factory Tests:
1. Conduct all standard tests in accordance with NEMA and ANSI standards to ensure conformance to Specification requirements.
2. After final assembly of the complete engineered product, the drive system shall be connected to a motor (load) to ensure it will drive the motor and that the controls will function properly.

2.10 MAINTENANCE MATERIALS

A. Provide manufacturer's recommended renewable spare parts (e.g., power and control fuses).

B. Spare parts utilized during pre-start-up or start-up and demonstration testing shall be immediately restocked, at no cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and as indicated on the Drawings.

B. Verify the installed motor nameplate electrical requirements do not exceed the VFD capacity.

C. Provide services of manufacturer's representative to perform start-up services.

D. The selection of input and output harmonic and voltage spike protection shall also be made on the available physical space.
1. The space available on the Drawings shall not be exceeded.

3.2 START UP

A. Pre-start-up Services:
1. Shall be completed a minimum of 30 days prior to the start-up and demonstration period described in Specification Section 01650.

2. Shall consist of:
    a. Physical and electrical installation check.
    b. Final adjustments and calibration of drive parameters.
    c. VFD operation from simulated input signals.
3. Shall be complete when VFD(s) are fully operational.

B. Field Quality Control:
1. Perform field measurement of the maximum voltage peak at the terminals of each motor fed from a VFD per Motor Protection Requirements Article.
    a. Use a high speed oscilloscope to produce a plot of Voltage (Y axis) versus Time (X axis).
        1) Time shall be measured in microseconds.
    b. Tests shall be performed at full:
        1) Full voltage and speed.
        2) Loaded to 75 percent minimum.
        3) Duration: 1 HR minimum.
2. Record all data necessary for the preparation of required test reports.

C. Start-up and Demonstration Services:
1. Supervise start-up of all units including recheck of settings made during the pre-start-up tests.
    a. Perform all work in the presence of the Owner's designated representatives.
2. Setup all VFDs with carrier frequency at minimum value consistent with proper operation; inform Engineer of carrier frequencies set in excess of 5 kHz and reason for setting.
3. Simulate operation of the VFD and its associated control and instrumentation system in both the manual and automatic modes.
    a. Ensure compatibility of VFD with associated control and instrumentation signals.
4. Simulate VFD failures and demonstrate troubleshooting aids.

D. Instruct Owner's designated personnel:
1. Minimum of 8 HRS at the jobsite.
2. Include both field and classroom instruction.
3. Instructions shall include proper operation and maintenance procedures including, but not limited to:
    a. Lubrication.
    b. Troubleshooting.
    c. Repair and replacement.
    d. Parts inventory.
    e. Maintenance records.

END OF SECTION

1

2012/01/04

SECTION 16441
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lighting and appliance panelboards.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16491 - Low Voltage Surge Protective Devices (SPD).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. PB 1, Panelboards.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 50, Standard for Safety Cabinets and Boxes.
      b. 67, Standard for Safety Panelboards.
      c. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification:
      b. See Section 16010 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Cutler-Hammer.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Ratings:
   1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
   2. Panelboards rated 240 Vac or less: 10,000 amp minimum short circuit rating or as indicated in the schedule.
   3. Panelboards rated 480 Vac: 22,000 amp minimum short circuit rating or as indicated in the schedule.
   4. Service Entrance Equipment rated when indicated on the Drawings.

C. Construction:
   1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   2. Multi-section panelboards: Feed-through or sub-feed lugs.
   3. Main lugs: Solderless type approved for copper and aluminum wire.

D. Bus Bars:
   1. Main bus bars:
      a. Plated aluminum or copper sized to limit temperature rise to a maximum of 65 DegC above an ambient of 40 DegC.
      b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
   2. Ground bus and isolated ground bus, when indicated on Drawings: Solderless mechanical type connectors.
   3. Neutral bus bars: Insulated 100 percent rated or 200 percent rated, when indicated on the Drawings and with solderless mechanical type connectors.

E. Enclosure:
   1. Boxes: Code gage galvanized steel, furnish without knockouts.
   2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
   3. Lighting and appliance panelboard:
      a. Trims supplied with hinged door over all circuit breaker handles.
      b. Trims for surface mounted panelboards, same size as box.
      c. Trims for flush mounted panelboards, overlap the box by 3/4 IN on all sides.
      d. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
      e. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NEC.
      f. Clear plastic cover for directory card mounted on the inside of each door.

F. Overcurrent and Short Circuit Protective Devices:
   1. Molded Case Type:
      a. General:
         1) Standards: NEMA AB 1, UL 489.
         2) Unit construction.
         3) Over-center, toggle handle operated.
         4) Quick-make, quick-break, independent of toggle handle operation.
         5) Manual and automatic operation.
         6) All poles open and close simultaneously.
         7) Three (3) position handle: On, off and tripped.
         8) Molded-in ON and OFF markings on breaker cover.
         9) One-, two- or three-pole as indicated on the Drawings.
         10) Current and interrupting ratings as indicated on the Drawings.
         11) Bolt on type.
      b. Thermal magnetic type:
         1) Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.

2) Frame size 150 amp and below:
a) Non-interchangeable, non-adjustable thermal magnetic trip units.

2. Factory installed.

G. External surge protective device: See Section 16491.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on Drawings, in accordance with the NEC, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Section 16010.

C. Provide each panelboard with a typed directory:
1. Identify all circuit locations in each panelboard with the load type and location served.
2. Mechanical equipment shall be identified by Owner-furnished designation if different than designation indicated on Drawings.

END OF SECTION

1

2011/08/31

SECTION 16442
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Separately mounted motor starters.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. International Electrotechnical Commission (IEC).
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
      b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 16010 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Separately mounted combination starters:
         1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated as indicated on the Drawings and/or loop descriptions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen-Bradley.
   2. Cutler Hammer.
   3. General Electric Company.
   4. Square D Company.
   5. Siemens.

2.2 SEPARATELY MOUNTED COMBINATION STARTERS

A. Standards:
   1. NEMA 250, NEMA ICS 2.
   2. UL 508.

B. Enclosure:
   1. NEMA 12 rated:
      a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
      b. No knockouts, external mounting flanges, hinged and gasketed door.

C. Operating Handle:
   1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
   2. Circuit breaker and MCP operators includes a separate TRIPPED position.
   3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
   4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.
   5. Padlockable in the OFF position.
   6. Exceptions: NEMA 7 and NEMA 9 enclosures.

D. External mounted overload relay pushbutton.

E. Control Devices:
   1. The following devices are the minimum required unless otherwise indicated on the Drawings:
      a. Three-position switch (HAND-OFF-AUTO).
      b. Red ON indicator light.
   2. Devices will be accessible with the door closed.

F. Control Power Transformer:
   1. 120V secondary.
   2. Fused on primary and secondary side.
   3. Sized for 140 percent of required load.

G. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.

H. Motor Starters: See requirements within this Specification Section.

I. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:
   1. Motor circuit protector.
   2. Factory installed.

2.3 MOTOR STARTERS

A. Standards:
   1. NEMA ICS 2.
   2. UL 508.

B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
   1. NEMA full size rated contactor.
      a. NEMA half sizes and IEC contactors are not permitted.
   2. Double-break silver alloy contacts.
   3. Overload relays:
      a. Ambient compensated, bimetallic type with interchangeable heaters, 24 percent adjustability, single phase sensitivity, an isolated arm contact and manual reset.

2.4 PILOT DEVICES

A. General Requirements:
   1. Standards: NEMA ICS 2, UL 508.
   2. Heavy-duty NEMA 4/13 watertight/oiltight.
   3. Mounting hole: 30.5 mm.
   4. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
   5. Legend plate marked as indicated on Drawings or specified.

B. Selector Switches:
   1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
   2. Maintained contact type.
   3. Knob or lever type operators.

C. Indicating Lights:
   1. Allowing replacement of bulb without removal from control panel.
   2. Lamp: LED, 120 V or 24 V as required.
   3. Full voltage type.
   4. Push-to-test indicating lights.
   5. Glass lens.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.

B. Mounting height for surface mounted equipment: See Specification Section 16010.

C. Overload Heaters:
   1. Size for actual motor full load current of the connected motor.
   2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.

D. Combination Starter Enclosures:
   1. Permitted uses of NEMA 12 enclosure:
      a. Surface mounted in areas designated as dry.

END OF SECTION

1

2011/08/31

SECTION 16491
LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 2 SPD - High exposure locations (switchgear, switchboard, panelboard or motor control center), externally mounted.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
      b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
      c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
      d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Military Standard:
      a. MIL-STD-220B, Method of Insertion-Loss Measurement.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. LS 1, Low Voltage Surge Protective Devices.
   4. Underwriters Laboratories, Inc. (UL):
      a. 1283, Standard for Electromagnetic Interference Filters.
      b. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:
   1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
      a. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.

B. Let-Through Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.

2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:
1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.
2. Listed by mode, since number and type of components in any SPD may very by mode.

E. MCC: Motor Control Center.

F. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

G. Surge Current per Phase:
1. The per phase rating is the total surge current capacity connected to a given phase conductor.
a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
b. The N-G mode is not included in the per phase calculation.

H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Manufacturer's qualifications.
b. Standard catalog cut sheet.
c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
d. Testing procedures and testing equipment data.
e. Create a Product Data Sheet for each different model number of SPD provided (i.e., Model XYZ with disconnect and Model XYZ without disconnect, each require a Product Data Sheet).
1) Data in the Product Data Sheet heading:
a) SPD Type Number per PART 2 of the Specification.
b) Manufacturer’s Name.
c) Product model number.
2) Data in the Product Data Sheet body:
a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
b) Column two: Manufacturer’s certified value confirming the product meets the specified value/feature.
c) Name of the nationally recognized testing laboratory that preformed the tests.
d) Warranty information.
3) Data in the Product Data Sheet closing:
a) Signature of the manufacturer’s official (printed and signed).
b) Title of the official.
4) Date of signature.

1.5 WARRANTY

A. Minimum of a five (5) year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, NEMA LS 1, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE 2 SPD

A. Product:
   1. Externally mounted next to panelboard.
   2. Hybrid solid-state high performance suppression system.
      a. Do not use suppression system with gas tubes, spark gaps or other components which might short or crowbar the line resulting in interruption of normal power flow to connected loads.
   3. Do not connect multiple SPD modules in series to achieve the specified performance.
   4. Designed for parallel connection.
   5. Enclosure:
      a. Metallic NEMA 4 or 12 for interior locations.
      b. Metallic NEMA 4 or 4X for exterior locations.
   6. Field connection:
      a. Mechanical or compression lugs for each phase, neutral and ground that will accept #10 through #1/0 conductors. OR
      b. Preinstalled lead conductors: Size per manufacturer, length as required with a maximum of 5 FT.
   7. Device monitor:
      a. Long-life, solid state, externally visible indicators and Form C dry contact(s) that monitor the on-line status of each mode of the units suppression filter system or power loss in any of the phase.
      b. A fuse status only monitor system is not acceptable.

B. Operating Voltage: Nominal unit operating voltage and configuration as indicated on the Drawings.

C. Modes of Protection: All modes.
   1. Three phase (delta): L-L, L-G.
   2. Three phase (wye): L-N, L-L, L-G and N-G.
   3. Single phase (2 pole): L-L, L-N, L-G and N-G.
   4. Single phase: L-N, L-G and N-G.

D. Maximum Continuous Operating Voltage: Less than 130 percent of system peak voltage.

E. Operating Frequency: 45 to 65 Hz.

F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.

G. Maximum Surge Current: 240,000 A per phase, 120,000 A per mode minimum.

H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High waveform impulses with no degradation of more than 10 percent deviation of the clamping voltage.

I. SPD Protection:
   1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.

2. An IEEE C High waveforms shall not cause the fuse to open and render the SPD inoperable.

J. Maximum Clamping Voltages: Dynamic test at the 90 degree phase angle including 6 IN lead length and measured from the zero voltage reference:

		IEEE C62.41		
System Voltage	Test Mode	C High V & I Wave	B Combination Wave	UL 1449
L-L < 250 V	L-L	1470 V	1000 V	800 V
L-N < 150 V	L-N	850 V	600 V	500 V
	L-G	1150 V	800 V	600 V
	N-G	1150 V	800 V	600 V
L-L > 250 V	L-L	2700 V	2000 V	1800 V
L-N > 150 V	L-N	1500 V	1150 V	1000 V
	L-G	2000 V	1550 V	1200 V
	N-G	2000 V	1550 V	1200 V

K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:
1. Integral unit level and/or component level fusing.
2. Neutral and ground shall not be bonded during testing.
3. 6 IN lead lengths.
4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:
1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
2. Single pulse surge current capacity test.
3. Repetitive surge current capacity testing.
4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type 2 SPD:
1. Mounting options:
   a. On wall or support structure adjacent to the equipment to be protected with leads routed through conduit. OR
   b. Nipple connection directly to the equipment to be protected.
2. Install leads as short and straight as possible.
3. Maximum lead length: 5 FT.
4. Minimum lead size:
   a. Type 2 SPD: #2 stranded AWG.
5. When conduit connection is used, provide a minimum of four (4) twists per foot in the lead conductors and install in NFPA 70 sized conduit.

6. Connect leads to the equipment to be protected by one (1) of the following means:
    a. Through a circuit breaker or molded case switch mounted in the equipment.
        1) Use manufacturer recommended circuit breaker size.
    b. Directly to the protected equipment bus, when SPD has integral disconnect switch.

END OF SECTION

1

2012/01/12

SECTION 16493
CONTROL EQUIPMENT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Operator control devices (selector switches, pushbuttons, indicator lights, etc.).
   2. Control devices (timers, relays, contactors, etc.).
   3. Control panels and operator stations.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 2, Industrial Control and System Controllers, Contactors and Overload Relays Rated 600 Volts.
   2. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Safety Industrial Control Equipment.
      b. 508A, Standard for Safety Industrial Control Panels.

B. Miscellaneous:
   1. Supplier of Industrial Control Panels shall build control panel under the provisions of UL 508A.
      a. Entire assembly shall be affixed with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pilot devices and relays:
      a. Idec.
      b. Potter & Brumsfield.
      c. Time Mark.
      d. ATC Diversified Electronics.
   2. Contactors:
      a. Cutler-Hammer.
      b. General Electric Company.
      c. Square D Company.
      d. Siemens.
      e. Allen Bradley.
   3. Terminal blocks:
      a. Phoenix Contact.

b. Allen-Bradley.
4. Enclosures:
a. Hoffman Engineering Co.
b. Wiegmann.
c. B-Line Circle AW.
d. Adalet.

2.2 PILOT DEVICES

A. General Requirements:
1. Standards: NEMA ICS 2, UL 508.
2. Heavy-duty NEMA 4/13 watertight/oiltight.
3. Heavy-duty NEMA 4/4X corrosion resistant.
4. Heavy-duty factory sealed, explosion-proof and dust ignition-proof (Class I and II).
5. Mounting hole: 30.5 mm.
6. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
7. Legend plate marked as indicated on Drawings or specified.

B. Selector Switches:
1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
2. Maintained contact type.
3. Knob or lever type operators.

2.3 CONTACTORS

A. General Requirements:
1. Standards: NEMA ICS 2, UL 508.

B. Definite Purpose:
1. Coil voltage: 120 Vac or as required.
2. Contacts: Totally enclosed, double-break silver-cadmium-oxide.
3. Resistive load and horsepower rated.
4. Number of poles, continuous ampere rating and voltage, as indicated on Drawings or as specified.
5. Auxiliary contacts, as indicated on Drawings or as specified.

2.4 TERMINATION EQUIPMENT

A. General Requirements:
1. Modular type with screw compression clamp.
2. Screws: Stainless steel.
3. Current bar: Nickel-plated copper alloy.
4. Thermoplastic insulation rated for -40 to +90 DegC.
5. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
6. End sections and end stops at each end of terminal strip.
7. Machine-printed terminal markers on both sides of block.
8. Spacing: 6 mm.
9. Wire size: 22-12 AWG.
10. Rated voltage: 600 V.
11. DIN rail mounting.

B. Standard-type block:
1. Rated current: 30 A.
2. Color: Gray body.

2.5 ENCLOSURES

A. Control Panels:
   1. NEMA 12 enclosure:
      a. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. No knockouts.
      c. External mounting flanges.
      d. Non-hinged stainless steel cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
      e. Flat door with oil resistant gasket.
   2. Control panel miscellaneous accessories:
      a. Back plane mounting panels: Steel with white enamel finish or Type 304 stainless steel.
      b. Interiors shall be white or light gray in color.
      c. Wire management duct:
         1) Bodies: PVC with side holes.
         2) Cover: PVC snap-on.
         3) Size as required.
      d. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
      e. Weldnuts for mounting optional panels and terminal kits.
      f. Ground bonding jumper from door, across hinge, to enclosure body.
   3. Standards: NEMA 250, UL 508.

2.6 MANUAL MOTOR STARTERS

A. Standards:
   1. NEMA 250, NEMA ICS 2.
   2. UL 508.

B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.

C. Types:
   1. Horsepower rated, for ON/OFF control and thermal overload protection.
      a. Switch to clearly indicate ON, OFF, and TRIPPED position.

D. Voltage and current ratings and number of poles as required for the connected motor.

E. Overload Heaters: Size for actual motor full load current of the connected motor.

F. Enclosures:
   1. NEMA 1 rated:
      a. Galvanized steel or steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
      b. With or without concentric knockouts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Control Panels:
   1. Size as required to mount the equipment.
   2. Permitted uses of NEMA 12 enclosure:
      a. Surface mounted in areas designated as dry and/or dusty architecturally or non-architecturally finished areas.

3.2 FIELD QUALITY CONTROL

A. See Section 16010.

END OF SECTION

MINIMUM INSURANCE REQUIREMENTS
CITY OF GRAND ISLAND, NEBRASKA

The successful bidder shall obtain insurance from companies authorized to do business in Nebraska of such types and in such amounts as may be necessary to protect the bidder and the interests of the City against hazards or risks of loss as hereinafter specified. This insurance shall cover all aspects of the Bidder's operations and completed operations. Failure to maintain adequate coverage shall not relieve bidder of any contractual responsibility or obligation. Minimum insurance coverage shall be the amounts stated herein or the amounts required by applicable law, whichever are greater.

1. WORKERS COMPENSATION AND EMPLOYER'S LIABILITY

This insurance shall protect the Bidder against all claims under applicable State workers compensation laws. This insurance shall provide coverage in every state in which work for this project might be conducted. The liability limits shall not be less than the following:

Workers Compensation	Statutory Limits
Employers Liability	$100,000 each accident
	$100,000 each employee
	$500,000 policy limit

2. BUSINESS AUTOMOBILE LIABILITY

This insurance shall be written in comprehensive form and shall protect the Bidder, Bidder's employees, or subcontractors from claims due to the ownership, maintenance, or use of a motor vehicle. The liability limits shall be not less than the following:

Bodily Injury & Property Damage	$ 500,000 Combined Single Limit

3. COMPREHENSIVE GENERAL LIABILITY

The comprehensive general liability coverage shall contain no exclusion relative to explosion, collapse, or underground property. The liability limits shall be not less than the following:

Bodily Injury & Property Damage	$ 500,000 each occurrence
	$1,000,000 aggregate

4. UMBRELLA LIABILITY INSURANCE

This insurance shall protect the Bidder against claims in excess of the limits provided under employer's liability, comprehensive automobile liability, and commercial general liability policies. The umbrella policy shall follow the form of the primary insurance, including the application of the primary limits. The liability limits shall not be less than the following:

Bodily Injury & Property Damage	$1,000,000 each occurrence
	$1,000,000 general aggregate

5. ADDITIONAL REQUIREMENTS

The City may require insurance covering a Bidder or subcontractor more or less than the standard requirements set forth herein depending upon the character and extent of the work to be performed by such Bidder or subcontractor.

Insurance as herein required shall be maintained in force until the City releases the Bidder of all obligations under the Contract.

The Bidder shall provide and carry any additional insurance as may be required by special provisions of these specifications.

6. CERTIFICATE OF INSURANCE

Satisfactory certificates of insurance shall be filed with the City prior to starting any work on this Contract**. The certificates shall show the City as an additional insured on all coverage except Workers Compensation. The certificate shall state that thirty (30) days written notice shall be given to the City before any policy is cancelled (strike the "endeavor to" wording often shown on certificate forms). If the bidder cannot have the "endeavor to" language stricken, the bidder may elect to provide a new certificate of insurance every 30 days during the contract. Bidder shall immediately notify the City if there is any reduction of coverage because of revised limits or claims paid which affect the aggregate of any policy.**

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT

Contract Drawings For

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT

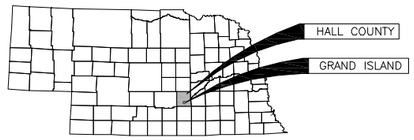
HDR Engineering, Inc.

URANIUM REMOVAL
WATER TREATMENT PLANT
EQUIPMENT INSTALLATION PACKAGE

Civil/Architectural/Structural
Process/Mechanical/Electrical

Project No.
145910

Grand Island, Nebraska
January, 2012



STATE OF NEBRASKA

LOCATION MAP
NOT TO SCALE

INDEX OF DRAWINGS

GENERAL
COVER LOCATION MAP, INDEX OF DRAWINGS
00G-01 GENERAL ABBREVIATIONS
00G-02 GENERAL NOTES
00G-03 GENERAL LEGEND
00G-04 CIVIL LEGEND
00G-05 MECHANICAL LEGEND
00G-06 ELECTRICAL LEGEND
00G-07 ELECTRICAL LEGEND

CIVIL
01C-01 SITE PLAN
*01C-02 URANIUM REMOVAL WTP BUILDING SITE PLAN
*01C-03 SITE PIPING PLAN & PROFILE

URANIUM REMOVAL WTP BUILDING
*02A-01 FLOOR PLAN
*02A-02 EXTERIOR ELEVATIONS
02D-01 PROCESS EQUIPMENT & PIPING PLAN
02D-02 HEADER PIPING DETAILS
*02U-01 MECHANICAL AND ELECTRICAL FLOOR PLAN
*02U-02 MECHANICAL, ELECTRICAL AND STRUCTURAL DETAILS AND SCHEDULES
02U-03 INSTRUMENTATION FLOOR PLAN

WELL IMPROVEMENTS
03U-01 WELL HOUSE PROCESS, ELECTRICAL & MECHANICAL PLAN
03E-01 WELL HOUSE 6,7 & 8 RISER DIAGRAM
03E-02 ELECTRICAL DETAILS AND DIAGRAMS

* BY OTHERS

APPROVALS:

REGISTERED CIVIL ENGINEER M. KENT PINNOR E-4202 STATE OF NEBRASKA

M. Kent Pinnor — 1/12/12
ENGINEER — DATE

UTILITIES DIRECTOR — DATE

FIRE CHIEF — DATE

PUBLIC WORKS DIRECTOR — DATE

ISSUED FOR BID
January 12th, 2012

A/C	AIR CONDITIONING
A/E	ARCHITECT/ENGINEER
A	AMPERE
AB	ANCHOR BOLT
ABAN	ABANDON
ABC	AGGREGATE BASE COURSE
ABT	ABOUT
AC	ALTERNATING CURRENT
ACK	ACKNOWLEDGE
ACP	ACOUSTIC CEILING PANEL, ASPHALTIC CONCRETE PAVEMENT
ACST	ACOUSTIC
AD	ADDENDUM, AREA DRAIN
ADDL	ADDITIONAL
ADH	ADHESIVE
ADJ	ADJUSTABLE, ADJACENT
AF	AMP FRAME, AMP FUSE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AGGR	AGGREGATE
AI	AREA INLET, ANALOG INPUT
AIC	AMPS INTERRUPTING CAPACITY
ALIG	ALIGNMENT
ALT	ALTERNATE, ALTITUDE
ALUM	ALUMINUM
AM	ACOUSTICAL MATERIAL
AMB	AMBIENT
ANC	ANCHOR
AO	ANALOG OUTPUT
AP	ACCESS PANEL
APRX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ASSY	ASSEMBLY
AT	ACOUSTICAL TILE, AMP TRIP
ATC	ACOUSTICAL TILE CEILING
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAGE
AWT	ACOUSTICAL WALL TILE
B TO B	BACK TO BACK
BAL	BALANCE
BBD	BULLETIN BOARD
BC	BASE CABINET, BOTTOM CHORD, BOLT CENTER, BOLT CIRCLE
BD	BOARD
BE	BOTH ENDS, BELL END
BF	BOTH FACES, BOTTOM FACE, BLIND FLANGE, BOARD FEET
BITUM	BITUMINOUS
BKG	BACKING
BL	BASE LINE
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BENCHMARK, BEAM
BOC	BACK OF CURB
BOD	BOTTOM OF DUCT
BOG	BOTTOM OF GRILLE
BOL	BOTTOM OF LOUVER, BOLLARD
BOP	BOTTOM OF PIPE
BOR	BOTTOM OF REGISTER
BOT	BOTTOM
BOU	BOTTOM OF UNIT
BP	BASE PLATE
BRG	BEARING
BRGP	BEARING PLATE
BRKT	BRACKET
BS	BOTH SIDES
BTU	BRITISH THERMAL UNIT
BTW	BETWEEN
BTWLD	BUTT WELD
BU	BELL UP, BUILT-UP
BUR	BUILT-UP ROOFING
BW	BOTH WAYS
BYP	BYPASS
C TO C	CENTER TO CENTER
C&G	CURB AND GUTTER
C	CHANNEL SHAPE, CENTIGRADE, CONDUIT
CAB	CABINET
CAP	CAPACITY
CAT	CATALOG, CATALOGIORY
CAV	CAVITY
CB	CATCH BASIN
CCB	CONCRETE BLOCK
CCW	COUNTER CLOCKWISE
CDF	CONTROLLED-DENSITY FILL
CE	CONCRETE EDGE
CER	CERAMIC
CF	CUBIC FEET (FOOT)
CFL	COUNTER FLASHING
CHBD	CHALKBOARD
CHD	CHORD
CHFR	CHAMFER
CHH	COMMUNICATION HANDHOLE
CI	CURB INLET
CIP	CAST-IN-PLACE
CIPB	CONCRETE INTERLOCKING PAVER BALLAST
CIRC	CIRCULATION, CIRCULAR
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTERLINE, CLASS, CLOSE
CLG	CEILING
CLKG	CAULKING
CLR	CLEAR
CMH	COMMUNICATION MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT, CONCRETE OPENING
COL	COLUMN
COM	COMMON
COMB	COMBINATION
COMM	COMMUNICATION
COMP	COMPOSITION, COMPRESSIBLE, COMPOSITE
CON	CONCENTRIC
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
COOR	COORDINATE
CORR	CORROSIVE, CORRUGATED
CP	CHECKER PLATE, CONTROL POINT
CPLG	COUPLING
CRL	CORROSION-RESISTANT LINING
CSC	COMPRESSION SLEEVE COUPLING
CSK	COUNTERSINK
CSS	CLINIC SERVICE SINK
CT	CERAMIC TILE
CTJ	CONTRACTION JOINT
CTR	CENTER
CTRL	CONTROL
CVT	CULVERT
CU	COPPER, CUBIC
CW	CLOCKWISE
CY	CUBIC YARD
d	PENNY (NAIL MEASURE)
D	DEEP, DIFFUSER, DRAIN
DB	DUCT BANK, DECIBEL, DRY BULB
DBA	DEFORMED BAR ANCHOR
DBL	DOUBLE
DC	DIRECT CURRENT
DEG	DEGREE
DEG C	DEGREE CENTIGRADE
DEG F	DEGREE FAHRENHEIT
DEMO	DEMOLITION
DEP	DEPRESSED
DEPT	DEPARTMENT
DET	DETAIL
DI	DROP INLET, DUCTILE IRON, DIGITAL INPUT
DIA	DIAMETER
DIAG	DIAGONAL, DIAGRAM
DIFF	DIFFERENTIAL, DIFFERENCE
DIM	DIMENSION
DISCH	DISCHARGE
DIST	DISTANCE, DISTRIBUTION
DIV	DIVISION
DL	DEAD LOAD
DMJ	DOUBLE MECHANICAL JOINT
DMPF	DAMP PROOFING
DN	DOWN
DO	DISSOLVED OXYGEN, DIGITAL OUTPUT, DITTO
DP	DEPTH
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DS	DOWN SPOUT
DT	DOUBLE TEE, DRIP TRAP ASSEMBLY
DUP	DUPLICATE
DWG	DRAWING
DWL	DOWEL
DWR	DRAWER
E	EAST
EA	EACH, EXHAUST AIR
EC	ELECTRICAL CONTRACTOR
ECC	ECCENTRIC
ED	EQUIPMENT DRAIN
EDB	ELECTRICAL DUCT BANK
EE	EACH END
EF	EACH FACE
EFF	EFFLUENT, EFFICIENCY
EHH	ELECTRICAL HANDHOLE
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELBOW, ELEVATION
ELEC	ELECTRICAL
EMBD	EMBEDDED
EMER	EMERGENCY
EMH	ELECTRICAL MANHOLE
ENCL	ENCLOSURE
ENGR	ENGINEER
ENTR	ENTRANCE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQUIP	EQUIPMENT
EQUIV	EQUIVALENT
ES	EACH SIDE, EQUAL SPACE, EMERGENCY SHOWER
ESEW	EMERGENCY SHOWER AND EYE WASH
EST	ESTIMATE
EW	EACH WAY, EMERGENCY EYE/FACE WASH
EWC	ELECTRIC WATER COOLER
EWEF	EACH WAY, EACH FACE
EWTB	EACH WAY, TOP AND BOTTOM
EXC	EXCAVATION
EXH	EXHAUST
EXP	EXPANSION, EXPOSED
EXST	EXISTING
EXT	EXTERIOR, EXTERNAL, EXTENSION
F TO F	FACE TO FACE
F&B	FACE AND BYPASS
FAB	FABRICATE
FB	FLOOR BEAM
FBD	FIBERBOARD
FBG	FIBERGLASS
FBM	BOARD FOOT MEASURE
FBO	FURNISHED BY OWNER
FC	FLUSHING CONNECTION
FCA	FLANGED COUPLING ADAPTER
FD	FLOOR DRAIN
FDC	FLEXIBLE DUCT CONNECTION
FDR	FEEDER
FDTN	FOUNDATION
FE	FLANGED END
FEC	FIRE EXTINGUISHER CABINET
FES	FLARED END SECTION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE, FACTORY FINISH, FLAT FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISH
FJT	FLUSH JOINT
FL	FLOW, FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLOR	FLUORESCENT
FLR	FLOOR
FLS	FLASHING, FLUSH
FN	FENCE
FO	FINISHED OPENING, FIBER OPTIC
FOB	FLAT ON BOTTOM
FOC	FACE OF CONCRETE, FACE OF CURB
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FRTM	FIRE RETARDANT TREATED MATERIAL
FS	FLOOR SINK, FAR SIDE
FT	FEET, FOOT
FTG	FOOTING, FITTING
FUR	FURRED, FURRING
FURN	FURNITURE, FURNISH
FUT	FUTURE
FV	FACE VELOCITY
FW	FIELD WELD, FIRE WALL
FWD	FORWARD
FWE	FURNISHED WITH EQUIPMENT
FXTR	FIXTURE
G	GRILLE, GROUND
GA	GAGE (METAL THICKNESS)
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR, GRADE BREAK
GC	GROOVED COUPLING
GD	GUARD
GEN	GENERAL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFMU	GROUND FACE MASONRY UNIT
GG	GUTTER GRADE
GJ	GROOVED JOINT
GL	GLASS
GLB	GLASS BLOCK, GLULAM BEAM
GND	GROUND
GP	GUY POLE
GR	GRADE
GRTG	GRATING
GSB	GYPSUM SHEATHING BOARD
GT	GREASE TRAP
GVL	GRAVEL
GW	GUY WIRE
GWB	GYPSUM WALLBOARD
GYP	GYPSUM HARDBOARD
H	HIGH
HB	HOSE BIBB
HBD	HARDBOARD
HC	HANDICAPPED, HOLLOW CORE, HORIZONTAL CURVE, HORIZONTAL CENTERLINE
HD	HEAD, HOT DIP
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
HGR	HANGER
HH	HANDHOLE
HID	HIGH-INTENSITY DISCHARGE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HIGH POINT, HORSEPOWER
HPC	HORIZONTAL POINT OF CURVATURE
HPS	HIGH-PRESSURE SODIUM
HPT	HORIZONTAL POINT OF TANGENCY
HR	HOSE REEL, HOUR
HS	HEADED STUD, HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SHAPE
HT	HEIGHT
HTG	HEATING
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWD	HARDWOOD
HWL	HIGH WATER LEVEL
HYD	HYDRAULIC
HZ	HERTZ, CYCLES PER SECOND
ID	INSIDE DIAMETER, INTERIOR DIMENSION
IE	INVERT ELEVATION, FOR EXAMPLE
IF	INSIDE FACE
IH	INTAKE HOOD
IMP	IMPACT
IN	INCH
INC	INCLUDE, INCANDESCENT
INF	INFLUENT
INSTR	INSTRUMENTATION
INSUL	INSULATION
INT	INTERIOR, INTERSECTION
INTR	INTERMEDIATE, INTERIOR
INV	INVERT
IPS	IRON PIPE SIZE
IPT	INTERNAL PIPE THREAD
IR	INSIDE RADIUS, IRON ROD
IRR	IRRIGATION
ISO	ISOMETRIC
JB	JUNCTION BOX
JCT	JUNCTION
JF	JOINT FILLER
JST	JOIST
JT	JOINT
K	KIP
KB	KNEE BRACE
KCMIL	THOUSAND CIRCULAR MILS
KD	KNOCK DOWN
KO	KNOCK OUT
KSI	KIPS PER SQUARE INCH
KW	KILOWATT
L	ANGLE, LENGTH, LAVATORY, LINTEL
LAD	LADDER
LAM	LAMINATE
LATL	LATERAL
LB	LAG BOLT, POUND
LCTB	LIQUID CHALK AND TACK BOARD
LDG	LANDING
LDR	LEADER
LE	LIFTING EYE
LF	LINEAR FOOT
LG	LONG
LH	LEFT HAND
LIN	LINEAR
LIQ	LIQUID
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LMLU	LIQUID MARKER LECTURE UNIT
LNG	LONGITUDINAL
LOC	LOCATION
LP	LOW POINT
LPS	LOW-PRESSURE SODIUM
LR	LONG RADIUS
LT	LEFT
LTD	LIMITED
LTG	LIGHTING
LTL	LINTEL
LTNG	LIGHTNING
LV	LOW VOLTAGE
LVL	LAMINATED VENEER LUMBER
LVR	LOUVER
LW	LIGHTWEIGHT
LWC	LIGHTWEIGHT CONCRETE
LWL	LOW WATER LEVEL
MA	MIXED AIR
MACH	MACHINED
MAINT	MAINTENANCE
MAN	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MBR	MEMBER
MC	MECHANICAL CONTRACTOR, MECHANICAL COUPLING, MOMENT CONNECTION
MCB	METAL CORNER BEAD
MCJ	MASONRY CONTROL JOINT
MDMJ	MODIFIED DOUBLE MECHANICAL JOINT
MECH	MECHANICAL
MED	MEDIUM
MFR	MANUFACTURER
MH	MANHOLE, METAL HALIDE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
ML	MASONRY LINTEL
MLO	MAIN LUGS ONLY
MMB	MEMBRANE
MO	MASONRY OPENING
MOD	MODULAR, MODIFY
MON	MONUMENT
MPT	MALE PIPE THREAD
MRGWB	MOISTURE-RESISTANT GYPSUM WALLBOARD
MS	MOP SINK
MSL	MEAN SEA LEVEL
MT	MOUNT
MU	MASONRY UNIT
MULL	MULLION
MV	MEDIUM VOLTAGE
MW	MONITORING WELL
N	NORTH, NEUTRAL
NA	NOT APPLICABLE
NAT	NATURAL, NATIONAL
NC	NORMALLY CLOSED
NEG	NEGATIVE
NF	NEAR FACE, NON-FUSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NPS	NOMINAL PIPE SIZE
NPT	NATIONAL PIPE THREAD
NS	NEAR SIDE
NTS	NOT TO SCALE
NWL	NORMAL WATER LEVEL
O TO O	OUT TO OUT
OA	OUTSIDE AIR, OVERALL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
OD	OUTSIDE DIAMETER
OED	OPEN END DUCT
OF	OUTSIDE FACE, OFFICE FURNISHING
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
OG	ORIGINAL GROUND
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
OR	OUTSIDE RADIUS
ORD	OVERFLOW ROOF DRAIN
ORIG	ORIGINAL
OVFL	OVERFLOW
OVHG	OVERHANG
OZ	OUNCE
P	PAINT
PA	PUBLIC ADDRESS
PAR	PARALLEL, PARAPET
PB	PANIC BAR, PULL BOX
PBD	PARTICLE BOARD
PC	POINT OF CURVE, PIECE, PRECAST
PCC	POINT OF COMPOUND CURVATURE
PCF	POUNDS PER CUBIC FOOT
PCT	PERCENT
PE	PLAIN END
PED	PEDESTAL
PEN	PENETRATION
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PF	POWER FACTOR
PFMU	PREFACED MASONRY UNIT
PH	PHASE
PI	POINT OF INTERSECTION
PKG	PACKAGE
PL	PLATE, PROPERTY LINE, PRECAST LINTEL
PLAS	PLASTER
PLAT	PLATFORM
PLBG	PLUMBING
PLF	POUNDS PER LINEAR FOOT
PNEU	PNEUMATIC
POL	POLISH
POS	POSITIVE, POSITION
PP	POLYPROPYLENE, POWER POLE
PRC	POINT OF REVERSE CURVATURE
PREF	PREFINISHED
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PREP	PREPARE
PRES	PRESSURE
PRI	PRIMARY
PROP	PROPERTY, PROPOSED
PROT	PROTECTION
PS	PIPE SUPPORT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PST	PRESTRESSED
PT	POINT, POINT OF TANGENCY
PTN	PARTITION
PVC	POLYVINYL CHLORIDE, POINT OF VERTICAL CURVE
PVMT	PAVEMENT
PWD	PLYWOOD
PWJ	PLYWOOD WEB JOIST
PZ	PIEZOMETER
Q	RATE OF FLOW
QT	QUARRY TILE
QTR	QUARTER
QTY	QUANTITY
QUAL	QUALITY
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
R	RADIUS, REGISTER, RISER
RA	RETURN AIR
RB	RESILIENT BASE, ROCK BERM
RCPT	RECEPTACLE
RD	ROOF DRAIN
REC	RECESS
RECD	RECEIVED
RECT	RECTANGULAR
RED	REDUCER
REF	REFERENCE
REINF	REINFORCING
REM	REMOVE
REQD	REQUIRED
RESIL	RESILIENT
RET	RETAINING, RETURN
REV	REVISION, REVERSE
RF	RESILIENT FLOORING
RFG	ROOFING
RFL	REFLECTED, REFLECTOR
RGH	ROUGH
RGS	RIGID GALVANIZED STEEL
RGS-PVC	PVC COATED RGS
RH	RELIEF HOOD, RIGHT HAND, RELATIVE HUMIDITY
RL	REQUIRED LAP
RLFA	RELIEF AIR
RND	ROUND
RNG	RUNNING
RO	ROUGH OPENING
ROW	RIGHT-OF-WAY
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RSP	ROCK SLOPE PROTECTION
RT	RIGHT
RVT	RESILIENT VINYL TILE
RY	READY
S	SOUTH, SINK
SA	SUPPLY AIR
SAMU	SOUND-ABSORBING MASONRY UNIT
SAN	SANITARY
SB	SPLASH BLOCK
SC	SOLID CORE
SCH	SCHEDULE
SCHEM	SCHEMATIC
SCN	SCREEN
SE	STEEL/ALUMINUM EDGE
SEC	SECONDARY, SECONDS
SECT	SECTION
SEP	SEPARATE
SF	SQUARE FOOT, SILT FENCE
SG	SHEET GLASS, SEALANT GROOVE
SH	SHOWER
SHT	SHEET
SHTG	SHEATHING
SIL	SILENCE
SIM	SIMILAR
SJ	SLAB JOINT
SL	SLOPE, STEEL LINTEL
SLTD	SLOTTED
SLV	SLEEVE
SMLS	SEAMLESS
SOG	SLAB ON GRADE
SP	SOUNDPROOF, STANDPIPE
SPA	SPACING
SPEC	SPECIFICATION
SPLY	SUPPLY
SPST	SINGLE POLE SINGLE THROW
SPT	SET POINT
SQ	SQUARE
SR	SHORT RADIUS
SS	SERVICE SINK
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STIF	STIFFENER
STIR	STIRRUP
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL, STRAIGHT
SUB	SUBSTITUTE
SUC	SUCTION
SUSP	SUSPENDED
SY	SQUARE YARD
SYM	SYMBOL
SYMM	SYMMETRICAL
SYN	SYNTHETIC
SYS	SYSTEM
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T	TILE, TREAD
TA	TOILET ACCESSORY, TEMPERED AIR
TAN	TANGENT
TBM	TEMPORARY BENCHMARK
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEF	TROWELED EPOXY FLOORING
TEMP	TEMPORARY, TEMPERATURE
THD	THREAD
THK	THICK
THRESH	THRESHOLD
TKBD	TACK BOARD
TOB	TOP OF BOLT, TOP OF BANK, TOP OF BEAM, TOP OF BERM
TOC	TOP OF CURB, TOP OF CONCRETE
TOD	TOP OF DUCT
TOF	TOP OF FOOTING
TOG	TOP OF GRATING
TOL	TOLERANCE, TOP OF LEDGER
TOM	TOP OF MASONRY
TOP	TOP OF PLATE
TOPO	TOPOGRAPHY
TOS	TOP OF SLAB, TOP OF STEEL, TOE OF SLOPE
TOW	TOP OF WALL
TP	TOILET PARTITION, TELEPHONE POLE, TOE PLATE, TRAP PRIMER
TPD	TOILET PAPER DISPENSER
TPG	TOPPING, THROUGH PLATE GIRDER
TR	TRANSOM
TRANS	TRANSITION
TRD	TRENCH DRAIN
TYP	TYPICAL
U	URINAL
UG	UNDERGROUND
ULT	ULTIMATE
UNFN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
V	VENT, VELOCITY, VOLT
VA	VOLT AMPERE
VAC	VACUUM
VAR	VARNISH, VARIABLE, VOLT AMPERES REACTIVE
VB	VAPOR BARRIER, VINYL BASE, VALVE BOX
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VCT	VINYL COMPOSITION TILE, VERTICAL CENTERLINE
VEL	VELOCITY
VENT	VENTILATION
VERT	VERTICAL
VERTS	VERTICAL REINFORCING
VG	VERTICAL GRAIN
VIF	VERIFY IN FIELD
VIN	VINYL
VOL	VOLUME
VPC	VERTICAL POINT OF CURVATURE
VPI	VERTICAL POINT OF INTERSECTION
VPT	VERTICAL POINT OF TANGENCY
VS	VERSUS, VAPOR SEAL
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W/	WITH
W/O	WITHOUT
W	WATT, WEST, WIDE, WINDOW, WIRE, WIDE FLANGE BEAM
WB	WOOD BASE
WC	WATER CLOSET, WATER COLUMN
WD	WOOD, WIDTH
WF	WIDE FLANGE, WASH FOUNTAIN
WG	WIRE GLASS, WATER GAGE
WH	WALL HYDRANT, WEEP HOLE
WI	WROUGHT IRON
WL	WATER LEVEL
WLD	WELDED
WM	WIRE MESH
WP	WEATHERPROOF
WS	WATERSTOP, WATER SURFACE
WSCT	WAINSCOT
WT	WEIGHT, WATER TIGHT
WTHP	WATERPROOF, WORKING POINT
WWF	WELDED WIRE FABRIC
XP	EXPLOSION-PROOF
XS	EXTRA STRONG
XSECT	CROSS SECTION
XXS	DOUBLE EXTRA STRONG
YH	YARD HYDRANT
YS	YIELD STRENGTH

GENERAL NOTES:

1. THESE ABBREVIATIONS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.
2. LISTING OF ABBREVIATIONS DOES NOT IMPLY THAT ALL ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS.
3. ABBREVIATIONS SHOWN ON THIS SHEET INCLUDE VARIATIONS OF A WORD. FOR EXAMPLE, "MOD" MAY MEAN MODIFY OR MODIFICATION; "INC" MAY MEAN INCLUDED OR INCLUDING AND "REINF" MAY MEAN EITHER REINFORCE OR REINFORCING.
4. SEE INSTRUMENTATION LEGEND SHEET FOR PROJECT-SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

HDR

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER KENT R. THERNES F-4202 STATE OF NEBRASKA

CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

URANIUM REMOVAL

WATER TREATMENT PLANT

GENERAL ABBREVIATIONS

0 1" 2"

FILENAME	00G-01.DWG
SCALE	NO SCALE

SHEET 00G-01

GENERAL NOTES:

THESE GENERAL NOTES APPLY TO THE ENTIRE SET OF DRAWINGS; HOWEVER SOME GENERAL NOTES, OR PARTS THEREOF, MAY NOT BE APPLICABLE TO INDIVIDUAL SHEETS.

1. COORDINATE THE PROTECTION, TEMPORARY SUPPORT, ADJUSTMENT, OR RELOCATION OF ANY UTILITIES AND STRUCTURES (UNDERGROUND, SURFACE, OR OVERHEAD) REQUIRED FOR INSTALLATION OF THE EQUIPMENT WITH THE OWNER OF EACH UTILITY BEFORE CONSTRUCTION IS STARTED.
2. EXISTING UTILITIES AND STRUCTURES (UNDERGROUND, SURFACE, OR OVERHEAD) ARE INDICATED ONLY TO THE EXTENT THAT SUCH INFORMATION WAS MADE AVAILABLE TO OR DISCOVERED BY THE ENGINEER IN PREPARING THE DRAWINGS.
3. "SCREENED" (LIGHT) DELINEATION DENOTES EXISTING FACILITIES. "SCREENED" INFORMATION WAS TAKEN FROM PREVIOUS CONSTRUCTION DRAWINGS AND IS FOR REFERENCE ONLY AND SHALL BE FIELD VERIFIED. "BOLD" (DARK) DELINEATION IS WORK TO BE CONSTRUCTED UNDER THIS PROJECT.
4. ALL EXISTING ITEMS SHALL BE PROPERLY BRACED, SUPPORTED, AND PROTECTED IN PLACE TO MAINTAIN THEIR EXISTING CONSTRUCTION AND INTEGRITY.
5. CONTRACTOR TO FIELD VERIFY EXISTING INSTALLATION AND DIMENSIONS AS SHOWN AND THAT THEY ARE CONSISTENT WITH PROJECT REQUIREMENTS. NEW PIPING AND EQUIPMENT INSTALLATION SHALL BE COORDINATED WITH EXISTING CONDITIONS.
6. CONTRACTOR TO REMOVE AND RESTORE INCIDENTAL ITEMS OF WORK NOT SPECIFICALLY IDENTIFIED TO BE REMOVED AND REPLACED. RESTORE TO EQUAL OR BETTER THAN ORIGINAL CONDITION.
7. PROJECT SITE IS LOCATED IN A SECURED LOCATION. CONTRACTOR TO COORDINATE ACCESS TO THE SITE WITH THE OWNER AND MAINTAIN SECURITY TO THE AREA.
8. CONTRACTOR MAY USE THE DRIVE AROUND THE BUILDING PERIMETER FOR A STAGING AREA. COORDINATE WITH THE OWNER FOR THE LIMITS OF THE STAGING AREA. RESTORE DRIVE TO EQUAL OR BETTER THAN ORIGINAL CONDITION.
9. THE DRAWING SHEETS MARKED AS "INFORMATIONAL PURPOSES ONLY" ARE BEING CONSTRUCTED BY OTHERS. CONTRACTOR SHALL COORDINATE WITH OTHERS AS NECESSARY FOR PROJECT COMPLETION. IF CONSTRUCTION SCHEDULES OVERLAP, EQUIPMENT INSTALLATION CONTRACTOR SHALL COORDINATE WITH BUILDING INSTALLATION CONTRACTOR FOR MINIMAL IMPACT TO CONSTRUCTION PROGRESS OR SCHEDULES.
10. SEE SHOP DRAWING SUBMITTAL 11301–01 GRAND ISLAND URANIUM REMOVAL WTP SYSTEM FROM WRT FOR INFORMATION PERTAINING TO SCHEDULE OF EQUIPMENT AND INSTALLATION DRAWINGS FOR ITEMS PROVIDED BY WRT.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER — BRENT BAUER — 4202 — STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

GENERAL NOTES

0 1" 2"

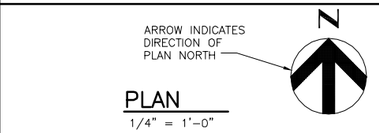
FILENAME	00G-02.DWG
SCALE	NO SCALE

SHEET **00G-02**

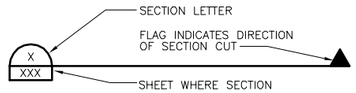
MATERIALS IN PLAN/SECTION

- ACOUSTICAL CEILING TILE (SECTION)
- ASPHALT (PLAN OR SMALL–SCALE SECTION)
- ASPHALT (LARGE–SCALE SECTION)
- BATT INSULATION (SECTION)
- BRICK MASONRY (PLAN AND/OR SECTION)
- CHECKERED PLATE (PLAN)
- CONCRETE (PLAN AND/OR SECTION)
- CONCRETE MASONRY (PLAN AND/OR SECTION)
- DEMOLITION (PLAN AND/OR SECTION)
- EARTH (SECTION)
- FILTER POINT MAT (PLAN)
- FINISHED WOOD (SECTION)
- GLULAM LUMBER (SECTION)
- GRANULAR FILL (SECTION)
- GRATING (SECTION)
- GRATING (PLAN)
- GROUT (SECTION)
- GYPSUM BOARD (SECTION)
- METAL (SECTION)
- ORIENTED STRAND BOARD (SECTION)
- PARTICLE BOARD (SECTION)
- PLYWOOD (LARGE–SCALE SECTION)
- PLYWOOD (SMALL–SCALE SECTION)
- PRECAST CONCRETE (PLAN AND/OR SECTION)
- RIGID INSULATION (SECTION)
- RIPRAP (PLAN AND/OR SECTION)
- SAND (SECTION)
- SOD (SECTION)
- WEEP JOINT MORTAR PROTECTION SYSTEM (SECTION)
- WOOD – CONTINUOUS (SECTION)
- WOOD BLOCKING (SECTION)

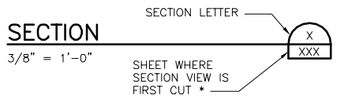
GENERAL SYMBOLOGY



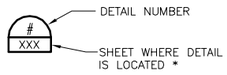
PLAN
1/4" = 1'–0"
PLAN TITLE



SECTION CUT MARKER



SECTION TITLE

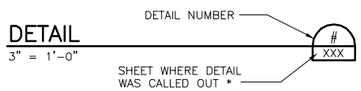


DETAIL MARKER

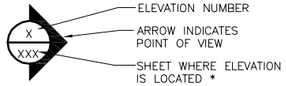
FOR REFERENCING DETAILS INCLUDED IN DRAWING SET.

DETAIL MARKER

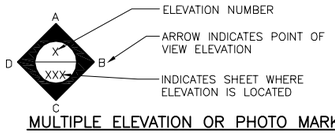
FOR REFERENCING DETAILS BOUND IN SPECIFICATIONS OR SEPARATE VOLUME.



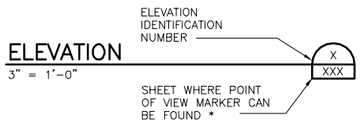
DETAIL TITLE



SINGLE ELEVATION OR PHOTO MARKER



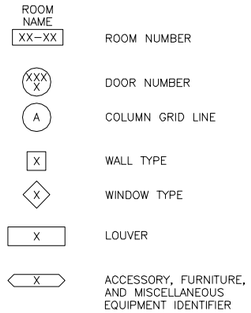
MULTIPLE ELEVATION OR PHOTO MARKER



ELEVATION TITLE

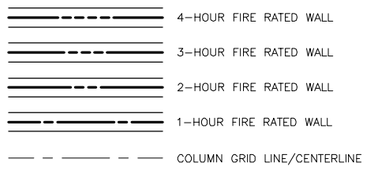
* EXCEPTIONS WHERE THE SHEET NUMBER IS REPLACED BY A DASH (–).
1) FOR COMMON DETAILS, SECTIONS, ELEVATIONS OR DETAILS THAT ARE CUT OR CALLED OUT ON MULTIPLE SHEETS.
2) SECTIONS, ELEVATIONS OR DETAILS THAT ARE LOCATED ON THE SAME SHEET THEY ARE CUT OR CALLED OUT ON.

ARCHITECTURAL



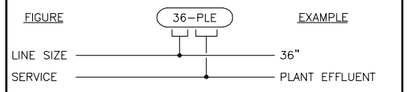
KEY NOTE DESIGNATION

GENERAL LINE SYMBOLOGY



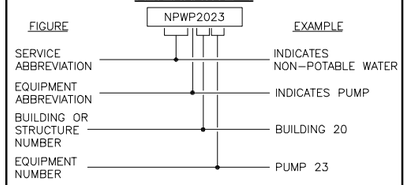
IDENTIFICATION SYMBOLOGY

PIPING

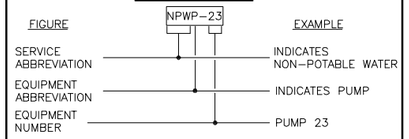


EQUIPMENT IDENTIFICATION

ALTERNATIVE 1



ALTERNATIVE 2



SHEET NAMING CONVENTION

AREA DESIGNATION

TO BE EDITED ON AN A PROJECT BASIS. TO BE DETERMINED BY THE PROJECT MANAGER, THEN ADDED TO THE GENERAL LEGEND.
EXAMPLE:
01 BUILDING OR AREA NAME
02 BUILDING OR AREA NAME
03 BUILDING OR AREA NAME

DISCIPLINE DESIGNATOR & DISCIPLINE ORDER

G	GENERAL
V	SURVEYING/MAPPING
X	DEMOLITION
C	CIVIL
L	LANDSCAPING
U	MULTI–DISCIPLINE
S	STRUCTURAL
A	ARCHITECTURAL
D	PROCESS
M	MECHANICAL (HVAC)
P	PLUMBING
F	FIRE PROTECTION
E	ELECTRICAL
Y	INSTRUMENTATION

DRAWING TYPE DESIGNATOR

0	GENERAL (SYMBOLS, LEGENDS)
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE SCALE VIEWS
5	DETAILS
6	SCHEDULES AND DIAGRAMS
8	PROFILES
9	3D REPRESENTATIONS

EXAMPLE

GRAVITY THICKENER ARCHITECTURAL SECTION, SHEET 01

0	5				

AREA DESIGNATION

		A			

DISCIPLINE DESIGNATOR

			3		

SHEET TYPE DESIGNATOR

				0	1

SHEET NUMBER

GENERAL NOTES:

1. THIS IS A STANDARD SHEET SHOWING COMMON SYMBOLOGY. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE–EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER
KENT THERNES
HDR
E-4202
STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

GENERAL LEGEND

0 1" 2"

FILENAME	00G–03.DWG
SCALE	NO SCALE

SHEET
00G-03

CIVIL MAPPING SYMBOLOGY

- EMBANKMENT SLOPE (CUT)
- EMBANKMENT SLOPE (FILL)
- EMBANKMENT SLOPE RIGHT ARROW RIGHT
- EMBANKMENT SLOPE LEFT ARROW LEFT
- SPOT ELEVATION/POINT #
- SURVEY BENCHMARK
- SURVEY CONTROL POINT
- HORIZONTAL CONTROL POINT
- VERTICAL CONTROL POINT
- SECTION CORNER MONUMENT
- SECTION CORNER NO MONUMENT
- IDENTIFICATION AND APPROXIMATE LOCATION OF SOIL TEST HOLE
- TEST PIT
- SOIL BORING
- BUOY
- FLOW ARROW
- WATER LEVEL IN SECTION/PROFILE
- TIDE GAUGE
- EXISTING UTILITY POLE
- DOWNGUY
- EXTERIOR UTILITY JUNCTION BOX
- INTERSTATE HIGHWAY SYMBOL
- US HIGHWAY SYMBOL
- STATE HIGHWAY SYMBOL
- HAY BALE SILT CHECK
- TEMPORARY SEDIMENT TRAP
- PIEZOMETER
- RAIL SIGNAL
- RAIL SWITCH
- SIGN
- TIRE TREDDLE
- TRAFFIC ARM WITH CARD READER
- TRAFFIC ARM MECHANICAL SWING

- CLEANOUT
- CULVERT END SYMBOL (WITH CULVERT SHOWN BETWEEN SYMBOLS)
- FIRE HYDRANT
- FUEL OIL METER
- FUEL OIL MANHOLE
- FUEL OIL VAULT
- GREASE TRAP
- GRIT CHAMBER
- HEADWALL
- INDUSTRIAL WASTE WATER METER
- INDUSTRIAL WASTE WATER MANHOLE
- NATURAL GAS METER
- NATURAL GAS RECEIVER
- NATURAL GAS TRAP
- NATURAL GAS LINE VAULT
- MONITORING WELL
- POST INDICATOR VALVE
- PUMP STATION
- SANITARY MANHOLE
- SEPTIC TANK
- TANK BELOW GROUND
- TANK HORIZONTAL ABOVE GROUND
- TANK VERTICAL ABOVE GROUND

- STORM CATCH BASIN
- STORM ROUND CATCH BASIN
- STORM DRAINAGE MANHOLE
- WATER/AIR VENT
- WATER BACKFLOW PREVENTER
- WATER BLOWOFF
- WATER METER
- WATER SHUTOFF
- WATER SOFTENER
- WATER VALVE VAULT
- VALVE
- WELL

UTILITY/CIVIL LINE SYMBOLOGY

- PIPELINE
- LARGE PIPELINE
- UTILITY BENEATH STRUCTURE
- RAILROAD
- CENTERLINE
- BOTTOM OF DITCH
- PROPERTY LINE
- EASEMENT
- LIMITS OF CONSTRUCTION
- ROW
- EXISTING CONTOUR (MINOR)
- EXISTING CONTOUR W/ELEVATION (MAJOR)
- EXISTING FENCE
- EXISTING VEGETATION/BRUSH LINE
- FENCE – BARB WIRE
- FENCE – CHAIN LINK
- FENCE – FIELD
- FENCE – OTHER
- FENCE – WOOD
- FENCE – WOVEN WIRE
- FLOOD LIMIT (25 YEAR)
- FLOOD LIMIT (50 YEAR)
- FLOOD LIMIT (100 YEAR)
- FLOOD LIMIT (200 YEAR)
- FLOOD LIMIT (500 YEAR)
- HIGHWAY GUARDRAIL
- LEVEE TOP
- LEVEE TOE
- NEW CONTOUR (MINOR)
- NEW CONTOUR (MAJOR)
- ROCK BERM
- SILT FENCE
- TOE OF SLOPE
- TOP OF SLOPE

Line label	Description
FO	FIBER OPTIC
IW	FUEL OIL
G	NATURAL GAS
IW	INDUSTRIAL WASTE WATER
SS	SANITARY SEWER
SD	STORM SEWER
W	DOMESTIC WATER
NPW	DOMESTIC WATER NON-POTABLE

GENERAL NOTES:

1. THIS IS A STANDARD CIVIL SYMBOLOGY SHEET. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.

2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER E-4202 STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL WATER TREATMENT PLANT

CIVIL LEGEND

0 1" 2"

FILENAME	00G-04.DWG
SCALE	NO SCALE

SHEET **00G-04**

PIPING SYMBOLOGY

VALVES

SINGLE LINE	DOUBLE LINE	ISOLATION
		BALL VALVE
		BUTTERFLY VALVE
		DIAPHRAGM VALVE
		GATE VALVE
		GLOBE VALVE
		KNIFE GATE VALVE
		NEEDLE VALVE
		PINCH VALVE
		PLUG VALVE
		THREE–WAY BALL VALVE
		THREE–WAY PLUG VALVE
		CONTROL
		BALL CHECK VALVE
		CHECK VALVE
		DOUBLE–DISK CHECK VALVE
		CONE VALVE
OR	OR	PRESSURE RELIEF VALVE
		PRESSURE–REDUCING VALVE
X	X	AIR RELEASE VACUUM VALVE A = AIR RELEASE VAC = VACUUM
		PRESSURE–REGULATING VALVE
		3–WAY CONTROL VALVE

MISCELLANEOUS

- PIPE JOINT (SEE SPECS FOR REQUIREMENTS)
- COMPRESSION SLEEVE TYPE COUPLING
- FLANGED COUPLING ADAPTER (FCA)
- FLEXIBLE CONNECTION
- HARNESSED MECHANICAL COUPLING
- PRESSURE GAGE (W/COCK)
- TRAP
- QUICK DISCONNECT CAM & GROOVE COUPLING
- CAP OR PLUG
- CO — INTERIOR CLEANOUT
- HB–X — HOSE VALVE, HOSE BIBB, OR FLUSHING CONNECTION
- HR–X — HOSE RACK
- FD–X — FLOOR DRAIN
- X = TYPE DESIGNATED IN SPECIFICATIONS
- PIPE IN SECTION
- BU — BELL UP (PLAN)
- BU — BELL UP (SECTION OR SCHEMATIC)
- D — DRAIN (SECTION OR SCHEMATIC)
- ATA — AIR TOOL ASSEMBLY
- AVS — AUTOMATIC VALVE STATION
- PRS — PRESSURE–REDUCING STATION

MISCELLANEOUS

- BACKFLOW PREVENTER
- M — WATER METER
- VARIABLE AREA METER
- UNION
- WYE–STRAINER
- PENETRATION THROUGH STRUCTURE
- FLEXIBLE HOSE OR TUBING
- FLEXIBLE PIPING CONNECTION
- LINE SIZE CHANGE (CONCENTRIC REDUCER)
- LINE SIZE CHANGE (ECCENTRIC REDUCER)
- LINE TURNING DOWN
- LINE TURNING UP
- BLIND FLANGE
- PIPE BREAK

NOTE:
MISCELLANEOUS SYMBOLOGY SHOWN IS FOR SINGLE–LINE PIPING. DOUBLE–LINE PIPING SYMBOLS ARE SIMILAR.

PLUMBING SYMBOLOGY

- VT — VENT (VT)
- POTABLE WATER, COLD (PWC)
- POTABLE WATER, HOT (PWH)

HVAC SYMBOLOGY

- 24x18 — SUPPLY AIR OR OUTSIDE AIR DUCT UP (SECTION CUT, FIRST DIMENSION DUCT WIDTH)
- SUPPLY AIR OR OUTSIDE AIR DUCT DOWN (NO SECTION CUT)
- RETURN AIR DUCT UP (SECTION CUT)
- RETURN AIR DUCT DOWN (NO SECTION CUT)
- EXHAUST AIR DUCT UP (NO SECTION CUT)
- EXHAUST AIR DUCT DOWN (NO SECTION CUT)
- ROUND ELBOW UP
- ROUND ELBOW DOWN
- TRANSITION – DOUBLE SIDED
- TRANSITION – ONE SIDED
- TRANSITION – RECTANGULAR TO ROUND DUCT
- STANDARD BRANCH – FOR SUPPLY AIR W/EXTRACTOR AND RETURN AIR W/O EXTRACTOR
- ELBOW – W/TURNING VANE (RECTANGULAR)
- ELBOW – W/TURNING VANES (RECTANGULAR), SMOOTH RADIUS
- GOOSENECK HOOD (COWL)
- 18x24 — RECTANGULAR DUCT OR OPENING SIZE – FIRST NUMBER INDICATES SIZE OF SIDE SHOWN
- 18" DIA — ROUND DUCT SIZE
- R OR D — RECTANGULAR DUCT INCLINE – RISE OR DROP IN RESPECT TO THE AIR FLOW
- R OR D — ROUND DUCT INCLINE – RISE OR DROP IN RESPECT TO THE AIR FLOW
- 18x24 — HIDDEN DUCT
- T 9'–10" / B 9'–0" / 18x10 — DUCT ELEVATION TAG ABOVE FINISH FLOOR
- PRESSURE/TEMPERATURE TEST PLUG (PETE PLUG OR EQUAL)
- SA — SOUND ATTENUATOR
- SD SD — SPLITTER DAMPER
- VD, BDD — VD = VOLUME DAMPER, BDD = BACKDRAFT DAMPER
- M — MOTOR OPERATED DAMPER
- FIRE DAMPER
- SMOKE DAMPER
- SMOKE AND FIRE DAMPER

- FLEXIBLE CONNECTION
- FLEXIBLE DUCT
- ACOUSTICAL LINING – DUCT DIMENSIONS FOR NET FREE AREA
- SIZE / CFM — SUPPLY AIR REGISTER OR GRILLE – W/DUCT–MOUNTED EXTRACTOR
- SIZE / CFM — EXHAUST AIR OR RETURN AIR REGISTER OR GRILLE
- SIZE / CFM — EXHAUST AIR OR RETURN AIR REGISTER OR GRILLE
- SIZE / CFM — SUPPLY AIR ASSEMBLY SQUARE DIFFUSER
- SIZE / CFM — SUPPLY AIR ASSEMBLY ROUND DIFFUSER
- WALL LOUVER
- AD PLAN / AD SECTION — ACCESS DOOR
- UC 3/4" — UNDERCUT DOOR 3/4"
- AD — ACCESS DOOR OR ACCESS PANEL IN DUCTWORK
- INTAKE OR RELIEF HOOD
- DOOR GRILLE
- AIR FLOW — BACKDRAFT DAMPER
- EXHAUST ROOF VENTILATOR PROPELLER OR CENTRIFUGAL TYPE
- PROPELLER WALL FAN
- ROOM AIR CONDITIONING UNIT
- INTAKE/EXHAUST LOUVER
- SUPPLY, RETURN OR EXHAUST FAN
- AIR FILTER

HVAC CONTROL SYMBOLOGY

- TC — TEMPERATURE CONTROLLER
- TT — TEMPERATURE TRANSMITTER
- TS — TEMPERATURE SWITCH
- T — THERMOSTAT
- TI — TEMPERATURE INDICATOR
- % — PERCENTAGE TIMER
- RC — RECEIVER CONTROLLER
- HOA — HAND–OFF–AUTO
- MS — MOTOR STARTER
- M — DAMPER ACTUATOR
- PI — PRESSURE INDICATOR
- FRZ — FREEZE STAT
- FS — FIRE STAT
- DPS — DIFFERENTIAL PRESSURE SWITCH
- SD — SMOKE DETECTOR
- FS — FLOW SWITCH
- PS — PRESSURE SWITCH
- D — TIME DELAY
- M — MINIMUM POSITION RELAY
- S — SIGNAL
- AO — ANALOG OUTPUT
- AI — ANALOG INPUT
- DO — DIGITAL OUTPUT
- DI — DIGITAL INPUT
- C — COMMON PORT
- S — SIGNAL PORT
- NO — NORMALLY OPEN
- NC — NORMALLY CLOSED
- BALANCING VALVE
- RHC — RESISTANCE HEATING CONTACTOR
- TA — TEST–AUTO
- TOA — TEST–OFF–AUTO
- ELECTRIC SIGNAL
- PIPING
- BULB–TYPE THERMOSTAT

AIR FLOW SCHEMATIC AND TEMPERATURE CONTROL DIAGRAM SYMBOLOGY

- C / C — CHILLED WATER COOLING COIL
- H / C — HOT WATER HEATING COIL
- EP / R — DIRECT EVAPORATIVE COOLER
- D / X — DIRECT EXPANSION COOLING COIL
- EH / C — ELECTRIC HEATING COIL
- VFD — VFD (VARIABLE FREQUENCY DRIVE)
- H / C CAV — CONSTANT AIR VOLUME BOX WITH REHEAT COIL
- H / C VAV — VARIABLE AIR VOLUME BOX WITH REHEAT COIL

MISCELLANEOUS SYMBOLOGY

- MIST ELIMINATOR
- ACTIVATED CARBON OR CHEMICAL FILTER
- CENTRIFUGAL PUMP
- SPRAY NOZZLE/HUMIDIFIER

GENERAL NOTES:

1. THIS IS A STANDARD PROCESS, MECHANICAL AND PLUMBING SYMBOLOGY SHEET. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE–EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
3. SEE INSTRUMENTATION LEGEND SHEET FOR PROJECT–SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER — KENT THERNES — 4202 — STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

MECHANICAL LEGEND

0 1" 2"

FILENAME	00G–05.DWG
SCALE	NO SCALE

SHEET **00G–05**

LOW – VOLTAGE CIRCUIT BREAKER (CB). RATINGS AND NO. OF POLES AS SHOWN. WHEN SPECIFIC TYPE IS REQUIRED, X INDICATES TYPE.

TYPES:
MCCB – MOLDED CASE
ICCB – INSULATED CASE
LVP – LOW – VOLTAGE POWER
MCP – MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)

SEPARATELY MOUNTED CIRCUIT BREAKER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION

GROUND FAULT PROTECTION

MEDIUM – VOLTAGE CIRCUIT BREAKER

FUSE, SIZE, AND NUMBER OF FUSES AS NOTED

FUSED CUTOUT, CURRENT RATING, FUSE SIZE, AND NUMBER OF POLES AS NOTED

FUSIBLE SWITCH, CURRENT RATING, FUSE SIZE, AND QUANTITY AS NOTED

NON–FUSED SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED

DISCONNECT OR DRAWOUT CONNECTION

MAGNETIC MOTOR STARTER AND SEPARATELY MOUNTED COMBINATION MAGNETIC MOTOR STARTER

MOTOR CONTROLLER AND SEPARATELY MOUNTED MOTOR CONTROLLER WITH SHORT CIRCUIT PROTECTION AND DISCONNECT

MOTOR STARTER AND CONTROLLER SUBSCRIPTS:

A – MAGNETIC STARTER NEMA SIZE

B – STARTER TYPE
NONE – FULL VOLTAGE NON–REVERSING (FVNR)
FVR – FULL VOLTAGE REVERSING
2S – TWO SPEED
RVAT – REDUCED VOLTAGE AUTO TRANSFORMER

C – CONTROL DIAGRAM OR CONTROLS SCHEDULE NUMBER (IF REQUIRED)

D – CONTROLLER TYPE
VFD – VARIABLE FREQUENCY DRIVE
SS – SOLID STATE

SEPARATELY MOUNTED COMBINATION MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION

THERMAL OVERLOAD ELEMENT

THERMAL OVERLOAD RELAY CONTACT

DISCONNECT OR SAFETY SWITCH, 30A, 3P, NON–FUSED UNLESS OTHERWISE NOTED

MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)

GENERATOR

TRANSFER SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED

ATS – AUTOMATIC
MTS – MANUAL

TRANSFORMER

Δ 3–PHASE, 3–WIRE DELTA CONNECTION

3–PHASE, 4–WIRE GROUNDED WYE CONNECTION

SWITCHBOARD OR PANELBOARD; NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED

NON–MOTOR LOAD WITH DESIGN KVA, KW, OR AMP

CONTROL POWER TRANSFORMER (CPT)

VOLTAGE TRANSFORMER (VT OR PT)

CURRENT TRANSFORMER (CT)

UTILITY WATT–HOUR METER PER UTILITY REQUIREMENTS

DIGITAL METERING PACKAGE

RUN TIME METER

GROUND

LIGHTNING ARRESTER

LOW VOLTAGE SURGE PROTECTIVE DEVICE

ELECTRICAL CONNECTION

NO ELECTRICAL CONNECTION

SOLENOID VALVE

CONTROL/RELAY COIL; X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED

TYPES:
CR – CONTROL RELAY
DP – DEFINITE PURPOSE RELAY
LC – LIGHTING CONTACTOR
M – MOTOR STARTER
PC – PHOTO CELL
TC – TIME CLOCK
TR – TIMING RELAY

NORMALLY OPEN CONTACT (N.O.)

NORMALLY CLOSED CONTACT (N.C.)

NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED

NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED

NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE–ENERGIZED

NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE–ENERGIZED

NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE

NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE

NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW

NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW

NORMALLY OPEN LEVEL SWITCH, CLOSE ON RISING LEVEL

NORMALLY CLOSED LEVEL SWITCH, OPEN ON RISING LEVEL

NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE

NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE

NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT

NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT

FIELD WIRING EXTERNAL TO CONTROL PANEL

INTERLOCK; X INDICATES TYPE

TYPES:
E – ELECTRICAL
M – MECHANICAL
K – KEY

3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2–POSITION SIMILAR

NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

INDICATING LIGHT, X INDICATES LENS COLOR

PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR

LENS COLORS:
R – RED
G – GREEN
B – BLUE
Y – YELLOW
W – WHITE
A – AMBER

TRANSFORMER

SELECTOR SWITCH

PUSHBUTTON

INSTRUMENTATION/CONTROL DEVICE

CONTROL PANEL INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT

CONTROL PANEL WITH DISCONNECT SWITCH INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT

JUNCTION OR PULL BOX

PANELBOARD (250V TO 600V)

PANELBOARD (LESS THAN 250V)

ELECTRICAL EQUIPMENT ENCLOSURE: SWITCHBOARD, MOTOR CONTROL CENTER, CONTROL PANEL, OR OTHER EQUIPMENT AS INDICATED

PHOTOCELL

CEILING/PENDANT–MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT

WALL–MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT

CEILING/PENDANT–MOUNTED FLUORESCENT FIXTURE

WALL–MOUNTED FLUORESCENT FIXTURE

CEILING/PENDANT–MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY

WALL–MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY

EMERGENCY LIGHT FIXTURE, 2 ATTACHED HEADS AS SHOWN

EMERGENCY LIGHT, REMOTE MOUNTED HEAD

DOUBLE–FACED CEILING OR WALL–MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS

SINGLE–FACED CEILING OR WALL–MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS

AREA OR ROADWAY LIGHT – POLE–MOUNTED

LIGHTING FIXTURE SUBSCRIPTS:

X – INDICATES FIXTURE TYPE PER LIGHTING FIXTURE SCHEDULE
Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD
z – INDICATES CONTROLLING SWITCH (IF REQUIRED)

TOGGLE SWITCH

SUBSCRIPTS:
X – INDICATES TYPE
NONE – SINGLE POLE
3 – THREE–WAY
4 – FOUR–WAY
HP – TOGGLE SWITCH, HORSEPOWER RATED
K – KEY SWITCH
TE – MANUAL MOTOR STARTER WITH THERMAL ELEMENT
P – PILOT LIGHT
L – LIGHTED HANDLE
Y – INDICATES CONTROLLING SWITCH (IF REQUIRED)

SPECIAL–PURPOSE RECEPTACLE AS DEFINED ON PLANS

PLUG–IN RECEPTACLE STRIP, QUANTITY AND SPACING OF RECEPTACLES AS NOTED OR SPECIFIED

TELECOMMUNICATIONS OUTLET JUNCTION BOX

QUAD–DUPLEX RECEPTACLE, TWO NEMA 5–20R UNDER COMMON COVER PLATE

DUPLEX RECEPTACLE, NEMA 5–20R

SIMPLEX RECEPTACLE, NEMA 5–20R

SUBSCRIPTS:
X – INDICATES TYPE
GFCI – GROUND FAULT CIRCUIT INTERRUPTER
Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD

CONDUIT TURNING UP

CONDUIT TURNING DOWN

HOME RUN TO PANEL, 2 #12, 1 #12G IN 3/4"C UNLESS OTHERWISE NOTED

CIRCUIT RUN BETWEEN DEVICES EXPOSED IN NON–ARCHITECTURALLY FINISHED AREAS; CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.

CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON–ARCHITECTURALLY FINISHED AREAS OR UNDER FLOOR SLAB. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.

CIRCUIT HASH MARKS (WHEN INDICATED); LONG, SHORT, SINGLE DOT, AND DOUBLE DOT REPRESENT PHASE, NEUTRAL, EQUIPMENT GROUND, AND ISOLATED EQUIPMENT GROUND, RESPECTIVELY. #12 IN 3/4" CONDUIT UNLESS OTHERWISE INDICATED.

CIRCUIT CONTINUATION

CONDUIT STUBBED OUT AND CAPPED

CONDUIT TAG OR CIRCUIT NUMBER – WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS

GROUND CABLE

GROUND ROD

FIRE ALARM ANNUNCIATOR

FIRE ALARM CONTROL PANEL

FIRE ALARM MANUAL PULL STATION

FIRE ALARM CONTROL RELAY

FIRE ALARM CONTACT, FLOW SWITCH

FIRE ALARM CONTACT, TAMPER SWITCH

FIRE ALARM CONTACT, PRESSURE SWITCH

SMOKE AND DUCT DETECTOR

SUBSCRIPT:
I – IONIZATION TYPE
P – PHOTOELECTRIC TYPE

HEAT DETECTOR

SUBSCRIPT:
R/C – RATE COMPENSATION
R/F – COMBINATION RATE OF RISE AND FIXED TEMP
R – RATE OF RISE
F – FIXED

ALARM BELL

ALARM HORN

ALARM FLASHING LIGHT

ALARM BELL AND FLASHING LIGHT COMBINATION UNIT

ALARM HORN AND FLASHING LIGHT COMBINATION UNIT

SUBSCRIPT:
NONE – GENERAL ALARM DEVICE
F – FIRE ALARM DEVICE

GENERAL NOTES:

1. THIS IS A STANDARD ELECTRICAL SYMBOLOGY SHEET. NOT ALL SYMBOLS MAY BE USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE–EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
3. SEE P&ID LEGEND SHEET FOR PROJECT–SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

PROFESSIONAL ELECTRICAL ENGINEER · KEVIN THERNES · E-9566 · 12-17-12 · STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

ELECTRICAL LEGEND

0 1" 2"

FILENAME	00G–06.DWG
SCALE	NO SCALE

SHEET 00G-06

COMMUNICATION SYMBOLOGY

- WALL MOUNTED TELEPHONE OUTLET
- WALL MOUNTED DATA OUTLET
- WALL MOUNTED COMBINATION TELEPHONE AND DATA OUTLET
- RECESSED FLOOR MOUNTED TELEPHONE OUTLET
- RECESSED FLOOR MOUNTED DATA OUTLET
- RECESSED FLOOR MOUNTED COMBINATION TELEPHONE AND DATA OUTLET

AUDIO/VISUAL SYMBOLOGY

- (TV) TELEVISION OUTLET
- (S) CEILING MOUNT SPEAKER
- (S)X WALL MOUNT SPEAKER

  SPEAKER SUBSCRIPTS:
  X – INDICATES HEIGHT
- (H) HORN TYPE TRANSDUCER
- VC VOLUME CONTROL
- PAHE HEAD END EQUIPMENT
- M FLOOR MOUNTED MICROPHONE JACK
- M WALL MOUNTED MICROPHONE JACK

SECURITY SYMBOLOGY

- DOOR POSITION SWITCH
- COMBINATION ELECTRIC DOOR STRIKE AND POSITION SWITCH
- (R)P PROXIMITY CARD READER
- (R)K PROXIMITY CARD READER WITH KEYPAD
- (M) DUAL TECHNOLOGY MOTION DETECTOR
- REQUEST TO EXIT MOTION DETECTOR
- REQUEST TO EXIT PUSH BUTTON
- (G) GLASS BREAK DETECTOR
- PTZ CCTV CAMERA
  PAN/TILT/ZOOM WHEN INDICATED
- SEC SECURITY EQUIPMENT CABINET
- (R) REMOTE KEYPAD/CONTROL STATION

MASS NOTIFICATION SYMBOLOGY

- EXTERIOR LOCATION HIGH POWER SPEAKER ARRAY (HSPA)
- LOC LOCAL OPERATING CONSOLE
- TXT TEXT MESSAGE DISPLAY UNIT
- MNCP MASS NOTIFICATION SYSTEM CONTROL PANEL
- M COMBINATION SPEAKER/STROBE NOTIFICATION APPLIANCE
- M SPEAKER NOTIFICATION APPLIANCE
- M STROBE NOTIFICATION APPLIANCE
- (MS) CEILING MOUNTED SPEAKER
- (MS) WALL MOUNTED SPEAKER
- MFCP COMBINATION MASS NOTIFICATION/FIRE ALARM CONTROL PANEL
- MF COMBINATION MASS NOTIFICATION/FIRE ALARM SPEAKER NOTIFICATION APPLIANCE
- MF COMBINATION MASS NOTIFICATION/FIRE ALARM STROBE NOTIFICATION APPLIANCE
- MF COMBINATION MASS NOTIFICATION/FIRE ALARM STROBE NOTIFICATION APPLIANCE

  LENS:
  FIRE ALARM – CLEAR
  MASS NOTIFICATION – AMBER

EMERGENCY ALARM SYMBOLOGY

- E ALARM BELL
- E ALARM HORN
- E ALARM FLASHING LIGHT
- E ALARM BELL AND FLASHING LIGHT COMBINATION UNIT
- E ALARM HORN AND FLASHING LIGHT COMBINATION UNIT

CONTROL SYMBOLOGY

- ELECTRICAL CONNECTION
- OR OR NO ELECTRICAL CONNECTION
- (SV) OR SOLENOID VALVE
- (X / Y) CONTROL/RELAY COIL; X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED

  TYPES:
  CR – CONTROL RELAY
  DP – DEFINITE PURPOSE RELAY
  LC – LIGHTING CONTACTOR
  M – MOTOR STARTER
  PC – PHOTOCELL
  TC – TIME CLOCK
  TR – TIMING RELAY
- NORMALLY OPEN CONTACT (N.O.)
- NORMALLY CLOSED CONTACT (N.C.)
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE–ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE–ENERGIZED
- NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE
- NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE
- NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW
- NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW
- NORMALLY OPEN LEVEL SWITCH, CLOSE ON RISING LEVEL
- NORMALLY CLOSED LEVEL SWITCH, OPEN ON RISING LEVEL
- NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE
- NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE
- NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT
- NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT
- MICROPROCESSOR (PLC, RTU, ETC.) OUTPUT
- MICROPROCESSOR (PLC, RTU, ETC.) INPUT
- FIELD WIRING EXTERNAL TO CONTROL PANEL
- INTERLOCK; X INDICATES TYPE

  TYPES:
  E – ELECTRICAL
  M – MECHANICAL
  K – KEY
- OFF / HAND / AUTO; XOO; OOX — 3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2–POSITION SIMILAR
- NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
- NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

CONTROL SYMBOLOGY

- (X) INDICATING LIGHT, X INDICATES LENS COLOR
- (X) PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR

  LENS COLORS:
  R – RED
  G – GREEN
  B – BLUE
  Y – YELLOW
  W – WHITE
  A – AMBER
- THERMAL OVERLOAD ELEMENT
- OL (X) THERMAL OVERLOAD RELAY CONTACT. WHEN SHOWN X INDICATES QUANTITY.
- CPT CONTROL POWER TRANSFORMER (CPT)
- RTM RUN TIME METER

FIRE ALARM SYMBOLOGY

- FACP FIRE ALARM CONTROL PANEL
- FAA FIRE ALARM ANNUNCIATOR
- F FIRE ALARM MANUAL PULL STATION
- (FS) OR FLOW SWITCH
- (TS) OR TAMPER SWITCH
- (PS) OR PRESSURE SWITCH
- X AND X SPOT AND DUCT SMOKE DETECTOR, X INDICATES TYPE

  SUBSCRIPT:
  I – IONIZATION
  P – PHOTOELECTRIC
  D – FIRE OR SMOKE DAMPER
- X HEAT DETECTOR

  SUBSCRIPT:
  R/C – RATE COMPENSATION
  R/F – COMBINATION RATE OF RISE AND FIXED TEMP
  R – RATE OF RISE FIXED
  F –
- X FLAME DETECTOR

  SUBSCRIPT:
  IR – INFRARED
  UV – ULTRAVIOLET
- DOOR HOLDER
- F BELL
- F HORN/SPEAKER
- F FLASHING LIGHT
- F HORN/SPEAKER AND FLASHING LIGHT COMBINATION UNIT
- F BELL/SPEAKER AND FLASHING LIGHT COMBINATION UNIT

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

PROFESSIONAL ELECTRICAL ENGINEER · KEVIN L. THERNES · E-9566 · REGISTERED · STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

ELECTRICAL LEGEND

0 1" 2"

FILENAME	00G-07.DWG
SCALE	NO SCALE

SHEET 00G-07

N

GENERAL NOTES:

1. SEE SPECIFICATIONS AND DRAWING SHEET 00G-02 FOR PROJECT REQUIREMENTS.

SITE PLAN
SCALE: 1" = 10,000'

1
00C-01

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER
KENT R. PRIOR
E-4202
STATE OF NEBRASKA

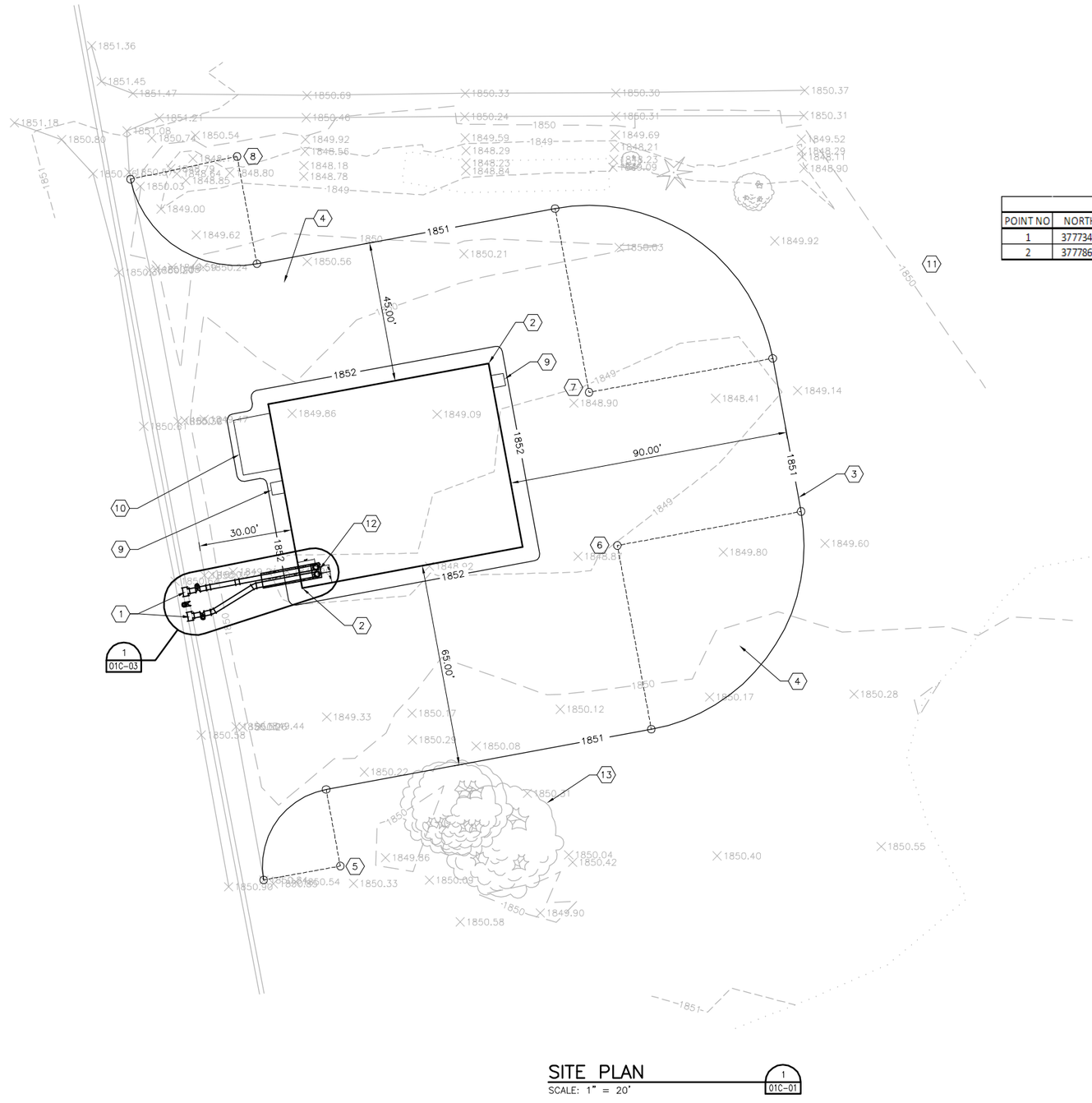
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

SITE PLAN

0 1" 2"

FILENAME	01C-01.dwg
SCALE	1" = 10,000'

SHEET
01C-01



SITE PLAN
SCALE: 1" = 20'

N

SURVEY CONTROL POINTS				
POINT NO	NORTHING	EASTING	ELEV	DESCRIPTION
1	377734.4890	2107433.4680	1850.875	N QTR 11-10-9
2	377786.3010	2110072.1530	18448.431	NE CORNER 11-10-9

KEY NOTES:

1. 18" SUPPLY AND DISCHARGE PIPING BY OTHERS, COORDINATE WITH OWNER
2. BUILDING COORDINATES
   NE CORNER
   N = 377656.8979
   E = 2108017.5456
   SW CORNER
   N = 377584.8069
   E = 2107957.6551
3. TRANSITION FILL TO EXISTING GRADE AT 4:1 SLOPE
4. PROVIDE 3" RECYCLED CONCRETE AGGREGATE, 3/4" – 1 1/2" ø, FULL PERIMETER OF BUILDING TO LIMITS OF 1851 CONTOUR, COMPACTION REQUIREMENT PER SPECIFICATIONS
5. 25' RADIUS
   CENTER POINT
   N = 377495.5407
   E = 2107969.8745
   PC
   N = 377491.0660
   E = 2107945.2782
   PT
   N = 377520.1240
   E = 2107965.3290
6. 60' RADIUS
   CENTER POINT
   N = 377598.436
   E = 2108058.8640
   PC
   N = 377539.4361
   E = 2108069.7733
   PT
   N = 377609.3453
   E = 2108117.8639
7. 60' RADIUS
   CENTER POINT
   N = 377647.6026
   E = 2108049.7729
   PC
   N = 377706.6025
   E = 2108038.8636
   PT
   N = 377658.5119
   E = 2108108.7728
8. 35' RADIUS
   CENTER POINT
   N = 377723.3107
   E = 2107936.7290
   PC
   N = 377716.0143
   E = 2107902.4980
   PT
   N = 377688.8941
   E = 2107943.0927
9. 4'x4' CONCRETE STOOP, SEE BUILDING FLOOR PLAN
10. 12'x18' CONCRETE APPROACH APRON, SEE BUILDING FLOOR PLAN
11. EARTH FILL SOURCED ON SITE ADJACENT TO BUILDING SITE, COORDINATE WITH OWNER
12. SEE BUILDING FLOOR PLAN FOR LOCATION FOR TERMINATION OF SUPPLY AND DISCHARGE PIPING BY OTHERS
13. EXISTING TREES TO REMAIN

INFORMATIONAL PURPOSES ONLY

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 7/1/2011 BY M. KENT PRIOR, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF NEBRASKA E–4202

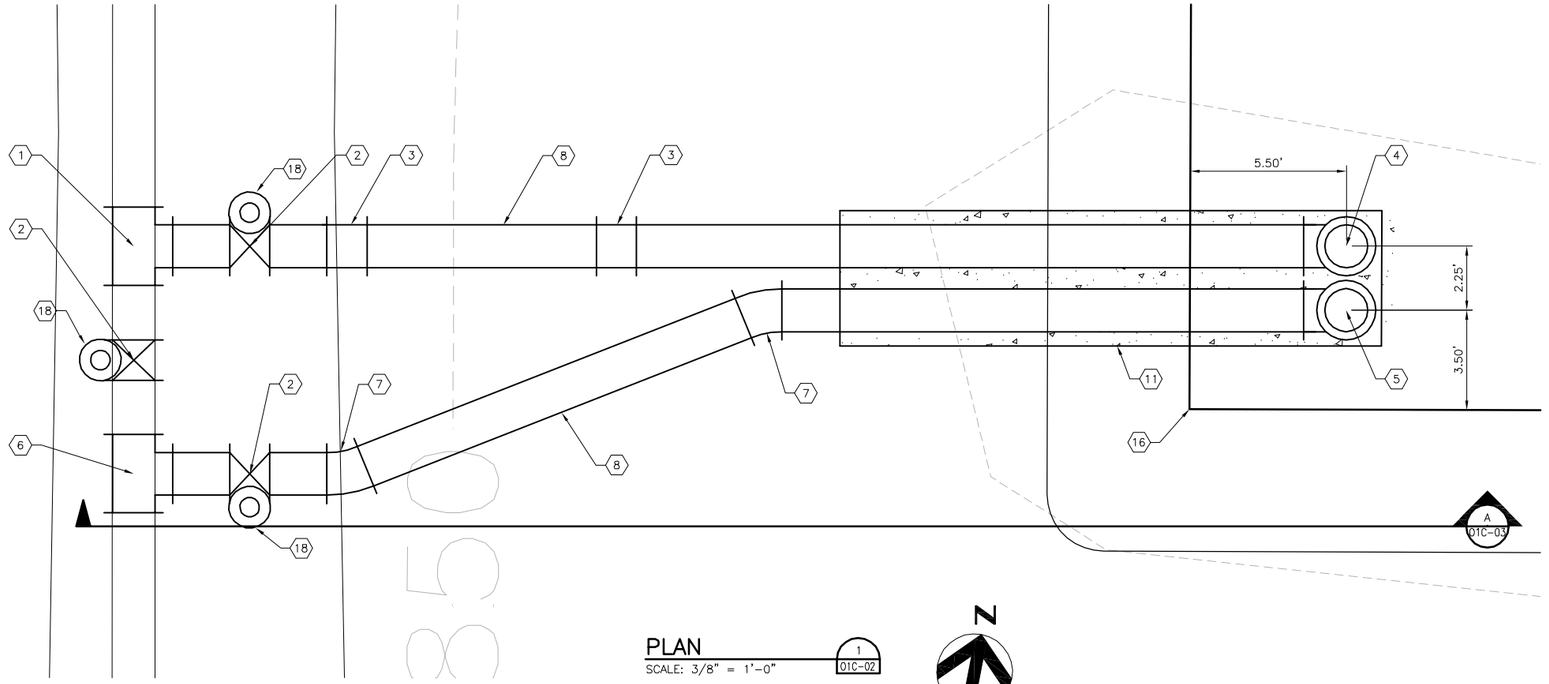
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

URANIUM REMOVAL WTP
BUILDING SITE PLAN

0 1" 2"

FILENAME	01C–02.dwg
SCALE	1" = 20'

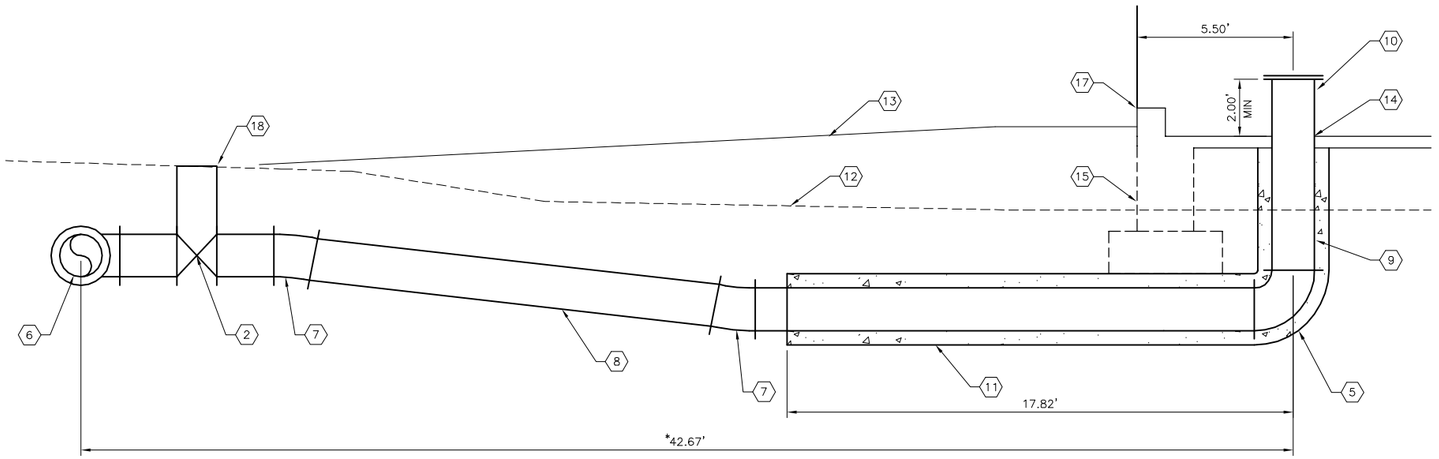
SHEET
01C-02



PLAN
SCALE: 3/8" = 1'-0"

1
01C-02

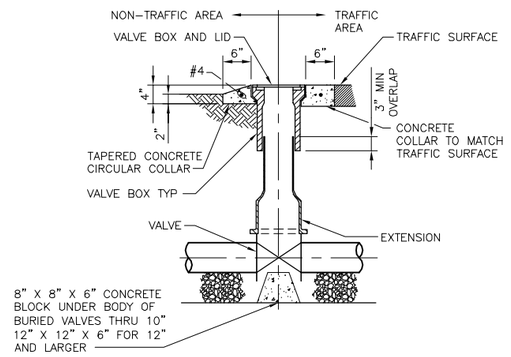
N



SECTION
SCALE: 3/8" = 1'-0"

A
01C-03

* CONTRACTOR VERIFY



BURIED VALVE BOX
3/4" = 1'-0"

2
01C-03

KEY NOTES:

1. 18" X 18" TEE, MJ, RJ
   ℄ EL = *1848.08±
   N = 377583.57
   E = 2107920.08
2. 18" BUTTERFLY VALVE, MJ, RJ
   BEVEL GEARING FOR HORIZONTAL INSTALLATION, ROTATE OPERATOR AS SHOWN IN PLAN
3. 18" X 11.25 BEND, MJ
4. 18" X 90° BEND, MJ, RJ
   ROTATE UP
   ℄ EL = 1845.42
   N = 377591.46
   E = 2107962.02
5. 18" X 90° BEND, MJ, RJ
   ROTATE UP
   ℄ EL = 1845.42
   N = 377589.25
   E = 2107962.43
6. 18" X 18" TEE, MJ, RJ
   ℄ EL = *1848.12±
   N = 377575.71
   E = 2107921.56
7. 18" X 22.5° BEND, MJ, RJ
   ROTATE FITTING AS NEEDED
8. 18" DI WATER MAIN, MJ, RJ
9. 18" DI SPOOL, PE X FLG
10. 18" BLIND FLANGE
11. 6" CONCRETE ENCASEMENT
12. EXISTING GRADE
13. PROPOSED GRADE
14. FLOOR EL 1851.07±
15. PROPOSED BUILDING FOUNDATION BY OTHERS
16. SW BUILDING CORNER
    N = 377584.81
    E = 2107957.66
17. TOP OF FOUNDATION EL = 1852.50
18. VALVE BOX, SEE DETAIL 2 THIS SHEET

INFORMATIONAL PURPOSES ONLY

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	10/14/2011	CLIENT REVIEW
1	12/2/2011	FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	
PROJECT NUMBER	14590

THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 10/4/2011 BY M. KENT PRIOR, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF NEBRASKA E-4202

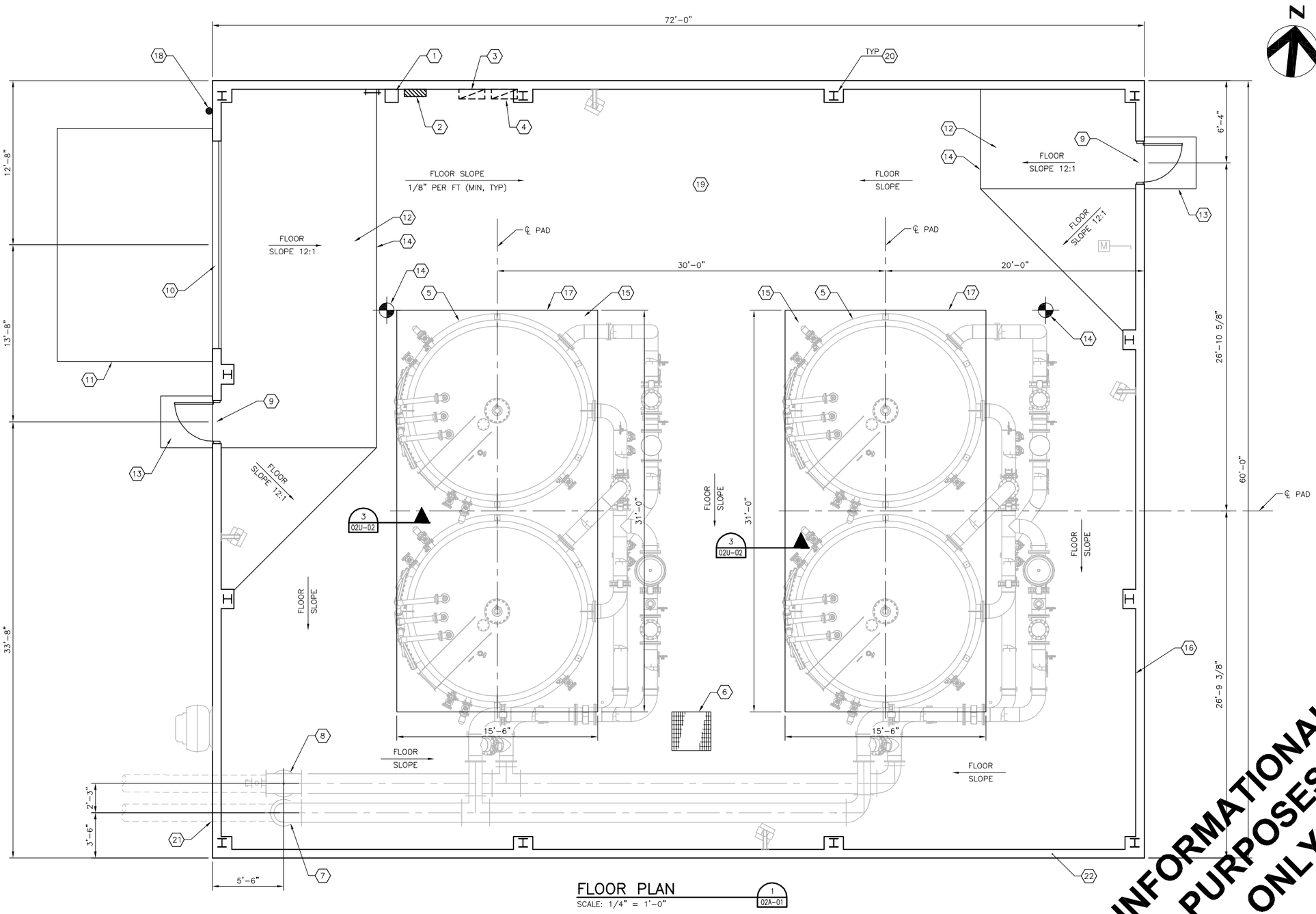
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

SITE PIPING PLAN AND PROFILE

0 1" 2"

FILENAME	01C-03.dwg
SCALE	AS SHOWN

SHEET
01C-03



GENERAL NOTES:

1. THIS DRAWING REPRESENTS OWNER'S MINIMUM REQUIREMENTS AND DOES NOT CONSTITUTE A COMPLETE DESIGN. REFER TO SPECIFICATIONS FOR DESIGN CRITERIA AND OTHER MATERIAL AND EQUIPMENT REQUIREMENTS.

KEY NOTES:

(1) ELECTRICAL METER BASE PROVIDED AND INSTALLED BY CONTRACTOR, COORDINATE WITH SERVICE PROVIDER. SEE ELECTRICAL PLAN

(2) POWER PANEL, SEE ELECTRICAL PLAN

(3) RTU PROVIDED BY OWNER AND INSTALLED BY CONTRACTOR

(4) WRT EQUIPMENT CONTROLLER PANEL PROVIDED AND INSTALLED BY OTHERS, CONTRACTOR PROVIDE CONDUIT TO PANEL, SEE ELECTRICAL PLAN, COORDINATE LOCATION OF CONDUIT WITH WRT DRAWINGS TO BE PROVIDED

(5) WRT TREATMENT EQUIPMENT AND PIPING SHOWN FOR REFERENCE, INSTALLED BY OTHERS

(6) 3' X 3' X 3' CONCRETE SUMP INTEGRAL WITH CONCRETE FLOOR, PROVIDE 1 1/2" ALUMINUM GRATING COVER WITH 1 3/4" SUPPORT ANGLES AROUND PERIMETER OF OPENING, SLOPE CONCRETE FLOOR TO DRAIN TO SUMP LOCATION, TOP OF GRATING AND CONCRETE AT SUMP EL 1850.75

(7) 18" DIP SUPPLY PIPING, BY OTHERS COORDINATE WITH OWNER AND EQUIPMENT SUPPLIED

(8) 18" DIP DISCHARGE PIPING, BY OTHERS COORDINATE WITH OWNER AND EQUIPMENT SUPPLIED

(9) 3' X 7' PASSAGE DOOR, SEE SPECIFICATION 13120

(10) 16' X 16' OVERHEAD DOOR, SEE SPECIFICATION 13120

(11) 18' X 12' CONCRETE APPROACH APRON WITH REINFORCING, DESIGN FOR H-20 WHEEL LOAD

(12) CONCRETE SLOPE FROM TOP OF BUILDING FOUNDATION TO FINISHED FLOOR, SLOPE 12:1 WITH 1 1/2" DEPRESSED VERTICAL EDGE AT FLOOR ELEVATION SHOWN TO POUR CONCRETE FILL AGAINST (FEATHER EDGE CONCRETE POURS NOT PERMITTED)

(13) 4' X 4' CONCRETE STOOP WITH REINFORCING, DESIGN TO AVOID FROST HEAVE

(14) CONCRETE FLOOR ELEVATION 1851.50

(15) 15'-6" X 31'-0" WRT EQUIPMENT PAD, ELEVATION 1851.87, CONTRACTOR CONFIRM PAD SIZE WITH OWNER AND WRT EQUIPMENT SUPPLIER

(16) SEE GENERAL EXTERIOR ELEVATIONS FOR BOTTOM OF FOOTING REQUIREMENTS, PROVIDE WATER STOP (GREENSTREAK STYLE #698 OR EQUAL) BETWEEN FLOOR SLAB AND VERTICAL FACE OF FOOTING WALL, PROVIDE SEALED JOINT

(17) PROVIDE WATERSTOP (GREENSTREAK STYLE #698 OR EQUAL) AND SEALED JOINT FOR FULL PERIMETER OF EQUIPMENT PAD, SEE 3/02U-02 TYP

(18) LOCATION OF RADIO ANTENNA SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR, SEE ELECTRICAL PLAN

(19) CONCRETE FLOOR DEPRESSED FROM TOP OF FOUNDATION MINIMUM 1'-0" FOR CONTAINMENT PROTECTION, PROVIDE CONTROL JOINTS IN SLAB AS REQUIRED TO PREVENT SLAB CRACKING, PROVIDE BASE SEAL WATERSTOPS (SIMILAR TO GREENSTREAK STYLE #639) AT ALL CONTROL JOINTS, REINFORCE SLAB WITH MINIMUM 0.30% STEEL IN BOTH DIRECTIONS

(20) COLUMN QUANTITY AND LOCATIONS ARE DIAGRAMMATIC AND MAY BE REVISED TO SUIT THE BUILDING FURNISHED, COORDINATE ALL BUILDING DETAILS WITH FOUNDATIONS AND ALL OTHER TRADES

(21) COORDINATE BUILDING FOOTING WITH PIPING, ENCASE ALL PIPES UNDER BUILDING FOOTINGS IN CONCRETE

(22) TOP OF CONCRETE EL 1852.50

INFORMATIONAL PURPOSES ONLY

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 7/1/2011 BY M. KENT PRIOR, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF NEBRASKA E-4202

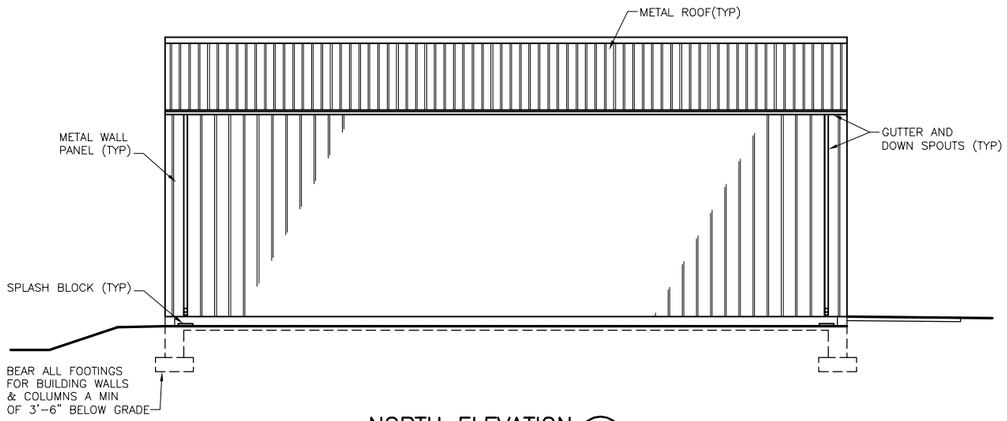
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

FLOOR PLAN

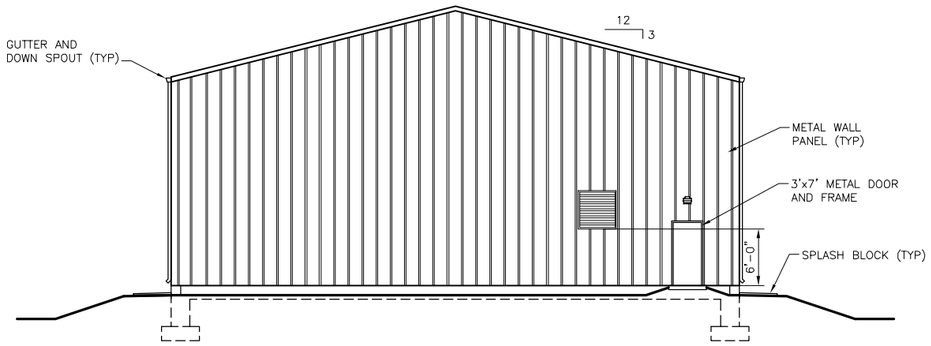
0 1" 2"

FILENAME	02A-01.dwg
SCALE	1/4" = 1'-0"

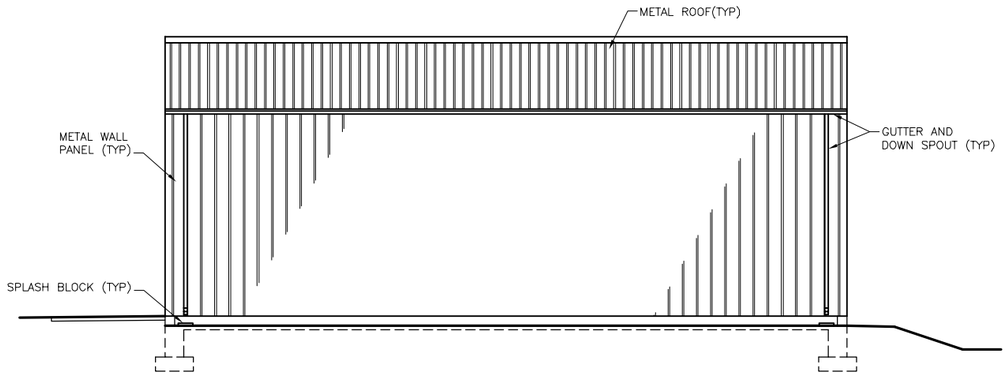
SHEET 02A-01



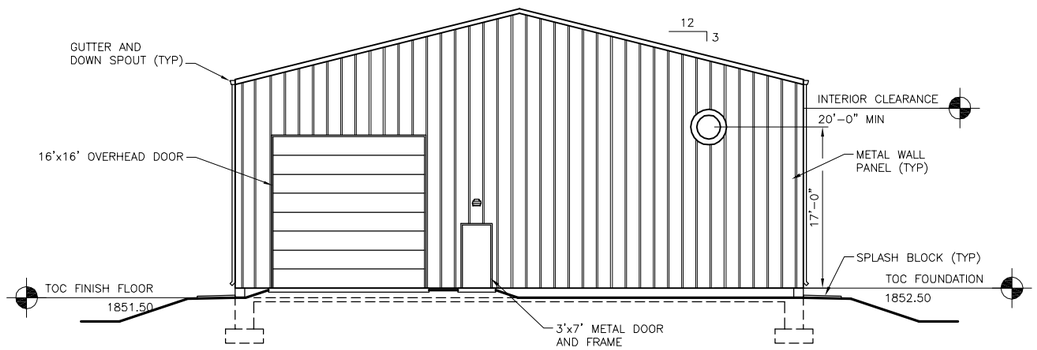
NORTH ELEVATION (1 / 02A-02)
SCALE: 1/8" = 1'-0"



EAST ELEVATION (2 / 02A-02)
SCALE: 1/8" = 1'-0"



SOUTH ELEVATION (3 / 02A-02)
SCALE: 1/8" = 1'-0"



WEST ELEVATION (4 / 02A-02)
SCALE: 1/8" = 1'-0"

INFORMATIONAL PURPOSES ONLY

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 7/1/2011 BY M. KENT PRIOR, A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF NEBRASKA E-4202

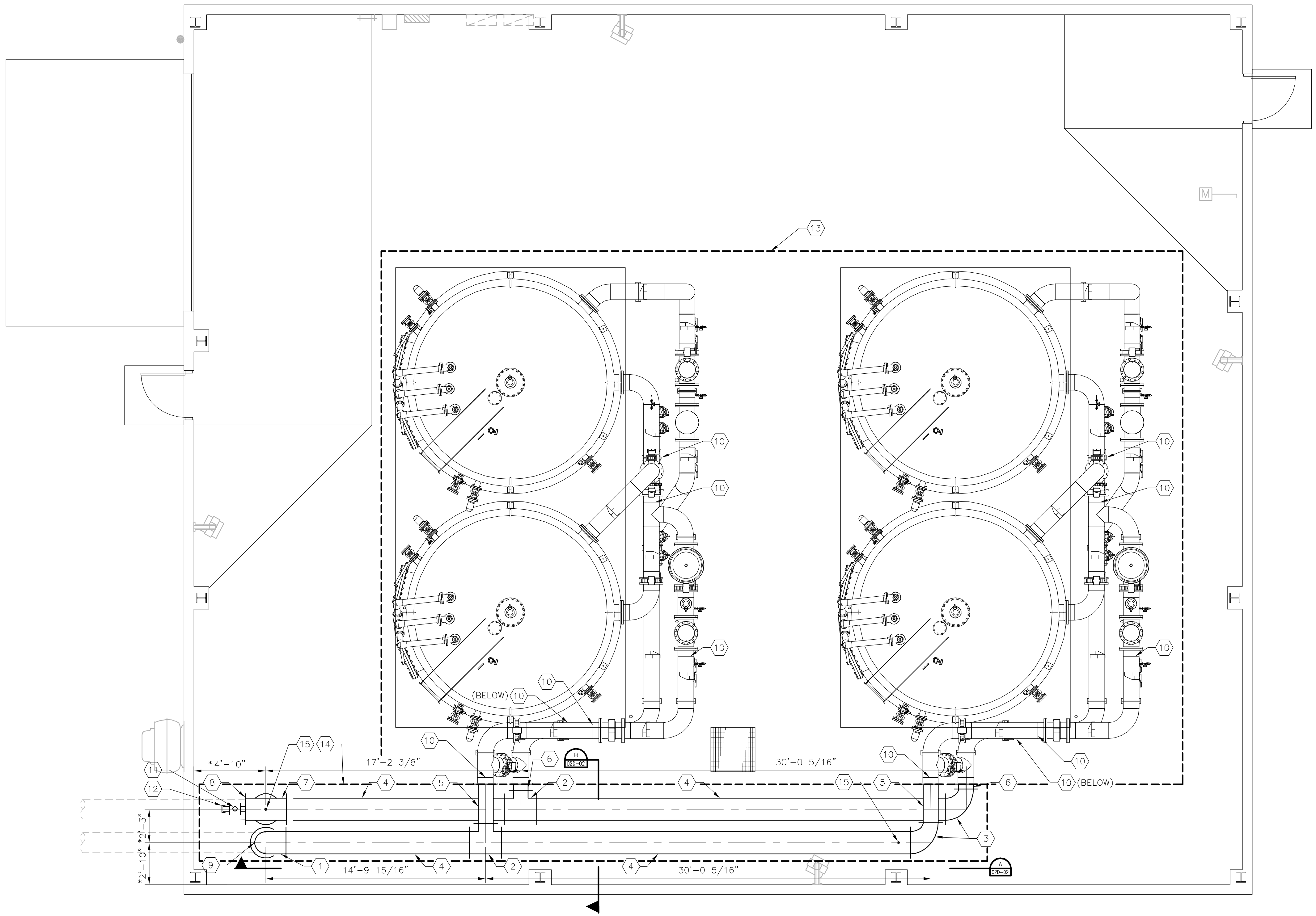
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

EXTERIOR ELEVATIONS

0 1" 2"

FILENAME	02A-02.dwg
SCALE	1/8" = 1'-0"

SHEET 02A-02



PROCESS EQUIPMENT & PIPING PLAN (1 / 02D-01)

SCALE: 1/4" = 1'-0"

N

KEYNOTES:

1. 18" X 90° BEND, FLG
2. 18" X 12" TEE, FLG
3. 18" X 12" 90° REDUCING BEND, FLG
4. 18"ø PIPE, FLG
5. 12"ø PIPE, FLG
6. 12" FILLER FLANGE
7. 18" X 18" TEE, FLG
8. 18" BLIND FLANGE W/4" THREADED PIPE TAP
9. PROVIDE 1" TAP & PLUG
10. WRT STAINLESS STEEL PIPE, FIELD CUT, FIT, AND WELDED
11. 4" BALL VALVE
12. PROVIDE 4" DRY DISCONNECT, 4" CAMLOC MALE ADAPTOR W/CAP
13. ITEMS ARE PROVIDED BY WRT AND INSTALLED BY CONTRACTOR
14. ITEMS ARE PROVIDED BY CONTRACTOR AND INSTALLED BY CONTRACTOR
15. PROVIDE 1" TAP AND PLUG FOR FUTURE AIR RELEASE VALVE IF REQUIRED

GENERAL NOTES:

1. VERIFY ALL PIPING DIMENSIONS AND ELEVATIONS FOR EQUIPMENT AND PIPING FURNISHED BY OTHERS AND SUPPLIED BY THE CONTRACTOR.
2. THE CONTRACTOR SHALL PROVIDE PIPE CONNECTIONS, PIPE SUPPORTS AND RESTRAINED PIPE AS SHOWN ON THE DRAWINGS OR, PER SPECIFICATIONS WHERE DETAILED INFORMATION IS NOT PROVIDED ON THE PLANS.
3. REFER TO WRT SUBMITTAL FOR EQUIPMENT SCHEDULE AND INSTALLATION DRAWINGS FOR ITEMS PROVIDED BY WRT.
4. TOUCH UP ANY SCRATCHED, MARRED OR DAMAGED AREA TO FINISH COAT OF CONTRACTOR SUPPLIED EQUIPMENT AND WRT SUPPLIED EQUIPMENT PER SPECIFICATION SECTION 09905.
5. ALL EXPOSED PIPING, FITTINGS AND VALVES SHALL BE FLANGE BY FLANGE CONNECTIONS UNLESS SPECIFICALLY CALLED OUT.

HDR

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER — KURT PRIOR — E-4202 — STATE OF NEBRASKA

CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

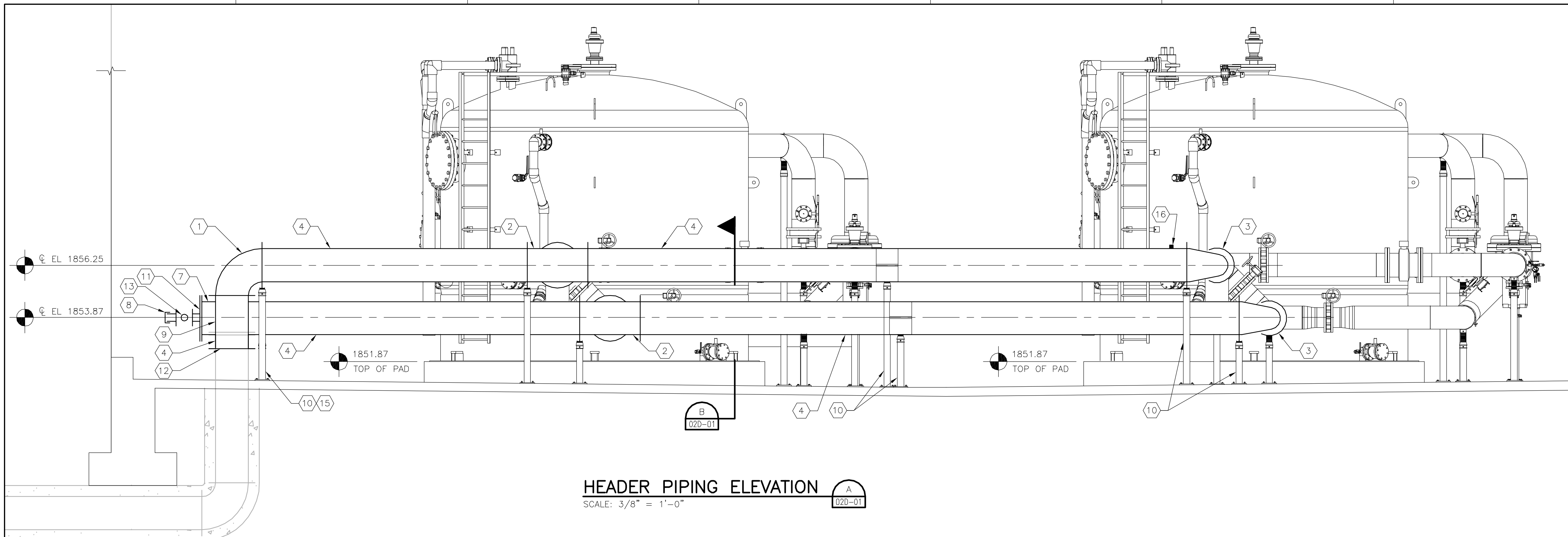
URANIUM REMOVAL WATER TREATMENT PLANT

PROCESS EQUIPMENT & PIPING PLAN

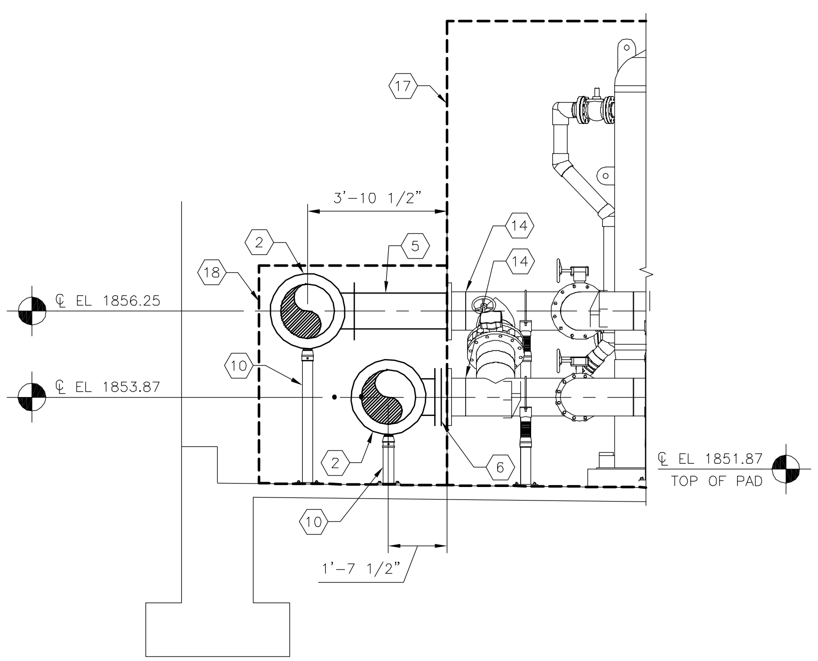
0 1" 2"

FILENAME	02D-01.dwg
SCALE	1/4" = 1'-0"

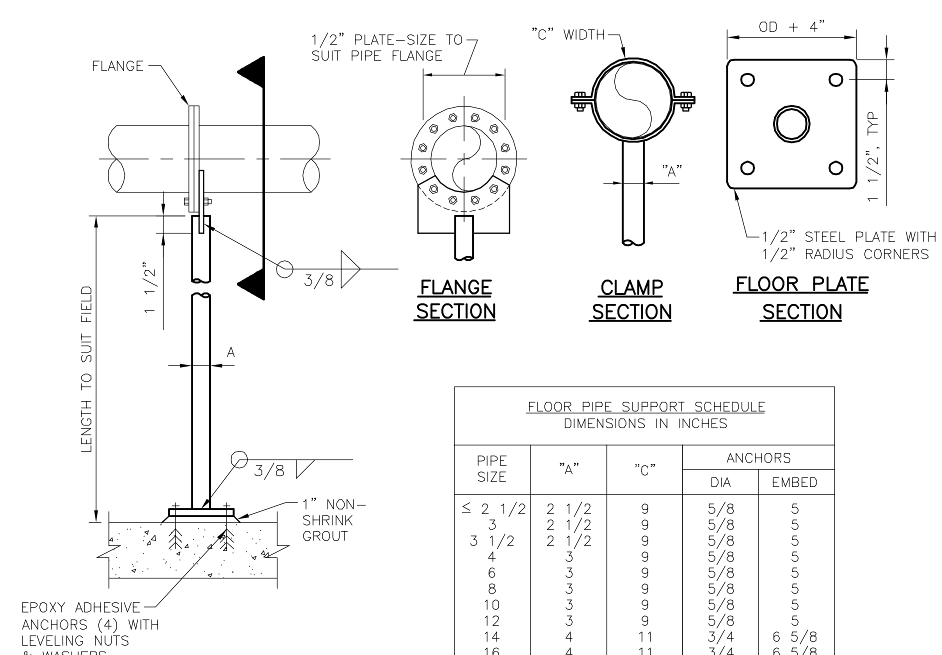
SHEET **02D-01**



HEADER PIPING ELEVATION (A, 02D-01)
SCALE: 3/8" = 1'-0"



HEADER PIPING ELEVATION (B, 02D-02)
SCALE: 3/8" = 1'-0"



NOTE:

1. NOT INTENDED FOR THRUST RESTRAINT.
2. PIPE SUPPORTS TO BE GALVANIZED.

FLOOR PIPE SUPPORT SCHEDULE
DIMENSIONS IN INCHES

PIPE SIZE	"A"	"C"	ANCHORS DIA	ANCHORS EMBED
≤ 2 1/2	2 1/2	9	5/8	5
3	2 1/2	9	5/8	5
3 1/2	2 1/2	9	5/8	5
4	3	9	5/8	5
6	3	9	5/8	5
8	3	9	5/8	5
10	3	9	5/8	5
12	3	9	5/8	5
14	4	11	3/4	6 5/8
16	4	11	3/4	6 5/8
18	6	13 1/2	3/4	6 5/8
20	6	13 1/2	3/4	6 5/8
24	6	13 1/2	3/4	6 5/8
30	6	13 1/2	3/4	6 5/8
32	6	13 1/2	3/4	6 5/8
36	6	13 1/2	3/4	6 5/8

FLOOR PIPE SUPPORT (1, 02D-02)
NOT TO SCALE

KEYNOTES:

1. 18" X 90° BEND, FLG
2. 18" X 12" TEE, FLG
3. 18" X 12" 90° REDUCING BEND, FLG
4. 18"ø PIPE, FLG
5. 12"ø PIPE, FLG
6. 12" FILLER FLANGE
7. 18" X 18" TEE, FLG
8. PROVIDE 4" DRY DISCONNECT, 4" CAMLOCK MALE ADAPTOR W/CAP
9. PROVIDE 1" TAP & PLUG
10. ADJUSTABLE PIPE SUPPORT (TYP) SEE 1/02D-02
11. 18" BLIND FLANGE W/4" THREADED PIPE TAP
12. CUT EXISTING PIPE TO REQUIRED ELEVATION, INSTALL "EBBA IRON SERIES 2018 MEGAFLANGE" PROVIDED BY OTHERS
13. 4" BALL VALVE
14. WRT STAINLESS STEEL PIPE, FIELD CUT, FIT AND WELDED
15. PROVIDE PIPE SUPPORT ON TEE, SEE 1/02D-02
16. PROVIDE 1" TAP AND PLUG FOR FUTURE AIR RELEASE VALVE IF REQUIRED
17. ITEMS ARE PROVIDED BY WRT AND INSTALLED BY CONTRACTOR
18. ITEMS ARE PROVIDED BY CONTRACTOR AND INSTALLED BY CONTRACTOR

GENERAL NOTES:

1. VERIFY ALL PIPING DIMENSIONS AND ELEVATIONS FOR EQUIPMENT AND PIPING FURNISHED BY OTHERS AND SUPPLIED BY THE CONTRACTOR.
2. THE CONTRACTOR SHALL PROVIDE PIPE CONNECTIONS, PIPE SUPPORTS AND RESTRAINED PIPE AS SHOWN ON THE DRAWINGS OR, PER SPECIFICATIONS WHERE DETAILED INFORMATION IS NOT PROVIDED ON THE PLANS.
3. REFER TO WRT SUBMITTAL FOR EQUIPMENT SCHEDULE AND INSTALLATION DRAWINGS FOR ITEMS PROVIDED BY WRT.
4. TOUCH UP ANY SCRATCHED, MARRED OR DAMAGED AREA TO FINISH COAT OF CONTRACTOR SUPPLIED EQUIPMENT AND WRT SUPPLIED EQUIPMENT PER SPECIFICATION SECTION 09905.
5. ALL EXPOSED PIPING, FITTINGS AND VALVES SHALL BE FLANGE BY FLANGE CONNECTIONS UNLESS SPECIFICALLY CALLED OUT.

HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

REGISTERED CIVIL ENGINEER — STATE OF NEBRASKA — 4202

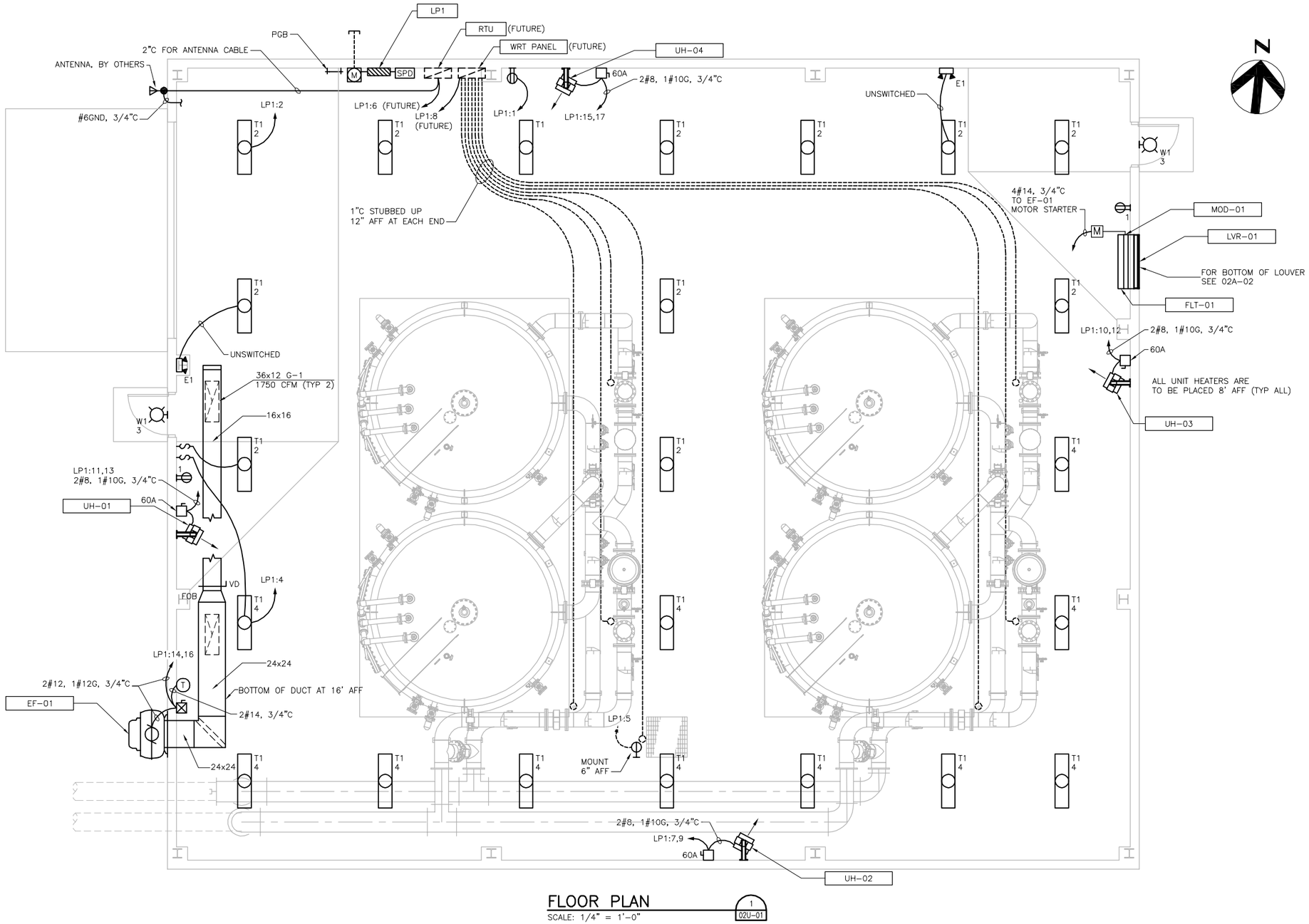
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

HEADER PIPING DETAILS

0 1" 2"

FILENAME	02D-02.dwg
SCALE	AS NOTED

SHEET 02D-02



FLOOR PLAN
SCALE: 1/4" = 1'-0"

1 / 02U-01

INFORMATIONAL PURPOSES ONLY

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 7/1/2011 BY PAUL F. O'BRIEN, A LICENSED MECHANICAL ENGINEER IN THE STATE OF NEBRASKA E-5235 & KEVIN CARL THERNES, A LICENSED ELECTRICAL ENGINEER IN THE STATE OF NEBRASKA E-8566

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

MECHANICAL AND ELECTRICAL FLOOR PLAN

0 1" 2"

FILENAME	02U-01.dwg
SCALE	1/4" = 1'-0"

SHEET 02U-01

FAN PERFORMANCE DATA

MARK NO.	LOCATION	TYPE	CFM	SP DROP INS WC	RPM	STATIC EFF %	MOTOR HP	MOTOR VOLTS	MOTOR PH	MAX SONES	UNIT ILLUSTRATED	REMARKS
EF-01	PROCESS ROOM	CENTRIFUGAL WALL MNTD	3500	0.5	756	52	.75	240	1	9.6	LOREN COOK 210W6B	

ELECTRIC UNIT HEATER PERFORMANCE DATA

MARK NO.	LOCATION	CAPACITY Btu./Hr.	CAPACITY KW	EAT °F	RECOM'D. MOUNTING	UNIT AMPS	VOLTS	PH	UNIT ILLUSTRATED	REMARKS
UH-01	PROCESS ROOM	25,598	7.5	55	WALL BRACKET	31.7	240	1	CHROMALOX LUH-07-21-34	27" THROW
UH-02	PROCESS ROOM	25,598	7.5	55	WALL BRACKET	31.7	240	1	CHROMALOX LUH-07-21-34	27" THROW
UH-03	PROCESS ROOM	25,598	7.5	55	WALL BRACKET	31.7	240	1	CHROMALOX LUH-07-21-34	27" THROW
UH-04	PROCESS ROOM	25,598	7.5	55	WALL BRACKET	31.7	240	1	CHROMALOX LUH-07-21-34	27" THROW

LOUVER PERFORMANCE DATA

MARK NO.	LOCATION	LOUVER DIM WIDTH	LOUVER DIM HEIGHT	CFM	MATERIAL	FINISH	FREE AREA SQ FT	PURPOSE	MAX SP DROP INS WC	UNIT ILLUSTRATED	REMARKS
LVR-01	PROCESS ROOM	48"	48"	3500	ALUM	SEE SPEC SECT 10200	9.08	INTAKE	0.02	RUSKIN ELF 6375DXH	-- --

DAMPER PERFORMANCE DATA

MARK NO.	LOCATION	DIMENSION WIDTH	DIMENSION HEIGHT	TYPE OPENING	SERVES	TYPE SERVICE	UNIT ILLUSTRATED	REMARKS
MOD-01	PROCESS ROOM	48"	48"	WALL	LVR-01	INTAKE	RUSKIN CD-50	-- --

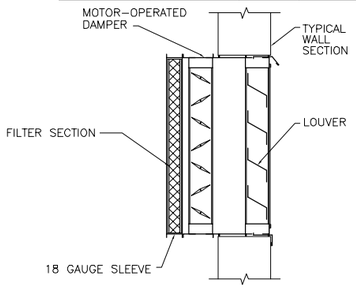
AIR FILTER PERFORMANCE DATA

MARK NO.	LOCATION	UNIT SERVED	CFM	PRESSURE DROP INS WC INITIAL	PRESSURE DROP INS WC FINAL	EFF %	OVERALL SIZE INCHES HEIGHT	OVERALL SIZE INCHES WIDTH	UNIT ILLUSTRATED	REMARKS
FLT-01	PROCESS ROOM	LVR-01	3500	.25	.75	30	48"	48"	CAMFIL FARR 30/30	1

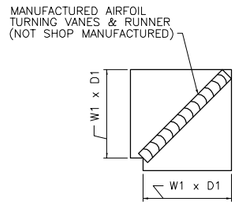
1. FILTER HOUSING SHALL BE 4P GLIDE/PACK BY CAMFIL FARR OR APPROVED EQUAL.

DIFFUSERS, REGISTERS AND GRILLES PERFORMANCE DATA

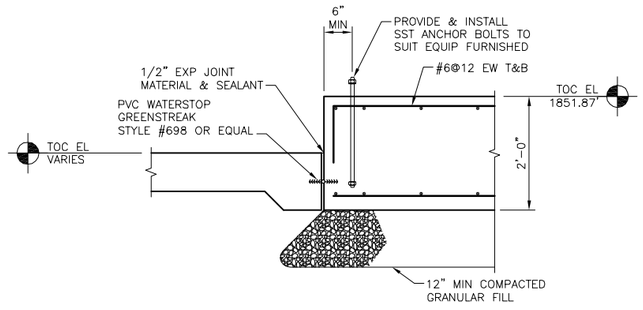
MARK NO.	MOUNTING	TYPE	MAX SP INS WC	MAX NC	SIZE	MATERIAL	UNIT ILLUSTRATED	ACCESSORIES	REMARKS
G-1	SURFACE	RETURN	.05	25	AS SHOWN	ALUM	TITUS 350FL	OPPOSED BLADE DAMPER	-- --



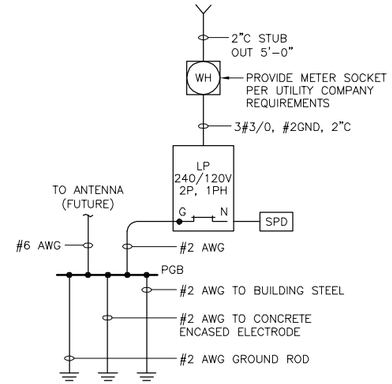
FILTERED AIR INTAKE 1 02U-02



SQUARE THROAT 90° ELBOW WHEN DUCT SIZE EQUAL 2 02U-02



DETAIL 3 02A-02
3/4"=1'-0"



GROUNDING DIAGRAM 4 02U-02
NO SCALE

GROUND SYSTEM DETAIL NOTES:

1. ABBREVIATIONS: PGB – 12" LONG POWER GROUNDING BAR.
2. ALL CONDUCTOR SIZES BASED ON COPPER.
3. SEE SECTION 16060-GROUNDING FOR ADDITIONAL REQUIREMENTS.

LUMINAIRE SCHEDULE

DWG ID TYPE	DESCRIPTION	MANUFACTURER AND LUMINAIRE TYPE	LAMP TYPE	LAMP QTY	LAMP WATTS	BALLAST	FIXTURE VOLTS	FIXTURE VA	MOUNTING TYPE	MOUNTING HEIGHT	NOTES
E1	INDUSTRIAL STEEL EMERGENCY LIGHTING HOUSING: STEEL PAINTED TAN BATTERY: SEALED MAINTENANCE-FREE LEAD-CALCIUM	LITHONIA ELT125 SERIES	INCANDESCENT	2	12	NA	120	12	WALL	6'-8"	
T1	HEAVY-DUTY INDUSTRIAL TURRET WITH WIREGUARD. HOUSING: STEEL PAINTED WHITE. REFLECTOR: SOLID (NO UP LIGHT)	LITHONIA AF SERIES	FO32/T8	4	32	ELECTRONIC	120	124	CHAIN	20'-0"	
W1	WALL-MOUNTED LUMINAIRE. LENS: TEMPERED GLASS. REFLECTOR: HYDROFORMED. HOUSING: BLACK PAINTED ALUMINUM. CONTROL: INTEGRAL PHOTOELECTRIC CELL	LITHONIA TWF1 SERIES	42TRT CFL	1	42	ELECTRONIC	120	42	WALL	8'-0"	

NOTES:
1. MOUNTING HEIGHT TO BE MEASURED FROM BOTTOM OF FIXTURE.
2. SUBMITTAL SHALL INCLUDE ALL REQUIRED FITTINGS AND A SKETCH OF THE INSTALLATION.

PANELBOARD NO: LP1

VOLTAGE: 240/120 **BUS RATING (A):** 200 **ENCLOSURE:** NEMA 1
PHASE: 1 **MAIN OC DEVICE:** 200/2 **MOUNTING:** SURFACE
WIRE: 3+GND **INTERRUPTING RATING (KA):** 10
200% NEUTRAL: NO **SERVICE ENTRANCE LABEL:** YES

CKT NO.	DESCRIPTION	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	OCP AMPS	OCP P		OCP AMPS	OCP P	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	DESCRIPTION	CKT NO.
1	RECEPTACLES		540			20	1	A	20	1	1,488				LIGHTING	2
3	EXTERIOR LTS	85				20	1	B	20	1	1,364				LIGHTING	4
5	SUMP PUMP				1,000	20	1	A	20	1				500	RTU	6
7	UNIT HEATER			3,750		40	2	B	20	1				500	WRT PANEL	8
9				3,750				A	40	2			3,750		UNIT HEATER	10
11	UNIT HEATER			3,750		40	2	B					3,750			12
13				3,750				A	20	2			280		EXHAUST FAN	14
15	UNIT HEATER			3,750		40	2	B					280			16
17				3,750				A	20	1					SPARE	18
19	SPARE					20	1	B	20	1					SPARE	20
21	SPARE					20	1	A	20	1					SPARE	22
23	SPACE							B							SPACE	24
25	SPACE							A							SPACE	26
27	SPACE							B	MFR	2					SPD	28
29	SPACE							A								30

LOAD SUMMARY

	LTS	REC	MECH	MISC	SPARE	TOTAL				PHASE BALANCE	
CONNECTED LOAD (KVA)	2.9	0.5	30.6	2.0	--	36.0		240	LINE-TO-LINE VOLTS	PHASE A (KVA)	19
DEMAND FACTOR	1.25	NEC	1.00	1.00	20%	--		150	CONNECTED AMPS	PHASE B (KVA)	17
DESIGN LOAD (KVA)	3.7	0.5	30.6	2.0	7.2	44.0		183	DESIGN AMPS		

INFORMATIONAL PURPOSES ONLY

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

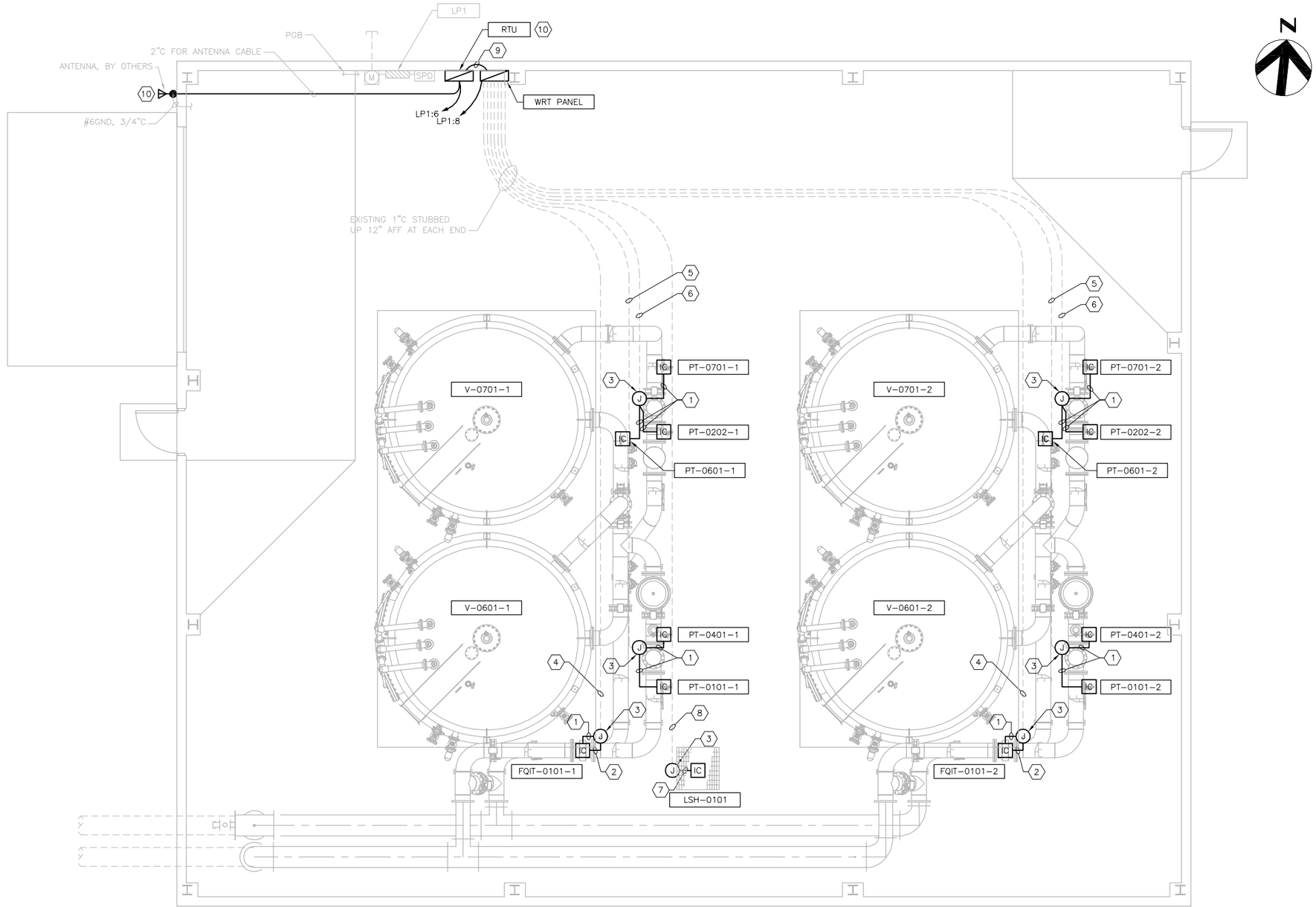
THIS DRAWING WAS ORIGINALLY APPROVED AND SEALED ON 7/1/2011 BY PAUL F. O'BRIEN, A LICENSED MECHANICAL ENGINEER IN THE STATE OF NEBRASKA E-5235 & KEVIN CARL THERNES, A LICENSED ELECTRICAL ENGINEER IN THE STATE OF NEBRASKA E-8566

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

MECHANICAL, ELECTRICAL & STRUCTURAL DETAILS AND SCHEDULES

0 1" 2"

FILENAME 02U-02.dwg
SCALE AS NOTED
SHEET 02U-02



KEY NOTES:

1. 1-#18TSP, 1/2" LT-FLEX.
2. 1-2/C W/G #14, 1/2" LT-FLEX.
3. J-BOX CONNECTED TO EXISTING 1"C STUB OUT.
4. 1-#18TSP, 1-2/C W/G #14 IN EXISTING 1" CONDUIT. EXTEND 1" TO WRT PANEL.
5. 2-#18TSP IN EXISTING 1" CONDUIT. EXTEND 1"C TO WRT PANEL.
6. 3-#18TSP IN EXISTING 1" CONDUIT. EXTEND 1"C TO WRT PANEL.
7. PROVIDE FLOAT SWITCH IN SUMP. CONNECT FLOAT CABLE TO J-BOX.
8. 2/C #14 IN EXISTING 1"C EXTEND 1"C TO WRT PANEL.
9. 4-2/C #14, 2"C; 2-#18TSP, 1"C; AND 1-2"C SPARE.
10. RTU, ANTENNA AND CABLE PROVIDED BY OWNER AND INSTALLED BY CONTRACTOR. EXTEND 2"C TO RTU. TERMINATE CONTROL CONDUCTORS AS DIRECTED BY GRAND ISLAND UTILITIES.

INSTRUMENTATION PLAN

SCALE: 1/4" = 1'-0"

1 / 02U-03

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

PROFESSIONAL ELECTRICAL ENGINEER — KEVIN K. THERNES — E-8566 — STATE OF NEBRASKA — 1-12-12

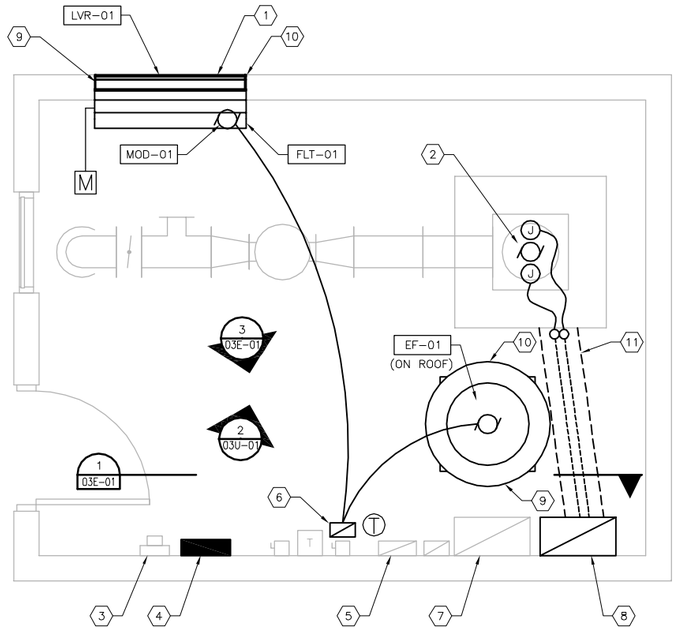
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

INSTRUMENTATION FLOOR PLAN

0 1" 2"

FILENAME	02U-03.dwg
SCALE	1/4" = 1'-0"

SHEET **02U-03**



FLOOR PLAN

SCALE: 1/2" = 1'-0"

1 03U-01

REFERENCE PHOTO

NOT TO SCALE

2 03U-01

KEYNOTES:

1. BOTTOM OF LOUVER 4' AFF
2. NEW WELL PUMP & MOTOR
3. 200A METER TO REMAIN
4. NEW 480V PANELBOARD
5. EXISTING LOAD CENTER
6. NEW T-STAT AND FAN CONTROL PANEL BELOW, SEE 03E-01 AND 03E-02 SHEET FOR EQUIPMENT
7. EXISTING RTU
8. NEW WELL VFD
9. SEE HVAC SCHEDULE THIS SHEET FOR REQUIREMENTS
10. PROVIDE NECESSARY OPENING PER PRE-ENGINEERED MANUFACTURER'S RECOMMENDATIONS
11. REMOVE AND REPLACE EXISTING CONCRETE FLOOR TO FACILITATE CONDUIT INSTALLATION
12. REMOVE EXISTING MOTOR AND SALVAGE TO OWNER
13. REMOVE AND REUSE EXISTING PUMP DISCHARGE HEAD, COLUMN, AND PUMP SHAFTING CONSISTENT WITH NEW PUMP AND MOTOR INSTALLATION REQUIREMENTS

GENERAL NOTES:

1. WORK SHOWN IS TYPICAL FOR THREE (3) WELL INSTALLATIONS INCLUDING WELL NO 6, 7, & 8. PUMP FOR WELL 8 HAS BEEN PULLED FROM WELL FOR WORK TO BE COMPLETED BY CONTRACTOR. PUMPS FROM WELL 6 & 7 HAVE NOT BEEN PULLED FOR WORK TO BE COMPLETED BY CONTRACTOR.
2. WELL NO 8 TO RECEIVE NEW PUMP. WELL NO 6 & 7 TO RECEIVE MODIFICATIONS TO EXISTING PUMP. NEW MOTOR & NEW VFD TO BE ADDED TO EACH PUMP.
3. SEE SPECIFICATIONS FOR PUMP & MOTOR EQUIPMENT AND REQUIREMENTS.

FAN PERFORMANCE DATA

MARK NO.	LOCATION	TYPE	CFM	SP DROP INS WC	RPM	STATIC EFF %	MOTOR HP	MOTOR VOLTS	MOTOR PH	UNIT ILLUSTRATED	REMARKS
EF-01	PUMP HOUSE	CENTRIFUGAL ROOF-MNTD	1600	0.375	587	60	1/4	120	1	LOREN COOK 195R3B	PREFABRICATED, INSULATED ALUMINUM ROOF CURB

LOUVER PERFORMANCE DATA

MARK NO.	LOCATION	LOUVER DIM WIDTH	LOUVER DIM HEIGHT	CFM	MATERIAL	FINISH	FREE AREA SQ FT	WATER PENETRATION	SP DROP INS WC	UNIT ILLUSTRATED	REMARKS
LVR-01	PUMP HOUSE	48"	24"	1600	ALUM	--	3.96	0	0.025	RUSKIN ELF 6375DXH	--

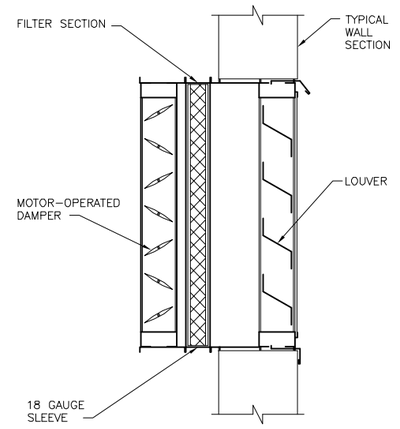
MOTOR-OPERATED DAMPER PERFORMANCE DATA

MARK NO.	LOCATION	DIMENSION WIDTH	DIMENSION HEIGHT	TYPE OPENING	SERVES	TYPE SERVICE	UNIT ILLUSTRATED	REMARKS
MOD-01	PUMP HOUSE	48"	24"	WALL	LVR-01	INTAKE	RUSKIN CD50	(1) 120 VOLT DAMPER MOTOR

AIR FILTER PERFORMANCE DATA

MARK NO.	LOCATION	UNIT SERVED	CFM	PRESSURE DROP INS WC INITIAL	PRESSURE DROP INS WC FINAL	EFF %	OVERALL SIZE INCHES HEIGHT	OVERALL SIZE INCHES WIDTH	UNIT ILLUSTRATED	REMARKS
FLT-01	PUMP HOUSE	LVR-01	1600	0.2	0.375	30	24"	48"	CAMFIL FARR 30/30	1,2

1. PROVIDE 48x24 FILTER HOUSING FOR 1 48x24 CAMFIL FARR 30/30 MERV 8 FILTER.
2. FILTER HOUSING SHALL BE 4P GLIDE/PACK BY CAMFIL FARR OR APPROVED EQUAL.



FILTERED AIR INTAKE

NOT TO SCALE

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	R DALRYMPLE
PROJECT NUMBER	145910

M. KENT PEARCE 4202 1-12 STATE OF NEBRASKA REGISTERED CIVIL ENGINEER

KEVIN THERNES E-8566 1-12-12 STATE OF NEBRASKA PROFESSIONAL ELECTRICAL ENGINEER

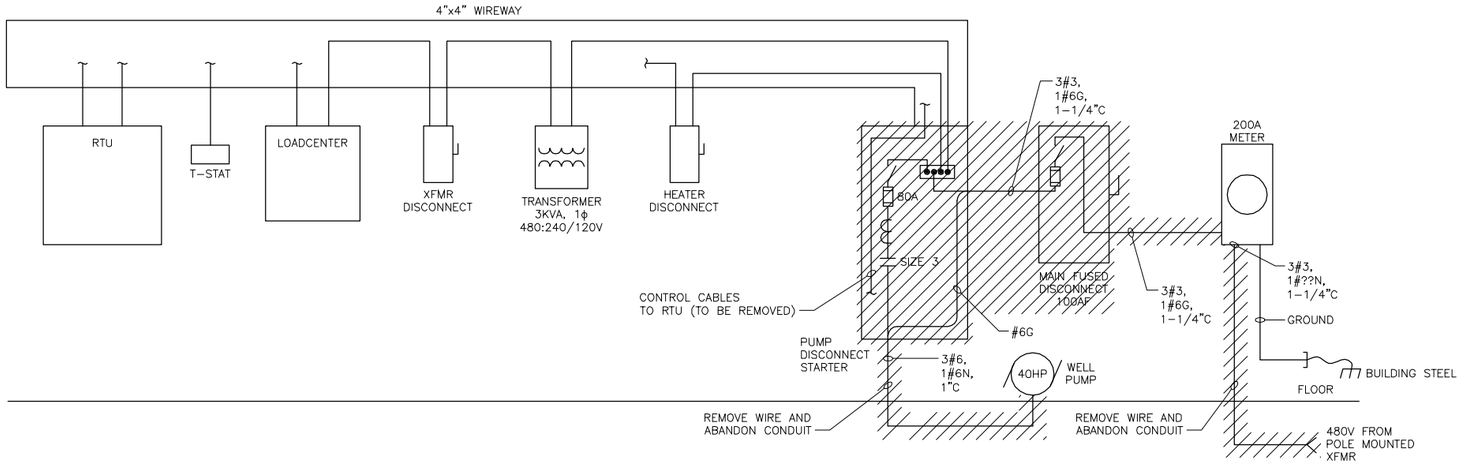
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

WELL HOUSE PROCESS, ELECTRICAL & MECHANICAL PLANS

0 1" 2"

FILENAME	03U-01.dwg
SCALE	AS NOTED

SHEET 03U-01

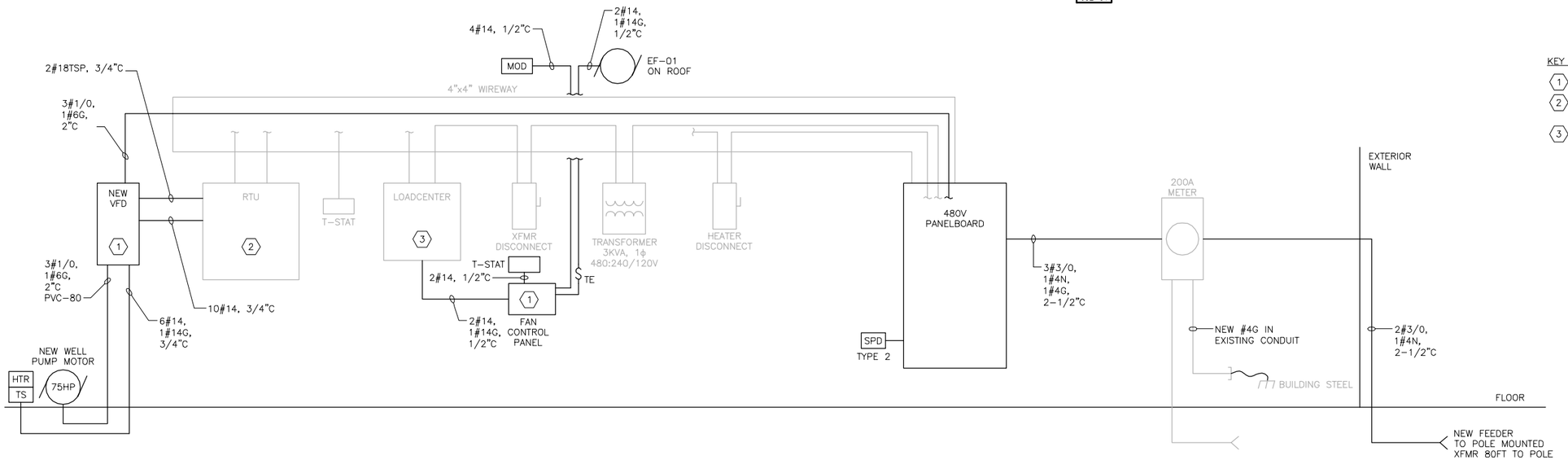


EXISTING WELL HOUSE 6, 7, & 8 RISER DIAGRAM AND DEMOLITION

1 / 03E-01

REFERENCE PHOTO

3 / 03E-01



NEW WELL HOUSE 6, 7, & 8 RISER DIAGRAM

2 / 03E-01

KEY NOTES:

1. SEE CONTROL DIAGRAM ON SHEET 03E-02.
2. TERMINATE CONDUCTORS AS DIRECTED BY GRAND ISLAND UTILITIES.
3. PROVIDE 15A/1P BREAKER IN LOAD CENTER.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

PROFESSIONAL ELECTRICAL ENGINEER — KEVIN K. THERNES E-8566 — STATE OF NEBRASKA — 1/12/12

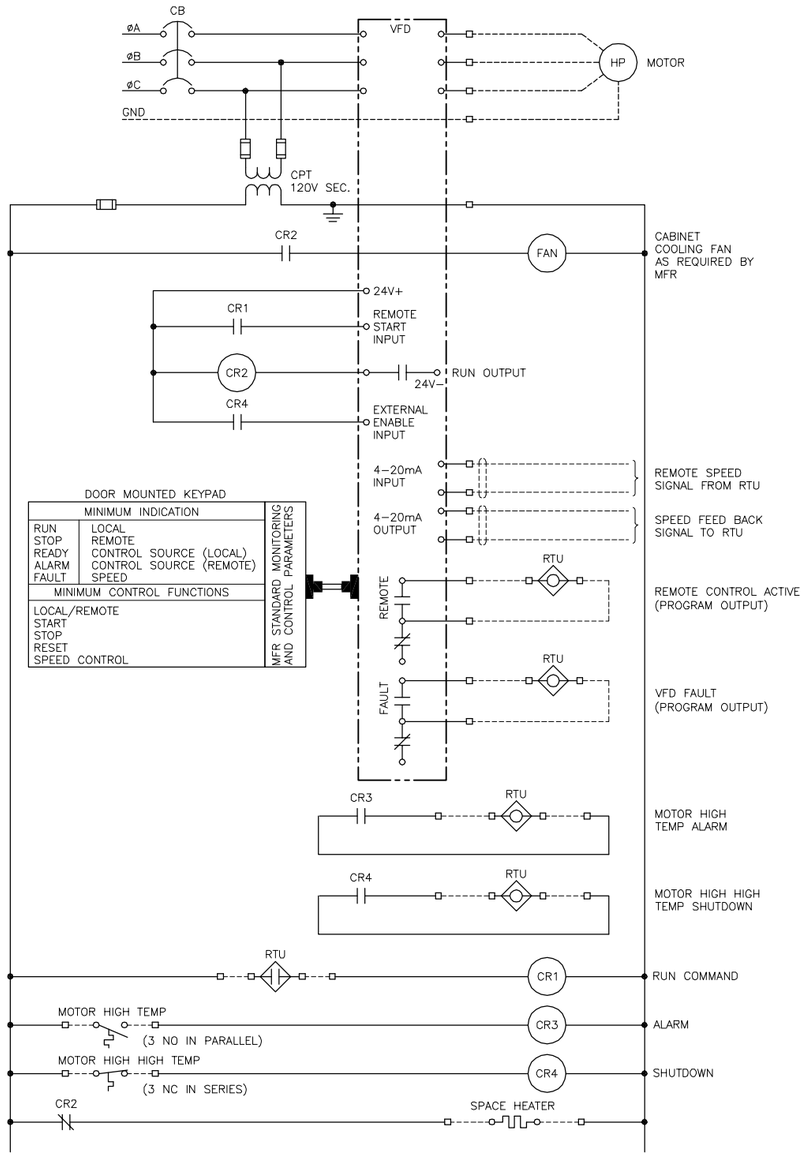
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

WELL HOUSE 6, 7, & 8 RISER DIAGRAM

0 1" 2"

FILENAME	03E-01.dwg
SCALE	NOT TO SCALE

SHEET 03E-01



WELL PUMP MOTOR CONTROL DIAGRAM

1
03E-02

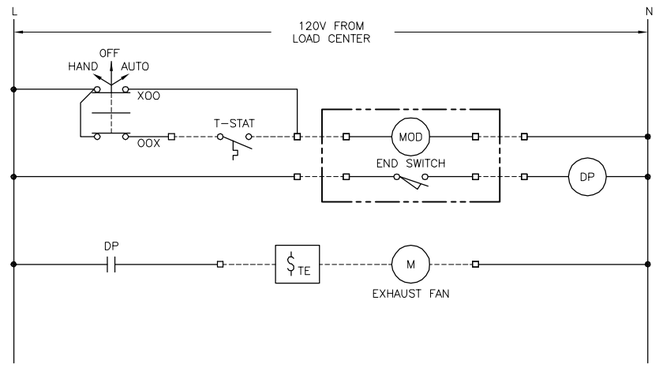
PANELBOARD NO: WELL HOUSE

VOLTAGE:	480Y/277	**BUS RATING (A):**	200	**ENCLOSURE:**	NEMA 1
PHASE:	3	**MAIN OC DEVICE:**	200/3	**MOUNTING:**	SURFACE
WIRE:	4+GND	**INTERRUPTING RATING (KA):**	22	**LOCATION:**	WELL HOUSE
200% NEUTRAL:	NO	**SERVICE ENTRANCE LABEL:**	YES		

CKT		CONNECTED LOAD (VA)				OCP			OCP		CONNECTED LOAD (VA)					CKT
NO.	DESCRIPTION	LTS	REC	MECH	MISC	AMPS	P		AMPS	P	LTS	REC	MECH	MISC	DESCRIPTION	NO.
1	3 KVA XFMR		1,500			15	2	A	150	3				25,400		2
3			1,500					B						25,400	WELL PUMP VFD	4
5	SPACE							C						25,400		6
7				1,000		15	3	A							SPACE	8
9	HEATER			1,000				B							SPACE	10
11				1,000				C							SPACE	12
13	SPACE							A							SPACE	14
15	SPACE							B							SPACE	16
17	SPACE							C							SPACE	18
19						40	3	A							SPACE	20
21	SPD							B							SPACE	22
23								C							SPACE	24

LOAD SUMMARY

	LTS	REC	MECH	MISC	SPARE	TOTAL				PHASE BALANCE	
CONNECTED LOAD (KVA)	0.0	3.0	3.0	76.2	--	82.2		480	LINE-TO-LINE VOLTS	PHASE A (KVA)	28
DEMAND FACTOR	1.25	NEC	1.00	1.00	20%	--		99	CONNECTED AMPS	PHASE B (KVA)	28
DESIGN LOAD (KVA)	0.0	3.0	3.0	76.2	16.4	98.6		119	DESIGN AMPS	PHASE C (KVA)	26



EXHAUST FAN CONTROL PANEL DIAGRAM

2
03E-02

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	1/12/2012	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	K THERNES
	P O'BRIEN
PROJECT NUMBER	145910

PROFESSIONAL ELECTRICAL ENGINEER
KEVIN THERNES
E-8566
STATE OF NEBRASKA

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

ELECTRICAL DETAILS AND DIAGRAMS

0 1" 2"

FILENAME	03E-02.dwg
SCALE	NOT TO SCALE

SHEET
03E-02