TOWN OF SALEM, NEW HAMPSHIRE

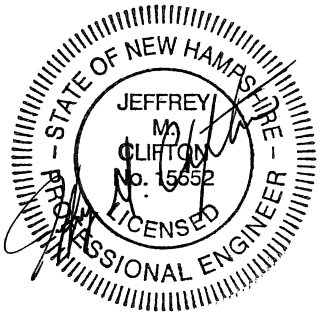
REQUEST FOR BIDS

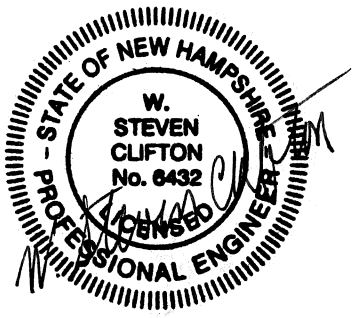
Bid No. 2018-031

COMMERCIAL DRIVE PUMPING STATION IMPROVEMENTS

For Construction

December 7, 2018





Underwood Engineers, Inc., Portsmouth, NH
UEI #2367

Town of Salem, New Hampshire
33 Geremonty Drive
Salem, NH 03079

A. REQUEST FOR PROPOSALS/BIDS (Bid No. 2018-031)

The Town of Salem, New Hampshire is requesting proposals/bids for **Commercial Drive Pumping Station Improvements** at the Wastewater Pumping Station, located at 4 Commercial Drive in Salem. The complete bid package will be available for download from the Town's Purchasing website (http://www.townofsalemnh.org/purchasing/pages/current-bids-proposals-and-awards) on or about December 7th.

All bidders are required to visit the site to determine existing conditions and obtain all pertinent dimensions, etc. that would affect the work. Bids submitted shall include a written certification that a site visit was made and that the Bidder is fully familiar with all existing conditions.

The Town of Salem will accept proposals/bids at **Town of Salem Town Hall, 33 Geremonty Drive, Salem, NH 03079 until 1:00 p.m. on Friday, December 21, 2018, at which time they will be opened publicly and read aloud in the Knightly Meeting Room**. The basis of selection for award of the work shall be the base bid plus alternates in ascending order as budget allows. The Town shall also award the work to the lowest responsible bid proposal that allows the project to be performed within the Town's available budget and will result in the work being performed in a schedule and manner that is in the best interest of the Town. The Town reserves the right to reject any and all bids, and the cost of preparing a bid submittal is the sole responsibility of the Bidder.

B. INFORMATION FOR BIDDERS:

Completion time for the proposed Substantial and Final Completion dates of the proposed work shall be specified by the Bidder in the submittal. In no case shall the proposed substantial completion date be later than June 28, 2019.

The successful bidder shall furnish a 100% Performance Bond and Payment Bond in a form acceptable to the Town of Salem upon execution of the Construction Contract.

Technical questions on the project and arrangements to inspect the Commercial Drive Pumping Station shall be directed to Dan Hudson, P.E., Town of Salem, at (603) 890-2033.

No bidder may withdraw a Bid within 60 days after the actual date of opening thereof.

Copies of the Contract Documents may be obtained only from the Town of Salem, 33 Geremonty Drive, Salem, NH 03079. The complete bid package will be available for download from the Town's Purchasing website at:

(http://www.townofsalemnh.org/purchasing/pages/current-bids-proposals-and-awards) on or about December 7th. Partial sets will not be distributed.

C. **BID:**

Proposal of _____

(hereinafter called "BIDDER"), organized and existing under the laws of the State of _____, doing business as _____

(Corporation, Partnership, Individual)

To the TOWN OF SALEM (hereinafter called "OWNER").

In compliance with the Information for Bidders, BIDDER hereby proposed to perform all WORK described in the Bid Package for the Commercial Drive Pumping Station Improvements within the time set forth herein at the price stated below.

BASE BID PRICE:

In Words: _____

_____ Dollars ($_____)

LUMP SUM

The basis of selection for award of the work shall be the base bid plus alternates in ascending order as budget allows.

Bid Alternative No. 1

Piping Replacement

In Words: _____

_____ Dollars ($_____)

LUMP SUM

PROPOSED START DATE: _____

PROPOSED SUBSTANTIAL COMPLETION DATE*: _____

*(Shall be no later than June 28, 2019)

PROPOSED FINAL COMPLETION DATE: _____

Respectfully submitted:

_____ _____

Signature Address

_____ _____

Title Date

Being duly sworn, deposes and says that he is

_____ of _____

(Name of Organization)

and that the answers to the foregoing questions and all statements contained therein are true and correct.

Sworn to before me this _____ day of **December** , **2018**

_____
Notary Public

My commission expires _____
(Seal - If BID is by Corporation)

ATTEST: _____

D. CONTRACT/AGREEMENT:

THIS AGREEMENT, made this _____ day of **December** 2018 by and between TOWN OF SALEM (Name of Owner), hereinafter called **"OWNER"** and _____ doing business as (an individual,) or (a partnership,) or (a corporation) hereinafter called **"CONTRACTOR".**

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The **CONTRACTOR** will commence and complete the construction of

Commercial Drive Pumping Station Improvements
(Project)

2. The **CONTRACTOR** will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the **PROJECT** described herein.

3. Execution of this Contract/Agreement shall constitute authorization to proceed and the start of contract time.

Liquidated damages will be in the amount of $ 250.00 for each calendar day of delay beyond the contract period established for substantial and final completion as proposed by the Bidder.

4. The **CONTRACTOR** agrees to perform all of the **WORK** described in the **CONTRACT DOCUMENTS** and comply with the terms therein for the sum of $ _____ or as shown in the **BID** schedule with Substantial Completion by _____, and Final Completion by _____.

5. The term "**CONTRACT DOCUMENTS**" means and includes the following:

(A) REQUEST FOR PROPOSALS/BIDS
(B) INFORMATION FOR BIDDERS
(C) BID
(D) CONTRACT/AGREEMENT
(E) CONTRACTOR'S RELEASE
(F) GENERAL CONDITIONS
(G) SPECIAL CONDITIONS
(H) TECHNICAL SPECIFICATIONS
(I) DRAWINGS DATED 12/7/2018.

6. The **OWNER** will pay to the **CONTRACTOR** in the manner agreed to by negotiations between the Bidder and the Town of Salem.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in Four (4) original copies, each of which shall be deemed an original on the date first above written.

OWNER: TOWN OF SALEM

By: _____

Name: _____
(Please type)

(SEAL)

ATTEST: _____

Name: _____

Title: _____

CONTRACTOR: _____

By: _____

Name: _____

Address: _____

_____

(SEAL)

ATTEST: _____

Name: _____

Title: _____

E. CONTRACTOR'S FINAL RELEASE AND WAIVER OF LIEN

Project/Owner | Contractor

Project: **Commercial Drive Pumping Station Improvements**

Town of Salem, NH
Address: 33 Geremonty Drive
Salem, NH 03079
City State Zip

Name: _____
Address: _____
_____
City State Zip

Owner Town of Salem, NH

Contractor License: _____

_____

Contract Date: _____

TO ALL WHOM IT MAY CONCERN:
For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned Contractor hereby waives, discharges, and releases any and all liens, claims, and rights to liens against the above-mentioned project, and any and all other property owned by or the title to which is in the name of the above-referenced Owner and against any and all funds of the Owner appropriated and available for the construction of said project, and any and all warrants drawn upon or issued against any such funds or monies, which the undersigned Contractor may have or may hereafter acquire or process as a result of the furnishing of labor, materials, and/or equipment, and the performance of Work by the Contractor on or in connection with said project, whether under and pursuant to the above-mentioned contract between the Contractor and the Owner pertaining to said project or otherwise, and which said liens, claims or rights of lien may arise and exist.

The undersigned further hereby acknowledges that the sum of

_____

Dollars ($_____) constitutes the entire ***unpaid*** balance due the undersigned in connection with said project whether under said contract or otherwise and that the payment of said sum to the Contractor will constitute payment in full and will fully satisfy any and all liens, claims, and demands which the Contractor may have or assert against the Owner in connection with said contract or project.

Dated this ___ day of _____20__

_____
Contractor

Witness to Signature

By_____

Title_____

By_____

Title_____

F. **GENERAL CONDITIONS:**

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1. Materials, Services, Facilities and Workmanship shall be furnished as follows:

   1.1 Except as otherwise specifically stated in the contract documents, the Contractor shall provide all materials, labor, tools, equipment, supplies, as transportation, superintendence, temporary construction as required, and all other services and facilities necessary to execute, complete, and deliver the work within the specified time.

   1.2 Unless otherwise specifically provided for in the specifications, all equipment, materials and articles incorporated in the work shall be new.

   1.3 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, and started up in compliance with the manufacturer's recommendations.

2. Contractor's obligation is as follows: The Contractor shall in good workmanlike manner, perform and complete all the work required by this contract, within the time stated in the proposal in accordance with the plans and drawings covered by this contract. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the contract documents, and shall complete the work to the satisfaction of the Owner.

3. Protection of work and property shall be provided as follows:

   3.1 The Contractor shall at all times protect the Owner's property from injury or loss in connection with this contract. He shall at all times protect his own work, and that of adjacent property, from damage. The Contractor shall replace or make good any such damage, loss or injury related to this work unless caused directly by errors contained in the contract, or by the Owner.

   3.2 The Contractor shall take all necessary precautions for the safety of his employees on the work site, and shall comply with all applicable provisions of local, federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed.

   3.3 In case of emergency which threatens loss or injury of property, and/or safety of life, the Contractor is allowed to act, without previous instructions.

4. Defective work shall be processed as follows:

   4.1 The Contractor shall promptly remove from the premises all materials and work determined to be defective or failing to meet contract requirements,

whether incorporated in the work or not, and shall promptly replace such work in accordance with the contract at no additional expense to the Owner.

5. Acceptance, payment, and retainage provisions shall be as follows:

5.1 Progress Payments. The Owner will once each month make a progress payment to the Contractor on the basis of an estimate of total of work done to the time of the estimate and its value as prepared by the Contractor and approved by the Engineer.

5.2 Retainage by Owner. The Owner will retain a portion of the progress payment, each month, in accordance with the following procedures:

a. The Owner will establish an escrow account in the bank of the Owner's choosing. The account will be established such that interest on the principal will be paid to the Contractor. The principal will be the accumulated retainage paid into the account by the Owner. The principal will be held by the bank, available only to the Owner, until termination of the contract.

b. Until the work is 50% complete, as determined by the Engineer, retainage shall be 10% of the monthly payments claimed. The computed amount of retainage will be deposited in the escrow account established above.

c. After the work is 50% complete, and provided the Contractor has satisfied the Engineer in quality and timeliness of the work, and provided further that there is no specific cause for withholding additional retainage no further amount will be withheld. The escrow account will remain at the same balance throughout the remainder of the project.

5.3 Substantial completion and payment.

a. Substantial completion shall be that point, as certified by the Owner, or his Agent, at which the contract has been completed to the extent that the Owner can make full use of the replacement pumping system and electrical improvements as designed.

b. Upon substantial completion, the entire balance due and payable to the Contractor less 5 percent retainage of the Contract Price, and less a retention based on an estimate of the fair value for the cost of completing or correcting listed "punch list" items of work with specified amounts for each incomplete or defective item of work shall be made.

c. A guarantee period of one year for the work shall begin on the date certified by the Owner that the work is substantially completed.

5.4 Final completion shall be that point at which all work has been completed and all "punch list" and/or defective work has been corrected. Unless the Owner has issued a certificate of substantial completion, the general guarantee period shall begin upon certification by the Owner of final completion.

5.5 At the end of the general guarantee period when it is found that the work is satisfactory and that no work has become defective under the terms of the contract, the Owner will accept the entire project and make final payment, including the reimbursement of the 5% monies retained.

5.6 If the guarantee inspection discloses any work as being unsatisfactory, the Owner will give the Contractor the necessary instructions for correction of such work, and the Contractor shall immediately execute such instructions. Upon Correction of the work, another inspection will be made which shall constitute the guarantee inspection, provided the work has been satisfactorily completed.

5.7 The acceptance by the Contractor of final payment shall release the Owner from all claims and all liability to the Contractor relating to this work, and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall release the Contractor or his sureties from any obligations of the performance and payment bond under this contract.

6. The Contractor and any Subcontractor shall obtain all the insurance required under this article.

6.1 The Contractor and all Subcontractors shall procure and shall maintain during the life of this contract workmen's compensation insurance as required by applicable state law. The Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance.

Limits of Liability:
$100,000 each accident;
$500,000 disease - policy limit;
$100,000 disease - each employee.

6.2 The Contractor shall procure and shall maintain during the life of this contract Commercial General Liability insurance to include contractual liability, explosion, collapse and underground coverages, including the Owner as an insured party.

Limits of liability:

$1,000,000 each occurrence bodily injury and property damage;
$2,000,000 general aggregate - include per project aggregate endorsement;
$2,000,000 products/completed operations aggregate.

If blasting or demolition or both is required by the contract, the Contractor

or

Subcontractor shall obtain the respective coverage and shall furnish the Owner a certificate of insurance evidencing the required coverages prior to commencement of any operations involving blasting or demolition or both.

6.3 The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such insurance shall not be canceled or materially altered, except after 10 days written notice has been received by the Owner.

7. The Contractor shall not commence work until a pre-construction conference has been held at which representatives of the Owner are present.

G. SPECIAL CONDITIONS:

Note:

The following Special Conditions may modify, change, delete, or add to the "General Conditions." Where any part of the General Conditions is modified or voided by these Special Conditions, the unaltered provisions of that part shall remain in effect.

SPECIAL CONDITIONS

1. WORKING HOURS

The CONTRACTOR shall not begin work until after 07:00 hours and no construction activities shall be allowed after 15:30 hours. All cleanup shall have been completed by this hour. No work shall be allowed on weekends or holidays.

2. CHARACTER OF THE CONTRACTOR'S SUPERINTENDENT AND WORKERS

A. The CONTRACTOR'S superintendent shall conduct himself in a professional, cooperative, and responsible manner. If, in the opinion of the OWNER, the superintendent does not conducts him/herself in a manner that is professional and courteous, the OWNER may direct the CONTRACTOR to relieve the superintendent of his/her responsibilities and have him/her removed from the project. Upon written notice from the OWNER to the CONTRACTOR the superintendent shall immediately be relieved of his/her responsibilities and removed from the project. If a superintendent change is to be made, work shall be terminated until qualifications of a new superintendent have been submitted and approved by the OWNER. The superintendent that was removed from the site shall not be allowed to work on any other portion of work in this Contract without written approval of the OWNER.

B. Any person employed by the CONTRACTOR or by any subcontractor who, in the opinion of the OWNER, does not conduct him/herself in a proper and professional manner or is intemperate or disorderly shall, at written request of the OWNER, be removed immediately by the CONTRACTOR or subcontractor employing such person, and shall not be allowed to work on any other portion of work in this Contract without written approval of the OWNER.

3. SITE SECURITY

The CONTRACTOR shall be required to place temporary barriers or fencing (snow fence, fluorescent orange security fencing, etc.) around all storage yards at all times and around all equipment during non-working hours.

4. SCHEDULE

The CONTRACTOR shall submit a proposed progress schedule to the OWNER with their proposal.

5. PRECONSTRUCTION PHOTOGRAPHS

The CONTRACTOR shall take pre-construction digital photographs of the existing Pumping Station Building and Electrical and Controls system and supply two (2) sets of photographs to the Town clearly indicating the pre-construction physical condition of the existing Pumping Station Building and Electrical and Controls system prior to the start of work.

6. OWNER'S RIGHT TO MATERIAL

The OWNER retains the right to the existing soft starts and other electrical equipment after demolition by the CONTRACTOR under this Contract. The OWNER also retains the right to all existing conduit and wiring removed and/or replaced under this project. The CONTRACTOR shall package and deliver these items to a location at the water treatment facility site designated by the OWNER, covered on a suitable pallet or platform as appropriate. Should the CONTRACTOR wish to make an offer to the OWNER for the salvage value of these items; such an offer shall be made in writing to the OWNER for consideration as a deductive change order.

7. CLEANUP

The CONTRACTOR shall remove all construction material, equipment, or other debris remaining on the construction site as a result of construction operations and render the site of the work in a neat and orderly condition at least equal to that which existed prior to the start of construction.

The CONTRACTOR shall dispose of all materials and debris off-site in accordance with local, state, and federal regulations.

Once all work is complete, the CONTRACTOR shall perform a final cleaning of the work areas to remove any dust/dirt/debris from the areas to leave them in a clean and orderly fashion for use by the OWNER.

8. OCCUPYING PRIVATE PROPERTY

The CONTRACTOR shall not enter upon nor occupy with men, equipment or materials any property outside of the town property, unless written consent of the owner is obtained prior to entry.

H. TECHNICAL SPECIFICATIONS

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Division 1 – General Requirements

Division 9

Division 11

Division 15

Division 16 - Electrical

Scope of Work

The scope of this Division covers the General Administrative Requirements and the general work related provisions of the Construction Contract.

Contents of Division

Section No.	Section Title
01010	Summary of Work
01340	Submittals
01668	Services of Manufacturer's Representatives
01720	Project Record Documents
01730	Operation & Maintenance Manuals

SECTION 01010

SUMMARY OF WORK

PART 1 -- GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, equipment and materials necessary to install and construct:

Commercial Drive Pumping Station Improvements:

1. Furnish and install the duplex pumping system to replace the existing, consisting of (2) pumps and motors. Maintain existing pump skid, VFD's, level control and pump control panel.
2. Installation of all associated conduit, electrical power wiring, control systems and control wiring, assembly, and other construction activities necessary to provide complete and fully operational systems.
3. Furnish and install electrical improvements as shown on the drawings.

B. In addition, this Contract shall include, but not be limited to, the following:

1. All demolition and all other construction activities necessary to provide a complete and fully operational system to meet the intent of the construction Drawings and Project Manual.

1.2 CONTRACTOR'S RESPONSIBILITIES

A. The Contractor shall have the following responsibilities:

1. Furnish all labor, material, equipment, survey control and incidentals as required to perform the work in its entirety as shown on the Construction Drawings and specified herewith.
2. Coordinate all construction activities, including bypass pumping or temporary power, as necessary, with the Engineer and Owner.
3. Complete this construction project in accordance with the bid documents within the allotted time schedule and provide the required warranties.
4. The Contractor is responsible or all applicable health and safety requirements during construction.
5. Any damage to existing structures, equipment and property, accepted equipment or structures, and property or work in progress by others; as a result of the Contractor's or his subcontractor's operations shall be repaired/restored by the Contractor at no additional cost to the Owner.
6. The work includes, but is not limited to, furnishing all materials, labor and equipment to perform the following activities:
   a. Preparation and submittal of contract specified submittals
   b. Preconstruction Conference
   c. Project meetings (monthly or more often as necessary)
   d. Construction safety and quality control
   e. Temporary utilities
   f. Bypass pumping or other temporary systems
   g. Project closeout

h. Project record documents
i. State and local permits, if applicable.

1.3 ENUMERATION OF CONTRACT DOCUMENTS

A. Construction Drawings
1. The Construction Drawings, which form a part of this contract, include Drawings **SHT-1** through **SHT-4** (Section I).

B. Project Manual
1. The Project Manual, which forms a part of this contract, includes the following:
a. Request for Proposals/Bids
b. Information for Bidders
c. Bid Form
d. Contract Agreement
e. Contractor's Release
f. General Conditions
g. Special Conditions
h. Technical Specifications
2. All Addenda issued during the Bidding process also form a part of this contract.

C. The Construction Drawings and the Project Manual form the Contract Documents.

D. The Contractor will be given three (3) additional sets of contract documents (ie. plans and project manuals) for use during construction. If the Contractor requests additional sets, the Contractor shall pay for the cost for reproduction of the sets and the cost of the Engineer for the time required making the reproductions. The Contractor shall pay the Engineer directly for these additional charges.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

3.1 WORK SEQUENCE

A. It is the intention that the work required to be completed under this contract be performed in an organized and work-like manner. The construction shall be done to accommodate the existing wastewater flows. The Contractor shall coordinate progress, schedule and performance with the Owner and the Engineer during construction.

3.2 SPECIAL REQUIREMENTS

A. Contractor shall determine the lead time of all materials required and shall schedule and coordinate work to accommodate the delivery of equipment and materials.

B. Any proposed change in the existing system status (pumps, valves, controls, etc.) shall be coordinated in advance with the Owner and Engineer.

3.3 USE OF PREMISES

A. Contractor shall limit use of premises for work, for storage, and for access, to allow:

1. Owner occupancy on Owner's property
2. Normal public use of public property, rights-of-way, etc.
3. Access to public property

B. Coordinate use of premises under direction of Owner.

C. Assume full responsibility for protection of safekeeping of products under this Contract.

D. Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

3.4 WORK RESTRICTIONS

A. Work on the project will be only allowed between the hours of 7:00 am and 3:30 pm, excluding holidays and weekends, except during emergencies, unless requested in writing and approved by the Owner.

END OF SECTION

SECTION 01340

SUBMITTALS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Submit to the Engineer, Shop Drawings, Operation and Maintenance Manuals, Manufacturers' Certificates, Project Data, and Samples required by the Specification Sections.

B. Alternates
   1. If the Contractor elects to submit an Alternate that is considered a "substitute", the Contractor will be responsible to make all modifications to the Work resulting from the use of the Alternate at no additional cost to the Owner.

1.2 SHOP DRAWINGS

A. Shop Drawings are required for each and every element of the work. Each shop drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on required resubmission.

B. Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.

C. The Contractor shall submit to the Engineer a minimum of six (6) copies of Shop Drawings and approved data. The Engineer will retain four (4) copies (for Owner's, Engineer's and Field Representative's files) and return two (2) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more copies, then the number of copies submitted shall be adjusted accordingly.

D. The Contractor shall provide a copy of a completed submittal certification form which shall be attached to every copy of each shop drawing. Shop Drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the work.

E. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.

F. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such

materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.

G. Until the necessary review has been made, the Contractor shall not proceed with any portion of the work (such as the construction of foundations), the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which review is required.

H. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. Shop drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions. Approved standard sizes shall be: (a) 24 inches by 36 inches; (b) 11 inches by 17 inches, and (c) 8-1/2 inches by 11 inches. Provision shall be made in preparing the shop drawings to provide a binding margin on the left hand side of the sheet. Shop drawings submitted other than as specified herein may be returned for re-submittal without being reviewed.

I. Only drawings, which have been checked and corrected by the fabricator, should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer.

J. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.

K. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

L. A maximum of two submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion.

1.3 SAMPLES

A. The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available.

1.4 OPERATION AND MAINTENANCE MANUALS

A. At least 1 month prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein Specification Section 01730, and within individual equipment specification sections.

B. The Contractor shall furnish the Engineer a minimum of six (6) copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each item specified. The Engineer will retain four (4) copies (for Owner's, Engineer's and Field Representative's files) and return two (2) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more copies, then the number of copies submitted shall be adjusted accordingly.

C. Manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of catalogs, brochures, bulletins, charts, schedules, equipment numbers, shop drawings corrected to as-built conditions, wiring diagrams, and assembly drawings which shall describe capacity location, operation, maintenance, lubrication, operating weight, lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit, and other necessary information for the Engineer to establish a complete maintenance program.

D. The submittal shall also include details of all replacement parts; "Nameplate" data for all equipment; detailed instructions for start-up, normal operation, shutdown procedures, safety procedures and control techniques; and a guide to troubleshooting the system.

1.5 MANUFACTURER'S CERTIFICATES

A. Prior to accepting the installation, the Contractor shall submit manufacturer's certificates for each item specified.

B. Such manufacturer's certificates shall state that the equipment has been installed under either the continuous or periodic supervision of the manufacturer's authorized representative, that it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, and that it is operating in accordance with the specified requirements, to the manufacturer's satisfaction. All costs for meeting this requirement shall be included in the Contractor's bid price.

C. Certified performance test data will also be submitted to the Engineer as required by the specifications.

1.6 RECORD DRAWINGS

A. The Contractor shall submit, at the end of the Project, a clean, legible, and accurate set of red-lined drawings indicating any and all field changes that occurred during the course of construction. These drawings shall document all differences between what

was called for in the executed contract drawings and what was actually constructed in the field. These drawings shall constitute record drawings for the Project.

1.7 SUBMISSION REQUIREMENTS

A. Submittals not meeting these requirements will be returned to the CONTRACTOR without review by the ENGINEER for completion of this information and resubmittal without a claim of lost time being allowed for this deficiency.

B. Accompany submittals with transmittal found on Page 01340-6, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. The number of each Shop Drawing, Project Data and Sample submitted.
   5. Notification of deviations from Contract Documents.
   6. Other pertinent data.

C. Submittals shall include:
   1. Date and revision dates.
   2. Project title and number.
   3. The names of:
      a. Engineer.
      b. Contractor.
      c. Subcontractor.
      d. Supplier.
      e. Manufacturer.
      f. Separate detailer when pertinent.
   4. Identification of product or material.
   5. Relation to adjacent structure or materials.
   6. Field dimensions, clearly identified as such.
   7. Specification section number.
   8. Applicable standards, such as ASTM number or Federal Specification.
   9. A blank space, 4" x 4", for the Engineer's stamp.
   10. Identification of deviations from Contract Documents.
   11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.
   12. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
   13. Where specified, manufacturer's guarantee.

1.8 RESUBMISSION REQUIREMENTS

A. Revise initial submittals as required and resubmit as specified for initial submittal.

B. Indicate on submittals any changes which have been made other than those required by Engineer.

1.9 ENGINEER'S REVIEW

A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

SUBMITTAL CERTIFICATION FORM

PROJECT: Commercial Drive Pumping Station Improvements CONTRACTOR'S PROJ. NO: _____

CONTRACTOR: _____ ENGINEER'S PROJ. NO: 2367

ENGINEER: UNDERWOOD ENGINEERS, INC.

TRANSMITTAL NUMBER: _____ SUBMITTAL NUMBER: _____

SPECIFICATION SECTION OR DRAWING NO: _____

DESCRIPTION: _____

MANUFACTURER: _____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with

___ NO DEVIATIONS

or

___ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS[a]:

_____
_____
_____
_____
_____

By: _____ By: _____
Contractor[b] Manufacturer[c]

Date: _____ Date: _____

[a] Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if so directed.

[b] Required on all submittals

[c] When required by specifications

END OF SECTION

SECTION 01668

SERVICES OF MANUFACTURER'S REPRESENTATIVES

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. Coordinate and provide an overall startup, testing, and operator training schedule.
B. Arrange for the observation of the installation of the equipment.
C. Arrange for the checking, inspection, and adjustment of the equipment and certification of the equipment, alarms, instrumentation, and controls.
D. Provide power, labor, materials, equipment, and temporary facilities necessary for the performance testing and start-up of the equipment, alarms, instrumentation, and controls.
E. Arrange for operator training.

PART 2 -- PRODUCTS

Not used.

PART 3 -- EXECUTION

AT LEAST SEVEN (7) DAYS IN ADVANCE OF THE PROPOSED EQUIPMENT STARTUP, THE CONTRACTOR SHALL SUBMIT A PROPOSED STARTUP SCHEDULE IN WRITING TO THE ENGINEER FOR REVIEW.

3.1 TESTING IN PREPARATION FOR OPERATIONAL READINESS

A. The minimum period of time that the service representatives shall be available to perform the services described herein shall be in accordance with the schedule in the individual specification sections. Any delays resulting in additional time required by manufacturers to allow the Contractor to correct and make equipment ready to start-up as a result of support systems not being ready for startup will be provided at no additional cost to the OWNER.
B. Furnish the services of a manufacturer's qualified representative to observe, check, and certify as to the adequacy of the installation of equipment indicated in the individual specification sections.
C. Furnish the services of a manufacturer's qualified trained service representative or designee acceptable to the ENGINEER, to check, inspect, and adjust all equipment and accessories in preparation for operation in accordance with the individual specification sections prior to equipment startup. The services shall begin when the equipment is requested to be placed into operation by the CONTRACTOR and as approved by the ENGINEER.
D. The service representative shall: inspect the equipment for proper installation, lubrication and adjustment, damage and missing parts; inspect and check control systems and accessory equipment whether or not supplied by other manufacturers; and, make all

necessary corrections to make equipment ready to start-up and properly operate after start-up.

E. Prior to equipment start-up, the service representative shall furnish a written report to the ENGINEER confirming that equipment installation is in conformance with the manufacturer's recommendations; that all alignments, adjustments and corrections have been made; and, that the equipment is ready for operation.

3.2 PERFORMANCE TESTING

A. The CONTRACTOR shall provide the services of a manufacturer's qualified service representative or designee acceptable to the ENGINEER, as required for equipment provided on the Project, to directly supervise the performance testing of equipment installed on the Project. These services shall be provided in addition to the installation observation and/or installation certification requirements and operator training requirements as described in this section.

B. Performance testing shall not be performed until after the service representative's written confirmation of proper installation and preparation for startup has been furnished to ENGINEER.

C. Performance testing of all electrical, mechanical and hydraulic equipment and associated controls and instrumentation shall be performed to demonstrate that the equipment and associated systems meet the specified performance conditions (and documented to the Engineer in writing).

D. Performance criteria and/or procedures are contained in various sections of the individual equipment specifications. Where a specific procedure is not described in the individual specifications, testing procedures common to the industry shall be employed to verify performance.

E. All scheduling of performance testing shall be approved by the ENGINEER and a minimum of seven (7) days notice shall be provided to the ENGINEER by the CONTRACTOR prior to scheduling of testing. In addition, when more than one system is to be tested within a given week, the CONTRACTOR shall provide a proposed equipment testing schedule to the ENGINEER for review at least one week prior to initiating equipment tests.

F. Performance testing of all equipment shall be performed prior to acceptance of the Work.

G. Prior to initiating the performance tests, the procedure to be used shall be submitted to the ENGINEER for his review and approval at least 48 hours in advance.

H. During the performance tests, the designated manufacturer's service representative shall record all necessary data to verify that the equipment being tested meets the specified performance criteria, on forms acceptable to the ENGINEER.

I. Following completion of the performance tests, the CONTRACTOR shall submit a written performance test report to the ENGINEER which summarizes the results of the performance tests and certifies that the equipment meets the specified performance requirements.

J. If the equipment fails to meet the specified performance requirements, the equipment shall be modified or replaced and retested with the end result being that the equipment meets the specified performance criteria. Modification, replacement and retesting shall be provided at no extra cost to the OWNER.

K. Requests to place a piece of equipment or system into service will be considered only after completion of successful performance testing and submittal of the performance test report to the ENGINEER by the CONTRACTOR.

L. Successful Completion of Performance Acceptance Testing does not start the Warranty Period for that equipment. The start of the Warranty Period is defined by Substantial Completion.

3.3 OPERATOR TRAINING

A. Operator training shall not be performed until after the service representative's written report of installation certification and performance test report has been approved by the ENGINEER.

B. After certifying to the installation of the equipment and at the direction of the ENGINEER, the manufacturer's representative shall train the OWNER'S operational staff in the start-up, operation, controls, alarms, and routine maintenance and troubleshooting of the equipment in the presence of the ENGINEER.

C. A proposed training schedule shall be submitted to the ENGINEER for approval at least seven (7) days in advance of the proposed operator training. When more than one system is proposed for operator training in a given week, a proposed schedule for that week shall be submitted to the ENGINEER for approval at least one (1) week in advance.

D. Following the training, the manufacturer shall provide written certification to the ENGINEER that the required training was provided.

E. All training shall be coordinated with the ENGINEER.

F. All operator training shall be video taped by the CONTRACTOR with two (2) copies provided to the OWNER.

3.4 SCHEDULE OF MANUFACTURER'S SERVICE REPRESENTATIVE

A. Services of the manufacturer's representatives for observing installation, inspecting, adjusting, testing and start-up shall be provided in accordance with the schedule defined in Part 3 of the respective equipment specification section.

B. The minimum period of time that the service representatives shall perform the services described herein shall be in accordance with the schedule defined in Part 3 of the respective equipment specification section. Any additional time to correct and make adjustments so that equipment is ready for start-up as a result of improper equipment installation or unavailability of water, power, or other support systems/controls will be provided "as required" and at no additional cost to the OWNER.

UNDERWOOD ENGINEERS

EQUIPMENT START UP LOG

EQUIPMENT	Date:	Time:

PROJECT		REPRESENTATION	
Project No.		Engineer	
Project Name		Owner	
Location		Contractor	
Owner		Vendor/Mfr	

MANUFACTURER		VENDOR	
Name		Name	
Address		Address	
Phone No.		Phone No.	

EQUIPMENT			
Equipment Name		Equipment No.	
Model No.		Serial No.	
Capacity		Type	
ELECTRICAL			
Motor Mfr		Drive Type	
Motor Size		Motor Type	
V/Ph/Hz		Initial Amperage	

SPARE PARTS				
Qty.	Description	Part No.	Prov'd	Due

Comments

Prepared by _____
Date _____

UNDERWOOD ENGINEERS

EQUIPMENT START UP LOG

EQUIPMENT CERTIFICATION

Owner: _____ Date: _____

_____

Project: _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

_____

Equipment: _____

As an authorized representative of the Equipment Manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the construction contract between the Contractor and the Owner. The undersigned further certifies that the equipment has been installed in accordance with the Manufacturer's written instructions, that it is ready for permanent operation and that nothing in the installation will render the Manufacturer's warranty null and void.

_____ _____

(Authorized Representative of the Manufacturer) (Date)

_____ _____

(Witness) (Date)

UNDERWOOD ENGINEERS

EQUIPMENT START UP LOG

EQUIPMENT TRAINING CERTIFICATION

Owner: _____ Date: _____

_____

Project: _____

_____

Contractor: _____

_____

Equipment Manufacturer: _____

_____

_____

Equipment: _____

1. I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

_____ _____
(Authorized Representative of the manufacturer) (Date)

2. The personnel listed below attended the training session.

_____

_____

_____

_____ _____
(Owner's Representative) (Date)

3. Witnessed by _____ _____
Underwood Engineers, Inc (Date)

Underwood Engineers, Inc.
25 Vaughan Mall
Portsmouth, New Hampshire 03801

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Keep accurate Record Documents of all additions, substitutions of material, variations in work, and any other additions or revisions to the Contract.

PART 2 -- PRODUCTS

2.1 DOCUMENTS

A. Maintain at the job site, one copy each of:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Reviewed Shop Drawings.
   5. Change Orders.
   6. Any other modifications to the Contract.
   7. Field Test Reports.
   8. Inspection certificates
   9. Manufacturer's certificates
   10. Manufacturer's operation and maintenance manuals

PART 3 -- EXECUTION

3.1 STORAGE AND MAINTENANCE

A. Store Record Documents in approved files and racks apart from documents used for construction.
B. File Record Documents in accordance with Project Filing Format of Uniform Construction Index.
C. Maintain Record Documents in clean, dry, legible condition.
D. Do not use Record Documents for construction purposes.
E. Make Record Documents available at all times for inspection by the Engineer and Owner.

3.2 RECORDING

A. Label each document "PROJECT RECORD" in large printed letters.
B. Keep Record Documents current and do not permanently conceal any work until required information has been recorded.
C. Contract Drawings: Legibly mark to record actual construction (when applicable)

1. Method of locations and recording shall have prior approval of the Engineer.
2. Depths of various elements of foundations in relation to survey datum.
3. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
    a. Include all water, sewer, steam, air, instrumentation and fuel piping systems and all electrical and communications circuits including all direct burial cables.
    b. Whenever any existing utility line is uncovered in the course of excavation for new utility installation, record the location dimensions of such lines.
4. Location of house service connection points with any utility (water, sewer, electrical, telephone, etc.) and the location of capped or plugged ends of these same house service lines.
    a. Locations shall be recorded by accurate "swing ties" or other methods approved by the Engineer.
5. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    a. Electrical equipment such as conduits, piping, instrumentation located in slabs, walls and ceilings and to include approximate locations and routing.
    b. Schematic diagram of actual electric conduit or instrument tubing routing between equipment and supply.
6. Field changes of dimension and detail and changes made by Change Order or Field Order.
7. Details not on original Contract Drawings.

D. Specifications and Addenda: Legibly mark up each Section to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.

3.3 SUBMITTALS

A. At the completion of the project, deliver Record Documents to the Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:
1. Date, project title and number.
2. Contractor's name and address.
3. Title and number of each Record Document with certification that each document is completed and accurate.
4. Signature of Contractor, or his authorized representative.

C. Failure to record these locations on the Project Record Drawings shall result in non-approval of the final payment to the Contractor and/or if contract time (as specified in the Contract and/or modified in accordance with the Standard General Conditions of the Construction Contract) has elapsed, this shall be grounds for the assessment of the liquidated damages as specified.

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Submit to the Engineer, all Operation and Maintenance Manuals required by the individual Specification Sections.

1.2 SUBMISSION REQUIREMENTS

A. At least 2 months prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein Specification Section 01730, and within individual equipment specification sections.

B. The Contractor shall furnish the Engineer a minimum of six (6) copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each item specified. The Engineer will retain four (4) copies (for Owner's, Engineer's and Field Representative's files) and return two (2) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more copies, then the number of copies submitted shall be adjusted accordingly.

1.3 CONTENTS

A. Table of contents

B. Operating and maintenance information on all systems and items of equipment. The data shall consist of:
   1. Catalogs, brochures and bulletins of parts
   2. Charts and graphs
   3. "Nameplate" data for all equipment including equipment serial and model number
   4. Wiring diagrams
   5. Assembly drawings of location
   6. Schedule of maintenance
   7. Lubrication requirements
   8. Lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit
   9. Operating weight
   10. Name, address and telephone number of subcontractors, manufacturers and suppliers for each piece of equipment.
   11. Shop drawings corrected to as-built conditions
   12. Operation descriptions
   13. Warranties
   14. List of replacement parts

15. Detailed instructions for start-up, normal operation, shutdown procedures, and control techniques
16. Guide to troubleshooting the system
17. Description of controls including sequencing, diagrams, charts of valve tag numbers, etc.
18. Other necessary information for the Engineer to establish a complete maintenance program

C. Materials and Finishes. The data shall consist of:
1. Building products
2. Instructions for care and maintenance
3. Additional requirements

1.4 FORMAT
A. Provide binders with covers identifying detail title.
B. Provide tabs for each separate product and system
C. Provide drawings bound in with text or folded to text size pages.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

END OF SECTION

Scope of Work

Furnish, install and test all finishes and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

Section No.	Section Title
09912	Painting

SECTION 09912

PAINTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. Preparing surfaces which are to receive finish.
B. Work shown on Drawings.
C. Staging, Shoring, lifts, installation, application, etc.
D. Protection of existing items and cleanup.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces. This is a standard specification. **Not all surfaces or coating systems included in this section will apply to all projects.** Contractor shall refer to the Drawings for an explanation of surfaces to be painted/coated. Contractor shall resolve any apparent discrepancies between the Specifications and the Drawings with the Engineer prior to preparing surfaces for painting/coating.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Owner will select from standard colors and finishes available.
   1. Painting includes locations specified on Drawing No. P-1.
   2. Specialty coatings includes proper cleaning, surface preparation and application of specialty coatings for all surfaces, materials and equipment.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless otherwise noted.
   1. Prefinished items include the following factory-finished components. (Some of these items may not be applicable to this project.):
      a. Finished mechanical and electrical equipment.
      b. Light fixtures.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces. (Some of these items may not be applicable to this project.):

a. Foundation spaces.
b. Furred areas.

3. Finished metal surfaces include the following. (Some of these items may not be applicable to this project.):
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following. (Some of these items may not be applicable to this project.):
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following (where applicable):
1. Division 5 Section "Structural Steel" for shop priming structural steel.
2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
3. Division 8 Section “Fibertec Windows” for factory priming fiberglass windows.
4. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
5. Division 10 Section “Louvers and Vents” for factory priming louvers and vents.

1.4 REFERENCE STANDARDS

A. Steel Structures Painting Council (SSPC).

1.5 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.6 SUBMITTALS

A. Submit color chips for all paint types scheduled to be used on the project.
B. Submit manufacturer's product data for all paint types scheduled to be used on the project.
C. Submit manufacturer's preparation and application recommendations for all paint types scheduled to be used on the project.

1.7 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Painting: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 70 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.9 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.

C. Provide minimum 15 foot candles of lighting on surfaces to be finished.

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.10 MAINTENANCE MATERIALS

A. Furnish not less than one gallon of each color used for each type paint used, for maintenance.

B. Containers to be unopened, tightly sealed and clearly labeled for identification.

1.11 PROTECTION

A. Adequately protect other surfaces from paint and damage. Repair damage resulting from inadequate or unsuitable protection.

B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

C. Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names:

1. Specification is based on materials as manufactured by TNEMEC Company, Inc., North Kansas, Missouri.
2. Acceptable manufacturers are Tnemec and Dupont or products demonstrated to be of equal or better quality, function and performance.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Owner from manufacturer's full range.

D. Paints to have good flowing and brushing properties and be capable of drying or curing free of streaks or sags.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
   3. Correct defects and deficiencies in surfaces which may adversely affect work of this section.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Engineer about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Over incompatible primers remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods recommended by paint/coatings manufacturer.
      b. Determine alkalinity, chloride and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
      c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean

water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting. Confirm all methods with the manufacturer prior to proceeding.

3. Wet Well Concrete and Wet Well CMU (when specifically required):
   a. Surface preparation: see following section in this specification. Remove all grease, oils, and deleterious materials from the surfaces.
4. Surface preparation shall be in full compliance with the manufacturer's recommendations.
5. Remove contamination from all surfaces and repair defects, if any, which appear after prime painting.
6. Remove surface contamination and oils from galvanized surfaces and wash with solvent. Uniformly abrade to provide continuous surface profile of 1.5 – 2.0 mils.
7. Remove dirt stains, loose mortar, scale, powder and other foreign matter from concrete and concrete block surfaces which are to be painted.
8. If coatings of scale are evident, remove by abrasive blasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing. If shop primers are incompatible with painting systems submitted, remove shop priming and reprime with a compatible primer.
9. Remove grease, rust, scale, dirt and dust from steel and iron surfaces.
10. Clean unprimed steel surfaces, ensuring weld joints, bolts and nuts are similarly cleaned. Repair defects, if any, which appear after prime painting.
11. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
12. Prime interior and exterior woodwork.

3.3 APPLICATIONS

A. Apply each coat at proper consistency.
B. Sand lightly between coats to achieve required finish.
C. Do not apply finishes on surfaces that are not sufficiently dry.
D. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.
E. Prime exterior woodwork, which is to receive paint finish, with exterior primer paint.
F. Prime interior woodwork, which is to receive paint or enamel finish, with enamel undercoater paint.

3.4 MECHANICAL, ELECTRICAL AND PROCESS EQUIPMENT

A. Refer to mechanical and electrical sections with respect to painting and finishing requirements, color coding and identification banding of equipment, ducting, piping and conduit.
B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.
C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports.
E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
F. Paint exposed conduit and electrical equipment. Color and texture to match adjacent surfaces.
G. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
H. Color code equipment, piping, conduit and exposed ductwork.
I. For concrete immersion, blast all surfaces to comply with SSPC-SP13, ICRI CSP5 prior to the commencement of finish painting.
J. Caulk all pipe flanges prior to priming or painting.

3.5 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.
B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
C. Upon completion of work leave premises neat and clean, to the satisfaction of ENGINEER.
D. Dispose of all paint and solvents in accordance with state and federal regulations.

3.6 PAINT SYSTEMS

A. Provide the following paint systems for the various substrate, as indicated. All dry film thicknesses (DFT) are called for as total mils per coat specified and are considered minimums. OWNER to select colors.
B. Exterior:

1. Miscellaneous ferrous metal items:

Surface Preparation:	SSPC-SP6 Commercial Blast-Cleaning
1st Coat:	Series 1 Omnithane on unpainted metal or touchup (2.5-3.5 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (4.0 – 6.0 mil DFT)
3rd Coat:	Series 73 Endura-shield (2.0 – 3.0 mil DFT)

2. Ferrous metals, submerged:

Surface Preparation:	SSPC-SP10 Near White Metal Blast Cleaning
1st Coat:	Series N69 Hi-Build Epoxoline II(4.0-6.0 mil DFT)
2nd Coat:	Series 435 Perma-Glaze (15.0-20.0 mil DFT)
3rd Coat:	Series 435 Perma-Glaze (15.0-20.0 mil DFT)

3. Galvanized metal:

Surface Preparation:	Solvent Cleaned and SSPC-SP7 Brush off Blast Cleaning.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series 73 Endura-shield (2.03.0 mil DFT)

4. Concrete, concrete block masonry:

Surface Preparation: Wire brush and wipe.

1st Coat Prime-A-Pell H_20 Series 633

5. Asphalt and asphaltic cement (zone marking):

Traffic Marking Paint

6. Exposed PVC (vents, etc.)

Surface Preparation:	Sand uniformly and wipe.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0–3.0 mil DFT)
2nd Coat:	Series 73 Endurashield (2.0-3.0 mil DFT)

7. Exterior Woodwork:

Primer:	Series 151 Elasto-Grip (1.0-1.5 mil DFT)
1st Coat:	Series 6 Tneme-Cryl (2-3 mil DFT)
2nd Coat:	Series 6 Tneme-Cryl (2-3 mil DFT)

C. Interior:

1. Interior concrete walls, ceilings and concrete masonry:

Surface Preparation:	Per manufacturer's recommendation, shall include brush blasting.
1st Coat:	Block Filler, Series 130 Envirofill (80 -100 s.f./gal.)
2nd Coat:	Series N69 Hi-Build Epoxoline II (4.0- 6.0 mil DFT)
3rd Coat:	Series N69 Hi-Build Epoxoline II (4.0- 6.0 mil DFT)

Note: Spray, then backroll Series 130

2. Interior concrete floors:

Surface Preparation:	SSPC-SP13 Surface Preparation of Concrete (Reference ICRI CSP 2-3) (no acid etch).
1st Coat:	Series 201 Epoxoprime (6.0-8.0 mil DFT)
2nd Coat:	Series 282 Tneme-Glaze (8.0-10.0 mil DFT)
3rd Coat:	Series 282 Tneme-Glaze (8.0-10.0 mil DFT)

Spread aluminum oxide aggregate over second coat prior to curing to create a non-slip surface.

3. All interior metals, including structural steel, piping, railings, equipment and stairs:

Surface Preparation:	SSPC-SP6 Commercial Blast Cleaning
1st Coat:	Series 1 Omnithane (2.5-3.5 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (3.0-5.0 mil DFT)
3rd Coat:	Series N69 Hi-Build Epoxoline II (3.0-5.0 mil DFT)

4. All submerged ferrous metals:

Surface Preparation:	SSPC-SP10 Near White Blast.
1st Coat:	Series N69 Hi-Build Epoxoline II (4.0-6.0 mil DFT)
2nd Coat:	Series 435 Perma-Glaze (15-20 mil DFT)
3rd Coat:	Series 435 Perma-Glaze (15-20 mil DFT)

5. PVC piping:

Surface Preparation:	Sand Uniformly and Wipe.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

6. Copper and bronze piping:

Surface Preparation:	Sand to create uniform profile.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

7. Galvanized metals and aluminum:

Surface Preparation:	Solvent Cleaned and SPC-SP7 Brush off Blast Cleaning.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

8. Previously primed & existing painted surfaces (steel, CMU, drywall, piping, etc.

   As recommended by paint manufacturer based on existing conditions.

9. Painted woodwork:

1st Coat:	Series 151-1051 Elasto-Grip FC (1-1.5 mil DFT)
2nd Coat:	Series 6 Tneme-Cryl (2.0-3.0 mil DFT)
3rd Coat:	Series 6 Tneme-Cryl (2.0-3.0 mil DFT)

10. Canvas and cotton insulation coverings:

1st Coat:	Series 151 Elasto-Grip FC (1.0-1.5 mil DFT)
2nd Coat:	Series 113 Hi-Build Tneme-Tufcoat Water-Based Epoxy (4.0-6.0 mil DFT)

11. Plywood Walls:

Primer:	Series 151-1051 Elasto-Grip FC (1.0-1.5 mil DFT)
1st Coat:	Series 113 Tufcoat (4.0-6.0 mil DFT)
2nd Coat:	Series 113 Tufcoat (4.0-6.0 mil DFT)

12. Drywall and Plaster:

Primer:	Series 151-1051 Elasto-Grip FC (1.0-1.5 mil DFT)
1st Coat:	Series 113 Tufcoat (3.0-5.0 mil DFT)
2nd Coat:	Series 113 Tufcoat (3.0-5.0 mil DFT)

13. Gypsum Board Ceilings and Walls - Plaster

1st Coat:	Pratt & Lambert Latex Vinyl Acrylic Wall Primer
2nd Coat:	Pratt & Lambert AquaSatin Latex Enamel
3rd Coat:	Pratt & Lambert AquaSatin Latex Enamel

3.7 PREPARATION AND PRIMING

A. Condition of Surfaces: Painting/coatings shall start only after complete assembly of equipment components unless otherwise permitted by the Engineer in writing. Engineer may request that the manufacturer's representative to provide a preliminary evaluation. Examine all surfaces to be painted for conditions that will adversely affect the work and which cannot be put into an acceptable condition as hereinafter specified under "Preparation". Do not proceed with surface preparation or the application of coatings until conditions are suitable.

B. Preparation: Remove all rust and scale, oil and other items that may adversely affect paint film adhesion. Preparation shall include sandblasting.

1. Exterior and Interior Ferrous Metals: The following surface preparation specifications of Steel Structures Painting Council are required for exterior and interior ferrous metals for use in connection with treatment operations and service areas including basins, chambers, clarifiers and interior service areas; non- submersible exposure shall require SSPC-SP-6, Commercial Blast Cleaning; submersible exposure shall require SSPC-SP-10, Near-White Blast Cleaning. Prime coat specified shall be applied within 8 hours after preparation and prior to rust bloom formation.
2. Galvanized and Aluminum Metal Surfaces: Surfaces shall be solvent cleaned and wiped with clean, dry cloths and sanded to provide uniform surface profile of 1.5 – 2.0 mils.
3. Concrete: All concrete shall be prepared in accordance to SSPC SP13 Standard Surface Preparation for Concrete and ICRI CSP standards.

3.8 PIPING IDENTIFICATION

A. All piping shall be color coded as follows except as directed by the ENGINEER.

Item to be Painted	Color
1. Process piping & potable water lines	Dark Blue
2. Raw water lines	Olive Green
3. Sewer lines	Dark Gray
4. Drain lines	Light Gray
5. Gas (LP or natural gas) lines	Safety Red
6. Wall, floor, & ceiling	Owner to choose
7. Doors, windows, & frames	Owner to choose
8. Non-potable water line	Blue w/ Black Bands

B. After painting, piping shall be identified by self-adhesive pipe markers as manufactured by Seton Nameplate Corporation, W. H. Brady Company, or approved equal. Markers shall be of wording and color as selected by the ENGINEER. The markers shall be 2-1/4 inches high for pipe 3 inches in diameter or larger, and 1-1/8 inches high for smaller pipe. Markers shall be placed no more than 20 feet apart with at least one marker on every straight run, and additional markers at turns and where pipe passes through walls. An arrow indicating flow direction shall be placed adjacent to each marker.

END OF SECTION

Scope of Work

Furnish, install and test all finishes and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

Section No.	Section Title
11311	Self-Priming Suction Lift Pump Package

SECTION 11311

SELF-PRIMING SUCTION LIFT PUMP PACKAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Work under this section includes but is not limited to furnishing and installing two (2) pumps and motors as indicated on the project drawings as herein specified and integrating them into the existing pumping station skid and existing pump control panel for automated operation as necessary for proper and complete performance.

1.2 QUALITY ASSURANCE

A. Qualifications of Manufacturer:

1. Pumping equipment shall be of a design and manufacture that has been used in similar applications. Manufacturers shall provide evidence of at least five (5) installations in which similar equipment has provided satisfactory performance for a minimum of five (5) years in a similar application.
2. The pumps and pump station manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
3. Evidence of facilities, equipment and expertise shall demonstrate the manufacturer's commitment to long term customer service and product support.

B. Pump Performance Certifications

1. Solids Handling Capability
   a. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.
2. Reprime Performance
   a. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.
   b. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.
   c. Pump must reprime the specified vertical feet at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid

remaining in the pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:

1) A check valve to be installed down stream from the pump discharge flange. The check valve size shall be equal (or greater than) the pump discharge diameter.
2) A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.
3) The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a 2 feet minimum horizontal run, a 90 degree elbow and vertical run at the specified lift. Pipe size shall be equal to the pump suction diameter.
4) Impeller clearances shall be set as recommended in the pump service manual.
5) Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five minutes during each cycle.
6) Liquid to be used for reprime test shall be water.

3. Upon request from the engineer, certified reprime performance test results, prepared by the manufacturer, and certified by a registered professional engineer, shall be prepared and forwarded to the customer.

C. Manufacturer's Start-up Services

1. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.3. SYSTEM DESCRIPTION

A. Design requirements consist of factory-built pumps and motors, including materials of construction, pump features, valves and piping, and motor that shall be integrated into existing controls. Equipment shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1. Contractor shall furnish and install two (2) factory-built pumps and motors to be mounted in the existing pump skid frame in a secure and workmen like manner. All mounting frame adjustments shall be included.
2. Principle items of equipment shall include two (2) horizontal, self priming, centrifugal sewage pumps with suction check valves, V-belt drives, motors, internal piping, two (2) discharge air relief valves, two (2) discharge check valves, one three-way plug valve, one emergency plug valve, pipe, pump

and motor supports, integration of motors into existing pump control panel, existing liquid level control system, and internal wiring.

3. United Compressor and Pump Services, Salem, NH, tel (603) 552-5885 is the Town on-call service provider. Pump supplier shall include the cost for the Town's on-call service to integrate the pumps and motors into the existing control system. Pump control panel was fabricated by R.E. Prescott. The control schematic is included in the appendix.

B. Performance Criteria

1. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 6" suction connection, and 6" discharge connection. Each pump shall be selected to perform under following operating conditions:

Design Flow (GPM)	250
Total Dynamic Head (FT)	55
Total Suction Lift(FT)	20
Maximum Repriming Lift (FT)	21
Maximum Static Suction Lift (FT)	19.6
Total Discharge Static Head (FT)	21.7
Pump Impeller Size (IN)	12.38
Motor Size (HP)	15
Pump Speed (RPM)	1100
Pump Maximum NPSH REQ'D (FT)	6

C. Utility Power Requirements

Site power furnished to pump station shall be 3 phase, 60 hertz, 208 volts, 4 wire, maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

D. Station Existing Control Panel and Alarm Detection Interface

The existing system control panel wiring diagram is included as an appendix.

1.4. SUBMITTALS

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit 6 copies of submittal data for review and approval. Submittals shall be in accordance with requirements of the Contract General Conditions.
2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP).

B. Shop Drawings

1. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for station. Pipe penetrations and station access clearances shall be dimensioned relative to the station centerline. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations and Maintenance Manuals

1. Operation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.
b. Instructions for operating pumps and pump controls in all modes of operation.
c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
e. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver in accordance with the manufacturer's recommendations.
B. Store in original packaging on site under protective covering and out of the way of normal construction activities.
C. Handle equipment to prevent damage of any nature.

1.6 WARRANTY

A. All components of the pump station shall be field tested as a unit by the Contractor, with the assistance of the pump supplier. The Contractor and supplier must assume

system responsibility for pump operation and control. The pump and motor must be warranted by the manufacturer.

B. The pump and motor manufacturer shall warrant their equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.
   1. All equipment, apparatus, and parts furnished shall be warranted for five (5) years excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for warranty of the pump, motor, and any components provided as part of this specification.
   2. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts or labor to the owner.

C. The warranty shall become effective upon Final Completion of the project in accordance with the Contract.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURER

A. This specification is based on the Model T6A-B-4 pump and motor package as manufactured by The Gorman-Rupp Company.

B. Acceptable manufacturer is Gorman-Rupp only, in order to fit within the existing pump skid, piping penetrations and support frame.

2.2 PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

C. The existing base unit shall modified as required in order to fit the new pumps, motors and drive system. Adaptor plates shall be provided as required in order to achieve a workman like and professional installation.

D. Materials and Construction Features

1. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
   b. Fill port cover plate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.

d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.

2. Coverplate shall be cast iron Class 30. Design must incorporate following maintenance features:

a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.

b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.

In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.

Two O-rings of Buna-N material shall seal coverplate to pump casing.

Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

Easy-grip handle shall be mounted to face of coverplate.

3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:

a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

c. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

   Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

f. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.

   There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above

   Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

g. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the coverplate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

h. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

E. Serviceability

1. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.
2. No special tools shall be required for replacement of any components within the pump.

F. Drain Kit

1. Pumps to be supplied with a drain kit for ease of maintenance. The kit shall contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

G. Spare Parts Kit

1. The following minimum spare parts shall be furnished for each pump provided:
   a) One pump mechanical seal
   b) Required cover plate O-Ring(s)
   c) One rotating assembly O-Ring(s)
   d) One set of impeller clearance adjustment spacers

2.3 DISCHARGE VALVES AND PIPING

A. Check Valve: Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean-out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. Plug Valves: A three way plug valve shall be provided to isolate either pump from the force main or allow both pumps to discharge to the force main. An additional plug valve shall be provided for the emergency pump connection. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi-steel with flanged end connections drilled to 125 pound standard. The drip-tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

C. Air Release Valves

1. Each pump shall be equipped with an automatic air release valve, designed to vent air to atmosphere during initial priming, or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall automatically close to prevent recirculation. A visible indication of valve closure shall be evident, and shall operate solely on discharge pressure. Valves which connect to the suction line, or rely on vacuum pumps are not acceptable.
2. All valve parts exposed to sewage shall be cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms shall be fabric-reinforced neoprene, or similar inert material. Valve design shall incorporate following maintenance features:
    a. A clean-out port, at least 3 inches in diameter, shall allow easy inspection, clean-out, and service.
    b. Valves shall be field adjustable for varying discharge heads.
    c. Connection of the air release valves to the station piping shall include stainless steel fittings.

D. Gauge Kit

1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.
2. Gauges to be field mounted on a resilient panel with frame assembly secured to pumps or piping and be able to be removed to be stored off site. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.
4. Bolt holes shall be in angular alignment within 1/2 degree between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of 0.01 inch deep by approximately 0.03 inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart. Gaskets shall be suitable for sewage application.

F. Supports and/or Thrust Blocks: Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps, building structures or station piping. Pump station discharge force main piping shall be anchored with supports as required.

2.4 DRIVE UNIT

A. Motors

1. Pump motors shall be 15 HP, horizontal ODP, 1,800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with class F insulation and 1.15 Service Factor for normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified. Motors shall be suitable for operation using the utility power available specified in part 1 of this section. Motors shall also be inverted duty rated for existing VFD drives.
2. Motors shall be premium efficiency, 15hp, 3-Phase WEG W22 Motors or approved equal.
2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std. 112, Method B.

B. Drive Transmission

1. Power to pumps shall be transmitted via V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.
2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.
3. The pump manufacturer shall submit power transmission calculations which document the following:
   a. Ratio of pump/motor speed.
   b. Pitch diameter of driver and driven sheaves.
   c. Number of belts required per drive.
   d. Theoretical horsepower transmitted per belt, based on vendor's data.
   e. Center distance between pump and motor shafts.
   f. Arc-length correction factor applied to theoretical horsepower transmitted.
   g. Service factor applied to established design horsepower.

h. Safety factor ratio of power transmitted/brake horsepower required.

4. Pump drives shall be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch. Existing guards can be reused, but must still comply with the following:
   a. Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.
   b. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.
   c. The exiting guards shall be cleaned and prepped for a new refinish with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.5 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray W.R. non-lift primer and one coat white acrylic alkyd W.R. enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

2.6 ELECTRICAL CONTROL COMPONENTS

A. The existing pump control system shall be utilized with the new pumps and motors to assure a complete unit

B. United Compressor and Pump Services, Salem, NH, is the Town's on-call service provided. They are the preferred control system subcontractor. They can be reached at (603) 552-5885.

C. Panel Enclosure
   1. The existing panel is being relocated. See electrical drawings and specifications for additional information.

D. Sewage Pumps:
   1. The existing controls shall be utilized to provide controls for automatic operation of the sewage pumps.

2.9 LIQUID LEVEL CONTROL

A. The existing liquid level control shall be utilized to operate the pumps and motors.

B. The level control program shall start and stop the pump motors in response to changes in wet well level, as set forth herein.

2.10 BACKUP LIQUID LEVEL CONTROL

1. Existing controls shall be reconnected to the control panel for backup control.

PART 3 - EXECUTION

3.1. FIELD PREPARATION AND PAINTING

A. Finish field preparation and painting shall be performed as specified in Div. 9.

B. The CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

C. The CONTRACTOR shall supply paint for field touch-up and field painting.

D. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistance enamel.

E. Prior to assembly, all stainless steel bolts and nut threads shall be coated with a non-seizing compound by the CONTRACTOR.

3.2. INSTALLATION

A. CONTRACTOR shall install items in accordance with manufacturer's printed instructions and as indicated and specified.

B. The manufacturer shall be required to certify, in writing, that the installation done by others is in accordance with manufacturer's requirements.

C. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation. Contractor shall install pumping equipment on a concrete pad and final alignments shall be made thereon.

D. Contractor shall install accessories in accordance with manufacturer's written instruction.

3.3. FIELD SERVICES

A. After the CONTRACTOR has installed all supporting systems and the units are capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of one (1) day (up to 8 hours on-site), in one trip, to inspect the equipment and to supervise start-up and field testing for the CONTRACTOR at the pumping station. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the OWNER.

B. After installation of the pump(s), and after inspection, operation, testing, and adjustment have been completed by the Contractor in the presence of the Manufacturer's Field Service Technician, Contractor shall conduct a running test for each pump in the presence of the Engineer to determine its ability to operate within the performance limits specified and to deliver its rated capacity within the pressure requirements specified.

C. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.

D. Test pumps on product only.

E. Contractor shall provide labor, piping, equipment, oil, grease and materials necessary for conducting all field tests.

F. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

G. Equipment manufacturer shall also furnish a qualified representative for a minimum of one (1) day (up to 8 hours), in a separate trip from start-up for the Contractor at the pumping station, to provide operator training for OWNER'S personnel after system is fully operational, including supporting systems. Training will take place on a date pre-approved by the OWNER.

H. The manufacturer shall be required to certify, in writing, that complete operation and maintenance instructions were administered to the OWNER'S personnel.

3.4 TESTING

A. The pumps and motors shall be designed and constructed to avoid the generation of objectionable noise or vibration. The sound pressure level at full load shall not exceed 90 (A Scale) decibels above 300 cycles when measured at a point not exceeding 5 feet from the motor. When operating at any point between no-load and full load, the vibration measured in a horizontal plane at the top of the motor shall not exceed five mils displacement from peak to peak.

B. Field Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive shaft shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control system and equipment, proper alignment, excessive noise levels, and power consumption.

C. Field tests shall identify the shutoff head of the pump and that the pump is operating on the curve provided by the manufacturer.

D. Field testing shall include a test throughout the full range of operating conditions under manual speed control, and again using complete automatic operation from the PLC.

E. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained. If any deficiencies are revealed during any test, such deficiencies shall be corrected or pumps shall be removed and replaced with pumps which satisfy the conditions specified.

F. The CONTRACTOR shall furnish to the ENGINEER 6 copies of a complete written report identifying the tests conducted on the system, the date conducted, the results of those tests, any modifications necessary to correct deficient performance, any operational setpoints determined or programmed during the startup (flow, pressure, and speed at test points etc.)

3.5 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be provided as specified as follows.

B. For each piece of equipment, include a description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves with engineering data, head loss, tests, and certifications where appropriate and complete nomenclature and commercial number of replaceable parts, where applicable.

C. Panel Board Circuit Directories: Provide electrical service characteristics and name of load on each branch circuit breaker.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; alignment, adjusting, balancing, and checking instructions. Provide servicing and lubrication schedule, and list of lubricants required, cleaning requirements and frequency.

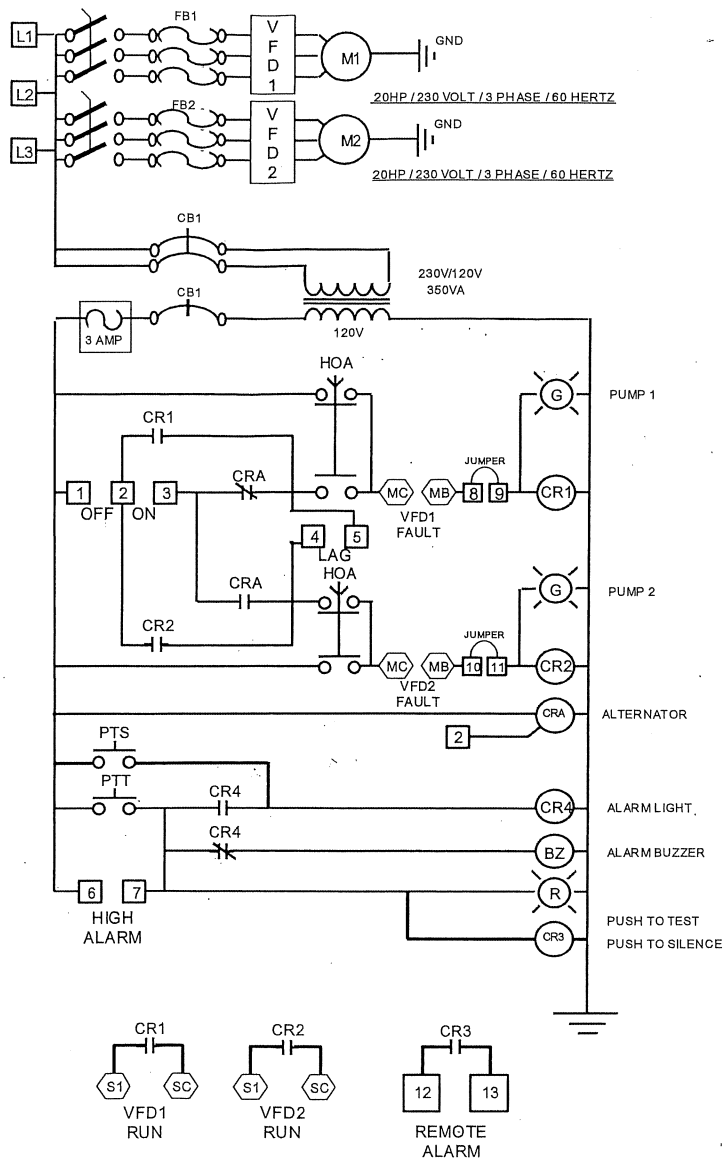
F. Controls: Provide the following:
   1. Sequence of operation.
   2. Original parts list, illustrations, assembly drawings, and diagrams required for maintenance.
   3. As-installed control diagrams.
   4. CONTRACTOR'S coordination drawings, with as-installed color-coded piping diagrams.
   5. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
   6. As-installed color-coded wiring diagrams.

(See Existing Control Panel Schematic, Next Page)

END OF SECTION

A B C D E F G H

230 VOLT / THREE PHASE / 60 HERTZ



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NOTE: CONNECT CABINET TO A GOOD GROUND
WARNING: DISCONNECT POWER BEFORE SERVICING

DUPLEX VFD CONTROL PANEL
DWG No. 226833
UNITED COMPRESSOR

REPCO Since 1954
R.E. PRESCOTT CO., INC.
10 RAILROAD AVENUE
EXETER, NH 03833

Scope of Work

Furnish, install and test all mechanical systems and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of work.

Contents of Division

Section No.	Section Title
15069	Ductile Iron Pipe and Fittings - Interior
15088	Couplings and Connectors
15092	Pipe Sleeves and Seals
15100	Valves and Specialties
15140	Pipe Hangers and Supports

SECTION 15069

DUCTILE IRON PIPE AND FITTINGS-INTERIOR

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install ductile iron pipe and ductile iron fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 QUALITY ASSURANCE

A. Standards:

1. Cement-mortar lining for water: ANSI A21.4/AWWA C104.
2. Rubber gasket joints: ANSI A21.11/AWWA C111.
3. Ductile iron pipe thickness: ANSI A21.50/AWWA C150.
4. Ductile iron pipe centrifugally cast in metal or sand lined molds: ANSI A21.51/AWWA C151.
5. Threaded flanges: ANSI A21.15/AWWA C115.
6. Ductile iron fittings: ANSI A21.10/AWWA C110.
7. Pipe flanges and fittings: ANSI B16-1, ANSI A-21.12.
8. Bolts: ASTM A-307, Grade B

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Exercise extra care when handling pipe and fittings.

B. Exercise extra care when handling cement lined pipe and fittings because damage to the lining will render it unfit for use.

C. Protect all pipe during shipment by wood lagging securely fastened in place.

1.5 INSPECTION

A. Provide all labor necessary for the Engineer to inspect pipe, fittings, gaskets, and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage.
2. Deviations beyond allowable tolerances for joint dimensions.

3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:
   1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
   2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Engineer.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Pipe:
   1. All pipes shall conform to the latest AWWA specification C-151. Unless otherwise shown on the Drawings, the requirements of ductile iron pipe shall be:
      a. Pipe with flanges: Class 53 (formerly Class 3) unless otherwise noted.
      b. All ductile iron pipe shall have cement lining of double thickness.
      c. All ductile iron pipe shall be provided with a factory applied prime coat compatible with the finish painting system.
   2. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
   3. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings.
   4. Factory applied bituminous coatings, as approved by the Engineer, shall be furnished for all underground piping.

B. Joints (as shown on the Drawings, specified and applicable):
   1. General: All joints shall be Class 125 unless otherwise shown on the Drawings.
   2. Flanged:
      a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
      b. Flanges shall be long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
      c. Gaskets:
         1). Ring type of rubber with cloth insertion.
         2). Thickness of gaskets 12 inches in diameter and smaller: 1/16 inch.
         3). Thickness of gaskets larger than 12 inches in diameter: 3/32 inch.
      d. Fasteners:
         1). Make joints with bolt, stubs with a nut on each end, or one tapped flanged with a stud and nut.
         2). The number and size of bolts shall meet the requirements of the same American National Standard as the flanges.

3). Nuts, bolts and studs shall be Grade B meeting the requirements of ASTM A307.
4). After jointing, coat entire joint with bituminous material compatible with pipe coating.

e. When applicable, provide and install flange clamps as shown on the Drawings.

3. Grooved split ring couplings, sleeve couplings, flexible joints and couplings: As specified and shown on the Drawings.

C. Standard Fittings:
1. All joints shall conform to the latest AWWA specification C-110 or ANSI 21.10.
2. Class 350, Ductile Iron, Cement Lined except as shown on the Drawings or as specified.
3. Joints the same as the pipe with which they are used or as shown on the Drawings.
4. Provide fittings with standard bases where shown on the Drawings.

D. Non-Standard Fittings:
1. Fittings having non-standard dimensions shall be subject to the Engineer's approval.
2. Non-standard fittings shall have the same diameter and thickness as standard fittings and shall meet the specification requirements for standard fittings.
3. The laying lengths and types of joints shall be determined by the particular piping to which they connect.
4. Flanged fittings not meeting the requirements of ANSI A21.10 (i.e., laterals or reducing elbows) shall meet the requirements of ANSI B16.1 in Class 125.

2.2 ACCEPTABLE MANUFACTURERS
A. US Pipe
B. Atlantic States
C. Griffin
D. Or approved equal

PART 3 -- EXECUTION

3.1 INSTALLATION
A. General:
1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.
2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
3. Install adaptors, approved by the Engineer, when connecting pipes constructed from different materials.

B. Assembling Joints:
   1. Bolted Joints:
      a. Remove rust preventive coatings from machined surfaces prior to assembly.
      b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.
   2. Flanged Joints:
      a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
      b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.

C. Fabrication:
   1. Tapped Connections:
      a. Make all tapped connections where shown on the Drawings or where directed by the Engineer.
      b. Make all connections watertight and of adequate strength to prevent pullout.
      c. Drill and tap normal to the longitudinal axis of the pipe.
      d. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.
   2. Cutting:
      a. Perform all cutting with machines having rolling wheel cutters or knives designed to cut cast or ductile iron. Do not use a hammer and chisel to cut pipe.
      b. After cutting, examine all cut ends for possible cracks.
      c. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.

3.2 FINISH

A. All pipe and fittings shall be painted in accordance with Section 09912.

3.3 TESTING

A. Procedure: Pipes shall be tested at one hundred and fifty percent (150%) of the maximum working pressure or a minimum of one hundred (100) psi whichever is greater. The test shall be run for four (4) ten minute cycles (i.e. on and off).

B. Acceptance: The piping will be deemed acceptable if there are no leakers during any of the cycle tests. If leakage is discovered, the test shall restart.

END OF SECTION

SECTION 15088

COUPLINGS AND CONNECTORS

PART 1 - GENERAL

1.1 DESCRIPTIONS

A. Work Included: Furnish and install couplings and connectors of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 QUALITY ASSURANCE

A. Minimum pressure rating equal to that of the pipeline in which they are to be installed.

B. Couplings and connectors, other than those specified herein, are subject to the Engineer's approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Couplings and Connectors:

1. Gasket Materials: Composition suitable for exposure to the liquids contained in the pipes.
2. Diameters to properly fit the specific types of pipes on which couplings and connectors are to be installed.

B. Sleeve Type Couplings (When Applicable):

1. Exposed Couplings (When Applicable):
   a. Steel middle ring,
   b. Two steel follower rings,
   c. Two wedge-section gaskets,
   d. Sufficient steel bolts to properly compress the gaskets,
   e. Acceptable Manufacturers:
      (1) Dresser Manufacturing Co. - Style 38,
      (2) Smith-Blair Inc. - Style 411,
      (3) Or approved equal.
2. Buried Couplings (When Applicable):
   a. Cast iron middle rings with pipe stops removed,
   b. Two malleable iron follower rings with ribbed construction.
   c. Two wedge-section gaskets,
   d. Sufficient galvanized steel bolts to properly compress the gaskets,
   e. Acceptable Manufacturers:
      (1) Dresser Manufacturing Co. - Style 53,

(2) Smith-Blair Inc. - Style 411,
(3) Or approved equal.

C. Split Type Couplings (When Applicable):
1. Constructed for malleable or ductile iron.
2. For use with grooved or shouldered end pipe with minimum wall thickness as required so as not to weaken pipe.
3. Cast in two segments for 3/4 inch through 14 inch pipe sizes, four segments for 15 inch through 24 inch pipe sizes, and six segments for pipe sizes over 24 inch.
4. Coating: Enamel.
5. Bolts: Carbon steel.
6. Acceptable Manufacturers:
a. Victaulic Company of America, Style 77,
b. Gustin-Bacon Co.
c. Or approved equal.

D. Flanged Adapters (When Applicable):
1. For joining plain end or grooved end pipe to flanged pipes and fittings.
2. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections.
3. Exposed Sleeve Type:
a. Constructed from steel.
b. Coating: Enamel.
c. Bolts: Carbon steel.
d. Acceptable Manufacturers:
(1) Dresser Manufacturing Co. - Style 128 for cast iron, ductile iron and steel pipes with diameters of 2 inches through 96 inches.
(2) Smith Blair Type 913
(3) Romac Type FC400
(4) Or approved equal.
4. Buried Sleeve Type:
a. Constructed from cast iron.
b. Bolts: Galvanized steel.
c. Acceptable Manufacturers:
(1) Dresser Manufacturing Co. - Style 227 locking type for cast iron, ductile iron, asbestos cement and steel pipes with diameters of 3 inches through 12 inches.
(2) Smith Blair Type 912
(3) Romac Type FCA501
(4) Or approved equal.

E. Flexible Joints:
1. Expansion Joints:
a. Materials shall be capable of withstanding the temperature, pressure and type of material in the pipeline.

b. Shall be the filled arch type that will prevent sediment build up for all sludge, sewage, and other lines with similar service.
c. Supplied with control rods to restrict elongation and compression.
d. Metal retaining rings shall be split and beveled galvanized steel for placement against the flange of the expansion joint.
e. Acceptable Manufacturers:
(1) EBAA – Flex Tend
(2) Star – Star Flex
(3) Or approved equal.

2. Deflection Joints:
a. Joints designed to permit a nominal maximum deflection of 15 degrees in all directions from the axis of the adjacent pipe length, will prevent pulling apart, and will remain watertight at any angle of deflection under 15 degrees.
b. Material to be manufactured from a composition material suitable for exposure to the liquid, pressure and temperature to be contained within the pipe.
c. Supplied with control rods as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sleeve Type Couplings (When Applicable):
1. Thoroughly clean pipe ends for a distance of 8 inches from the ends prior to installing couplings, and use soapy water as a gasket lubricant.
2. Slip a follower ring and gasket (in that order) over each pipe and place the middle ring centered over the joint.
3. Insert the other pipe length into the middle ring the proper distance.
4. Press the gaskets and followers evenly and firmly into the middle ring flares.
5. Insert the bolts, finger tighten and progressively tighten diametrically opposite nuts uniformly around the adapter with a torque wrench applying the torque recommended by the manufacturer.
6. Insert and tighten the tapered threaded lock pins.
7. Insert the nuts and bolts for the flange, finger tighten and progressively tighten diametrically opposite bolts uniformly around the flange to the torque recommended by the manufacturer.

B. Split Type Flange Adapters (When Applicable): Install in the same manner as Split Type Couplings.

C. Buried Couplings, Adapters and Connectors (When Applicable): Thoroughly coat all exterior surfaces, including nuts and bolts, after assembly and inspection by the Engineer with a heavy-bodied bituminous mastic as approved by the Engineer.

D. Install thrust rods, supports, and other provisions to properly support pipe weight and axial equipment loads.

END OF SECTION

SECTION 15092

PIPE SLEEVES & SEALS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install wall sleeves and seals of the type(s) and size(s) and in the location(s) shown on the Drawing and specified herein.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 QUALITY ASSURANCE

A. Provide and install all sleeves of the types specified herein, as shown on the Drawings and as directed by the Engineer.

B. Provide sleeves that are airtight, gastight or watertight as required.

PART 2 -- PRODUCTS

2.1 TYPES AND LOCATIONS

A. Interior masonry, drywall, or wood partition:
   1. 24 gauge, zinc coated (galvanized) steel tubes with wired or hemmed edges.
   2. Minimum 1/4 inch annular space between sleeve and pipe or insulation.
   3. Firmly pack with oakum and seal both ends with elastic cement.

B. Interior Concrete Partitions:
   1. Schedule 40 galvanized steel pipe.
   2. Minimum 1/4 inch annular space between sleeve and pipe or insulation.
   3. Firmly pack with oakum and seal both ends with elastic cement.

C. Concrete Floor Penetrations:
   1. Same as interior concrete partitions.
   2. Top side extending 2 inches above floor.
   3. Bottom flush with underside of slab.

D. Roof Penetrations: Same as interior concrete partitions and as shown on the Drawings.

E. Concrete Foundation Walls, Pipe Below Grade and into Interior Space:
   1. Steel pipe with 1 inch x 1/8 inch thick welded fin in middle, hot-dip galvanize after fabrication.
   2. Schedule of pipe and size of pipe as required by seal manufacturer.
   3. Rubber link compression seal.

F. Foundation Walls Below Grade:
   1. Schedule 40 or max. 3/8 inch thick wall galvanized steel sleeve.
   2. Minimum 1/2 inch annular space.

3. Firmly pack with oakum and seal both ends with elastic cement.

G. Other conditions shall be sleeved as shown on the Drawings or as approved by the Engineer.

H. Rubber Link Seals:
   1. Multi-rubber link type with pressure plates, bolts, nuts and sealing element providing a leakproof seal.
   2. General Service:
      a. Delrin plastic pressure plate.
      b. Carbon steel zinc-phosphated nut and bolt.
      c. Sealing element: EPDM rubber.
      d. -40 degrees F to 250 degrees F rating.
   3. Corrosive Service: (Where Applicable):
      a. Pressure plate: Delrin plastic.
      b. Bolt and nut, 18-8 stainless steel.
      c. Sealing element: EPDM rubber.
   4. Acceptable Manufacturers:
      a. Link Seal by Thunderline Company
      b. InnerLynx by Advance Product Systems, Inc.
      c. Or approved equal.

I. Wall Plates: Provide split type cast iron or brass wall plates on pipes penetrating walls in finished spaces such as labs and offices.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. New construction:
   1. Concrete: Set sleeves in proper location prior to placing concrete.
   2. Masonry: Provide sleeves and locations to masonry trades for installation.
   3. Partitions: Cleanly cut partitions and patch prior to any finish work.

B. Hollow Concrete Roof or Floor Planks:
   1. Provide planks with sleeve cast-in-place at time of construction,
   2. Or core drill planks in location approved by Engineer and plank manufacturer.
   3. Firmly grout sleeve in place.

C. Existing Construction:
   1. Concrete: The location will be approved by the Engineer prior to cutting hole.
   2. Holes shall be located to avoid the reinforcing steel when possible.
   3. Holes bored with equipment leaving a smooth hole, less than 1/2 inch larger than the pipe will not require a sleeve, unless otherwise specified.
   4. Fill the opening around the pipe with a non-hardening sealant.
   5. Place a non-shrink sleeve grout in other holes.
   6. Use sleeves with water stop fins at locations required to be watertight.
   7. Masonry: Cleanly cut block and brick as required and grout sleeve in place.

D. Rubber Link Seals: Install as required and in strict accordance with the manufacturer's instructions and recommendations.

END OF SECTION

SECTION 15100

VALVES & ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Furnish, install, support, and test valves (including valves, gates, hydrants, cocks, stops, hose bibs, and faucets) and valve operators, when applicable, in the location(s) and of the size(s) and quantities shown on the Drawings and as directed by the Engineer.

B. Related Work Specified Elsewhere (When Applicable):

1. Pipe, fittings, pipe hangers and supports, piping insulation, and pumps are specified in the appropriate sections in this Division.

1.2 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract. Clearly indicate make, model, location, size, and pressure rating.

B. Catalog Data: Submit manufacturer's literature and illustrations for each size of valve furnished.

C. Certificates: Submit manufacturer's certification that valves and accessories meet or exceed the requirements of these Specifications.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Prepare valves and accessories for shipment as required for complete protection.
2. Seal valve ends to prevent entry of foreign matter into valve body.
3. Box, crate, completely enclose and protect valves and accessories from accumulations of foreign matter.

B. Storage:

1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling:

1. Handle valves and accessories to prevent damage of any nature to the interior and the exterior surfaces.

D. Inspection:

1. Carefully inspect all materials for:
   a. Defects in workmanship and materials.
   b. Removal of debris and foreign material in valve openings and seats.
   c. Proper functioning of all operating mechanisms.
   d. Tightness of all nuts and bolts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide valves of the same manufacturer throughout where possible. Like items shall be of the same manufacturer.

B. Provide valves with manufacturer's name, valve size, and pressure rating clearly marked on outside of body, either cast on the body or bonnet or shown on a permanently attached plate in raised letters.

2.2 MATERIALS

A. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by the valve manufacturer for intended service but not of a lower quality than specified herein.

B. Valves and operators shall be suitable for the exposure they are subject to; buried, exterior, and corrosive, etc., as applicable. They shall have all safety features required by OSHA.

2.3 EQUIPMENT

A. Block Valves

1. Gate Valves

a. 2-1/2 inch and smaller: screwed or solder end, bronze body, rising stem, solid bronze disc, 125 psi steam pressure 200 psi W.O.G. Equal to Nibco T-111 or S-111.

b. 3-inch and larger: Cast Iron body, bronze trim, rising stem, OS&Y, solid wedge. Valves shall conform to the latest revision of AWWA Resilient Seated gate valve Standard C-509, be UL listed and FM approved for service to 250 PSI, cold water, non-shock water works service and 200 PSI fire protection service. Flanges drilled to ANSI B-16.1 (125#). Valves shall be KEN-SEAL II Resilient-Wedge Valves manufactured by Kennedy Valve Company or equal.

2. Plug Valves

a. All valves shall be non-lubricated eccentric type with resilient faced plugs and shall be furnished with end type as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb standard.

b. Valve bodies shall be of ASTM A126 Grade B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel.

c. Plugs shall be of ASTM Class B Cast Iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with

the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

d. Valves shall have sleeve type metal bearings and shall be sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M or AISI Type 317L stainless steel.

e. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable under pressure without removing the bonnet or actuator from the valve.

f. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72"

g. All Plug valves shall be manufactured by DeZurik/Copes-Vulcan or approved equal.

3. Ball Valves

a. CPVC

(1) 3" and smaller shall be CPVC Socket True Union Ball Valves with O-ring seat and seals compatible for use with ferric chloride and sodium hypochlorite with double union design. Manufactured by Hayward or equal.

b. Bronze

(1) 3" and smaller shall be female NPT; 3 part Bronze Body, TFE seats and seals, full diameter ports; 90° operation; rated at 600 psi WOG and UL Listed. Series 70 as manufactured by Apollo Ball Valves or equal.

4. Fire Hydrants: See Division 2

B. Throttling/Control Valves

1. Hose Bibbs: Hose bibs shall be heavy duty bronze or brass with replaceable hexagonal disc, removable handle, hose thread spout, and chrome plated. Hose Bibbs shall be Model 2002 manufactured by A.Y. McDonald Mfg. Co. or equal.

2. Non-Freeze Wall Hydrants: Cast brass anti-siphon non-freeze wall hydrant, 3/4 inch hose thread outlet, polished brass face, key handle, brass wall casing of proper length, 3/4 inch straight IPS inlet, integral vacuum breaker. Equal to Zurn Z-1310.

3. Air Relief Valves:

a. Combination air valves shall be provided at high points in the pipeline as shown on the Drawings. The valves shall be of the single housing style and provide features of both an air/vacuum and air release valve.

b. The air/vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow to re-enter the pipeline should the internal pressure of the pipeline approach a negative value due to draining of the pipeline etc. The air release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.

c. The combination air valve shall have a 2" NPT inlet and 1" outlet connection and a 3/16" diameter orifice for a maximum working pressure of 150 psi. The valve shall have a back flushing attachment. The valve shall be suitable for operating at low pressure of 2-40 psi.

d. The materials of construction shall be as follows:

Float	Stainless Steel
Fulcrum & levers	Stainless Steel
All other trim	Stainless Steel
Valve plunger	Stainless Steel
Fasteners & Hardware	Stainless Steel
Seat	Buna N
Orifice Button	Viton
Body	PVC
Cover	PVC

e. Valves shall be Crispin model US10SB PVC manufactured by Crispin Multiplex Manufacturing Co., or approved equal.

C. Non-return Valves

1. Swing Check Valves

a. 2-1/2 inch and smaller: Screwed or solder end, bronze body, Buna-N disc, 200 psi WOG cold pressure. Equal to Nibco T-413-W or S-413-W.

b. 3-inches and larger: Check valves shall be resilient seated type manufactured from ductile iron meeting or exceeding ASTM A-536 65-45-12. Valve ends shall be ANSI 150 lb flanged. Valves shall be rated for 250 psig cold water working pressure. Valves shall have a ductile iron disc fully encapsulated with rubber. Disc travel to closure shall not be more than 35 degrees and shall seal drop tight at pressures above 5 psig. Bronze seat rings are not allowed. Disc shall be the only allowable moving part. No O-rings, pivot pins or other bearings are allowed. Disc must be reversible such that either side will seal equally. Valves shall be equal to American Flow Control's Series 2100 Ductile Iron Resilient Seated Check Valve or equal.

2. Backflow Preventers: Double spring-loaded check valve assembly with automatically operating reduced pressure relief valve located in the pressure zone between the two check valves. All bronze construction with stainless steel internals, union or flanged connections. Inlet and outlet gate valves and inlet strainer. Test cocks on inlet, relief, and outlet pressure zones. Size, flow capacity and pressure drop as shown on the Drawings. N.S.F. and A.S.S.E. tested and approved. Air gap drain. 1/2 inch - 3/4 inch sizes: Watts #9D, FEBCO #815, Beeco #12. 1 inch - larger: Watts #909, FEBCO #825, Beeco #6-C.

D. Valve Actuators and Operators

1. Manual Operators

a. Hand Wheel Operators: Manual hand wheel operators shall be provided unless valves are above floor height in which case Chain wheels and Guides shall be provided. Where chains hang in normally traveled areas, provide "L" type tie-back anchors.

b. Lever and Wrench Operators
(1) See APPURTENANCES below

E. Valve Connections
1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
2. Thread pipe sizes 2 inches and smaller.
3. Flange pipe sizes 2-1/2 inches or larger.
4. Solder or screw to solder adaptors for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

F. Gauge Assemblies
1. Provide gauges as shown on the drawings with the appropriate protective fittings. Gauges shall be liquid filled, 4-1/2-inch diameter aluminum casing, and the measurement range shall be compatible with the applicable working pressure.
2. A corrosion resistant diaphragm seal shall be provided to protect the gauge instrument from the applicable liquid being measured. The diaphragm seal shall meet or exceed the pressure rating of the process piping. The seal shall include a flushing screw on the liquid side of the seal and a filling screw on the instrument side of the seal.
3. Pressure snubbers, stainless steel in construction, shall be provided for all assemblies to protect the gauge instrument.
4. A ball valve shall be provided for each gauge assembly to allow the assembly to be disconnected from the process piping and serviced. Unless otherwise specified on the drawing, the ball valve shall be a minimum of 1/2-inch in diameter.

2.4 ACCESSORIES

A. All accessory items such as positioners, actuators, limit switches, solenoid pilot valves, and speed control valves shown, specified, or required, shall be factory mounted on the indicated valve and adjusted accordingly.

2.5 APPURTENANCES

A. T-Handled Operating Wrenches: Provide one galvanized operating wrench, 4 feet total length, Muller No. A-24610, Clow No. F-2520, or equal. Provide galvanized operating keys for cross-handled valves.

B. Valve Boxes: Valve boxes shall be Buffalo two-piece sliding type, cast iron, with 5-1/4 inch shaft of appropriate length for the installation. The word WATER or SEWAGE shall be cast into the top of the lid, as appropriate for the service. Extension pieces, if required, shall be the manufacturer's standard type. Units shall be Mueller H-10364, Clow Corporation F-2452, or equal. All units shall be complete with all necessary bases and accessories.

C. Extension Stems for Valve Operators: Where the depth of the valve is such that is centerline is more than 4 feet below grade, operating extension stems shall be provided to bring the operating nut to a point 6 inches below the surface of the ground and/or box

cover. Extension stems shall be constructed of steel and shall be complete with 2-inch square operating nut.

D. Extension Bonnets for Valve Operators: Where shown on the Drawings, extension bonnets shall be supplied, complete with stem and accessories, as required to fit the given valves and operators. Bonnet and stem shall be constructed of steel and given manufacturer's standard paint system. Bonnets shall be as supplied by Pratt, Allis Chalmers, or equal.

E. Floor Stands and Extension Stems: When required by the installations, floor stands and extension stems shall be provided for operation of valves. Floor stands shall be of the non-rising stem, indicating type, complete with all necessary steel extension stems, couplings, hand wheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Stem guides shall be spaced so that the stem L/R ratio does not exceed 200. Provide all necessary anchor bolts in Type 304 stainless steel. Floor stands shall be cast iron base type, Figure F-5515 as manufactured by Clow Corporation, Figure A-26426 as manufactured by Mueller Company, or equal. All hand wheels shall turn counter clockwise to open and the valves. Where operators for quarter-turn valves are located on floor stands, extension stems shall be torque tube type properly sized for the maximum torque capacity of the valve.

F. Floor Boxes and Extension Stems: Floor boxes shall be Neenah Foundry R 7506, Clow No. F5690, or equal. Provide steel valve extension stems where required to locate the operating nut in the floor box. Stem guides shall be spaced so that the L/R slenderness ratio does not exceed 200. Provide all necessary anchor bolts in Type 304 stainless steel.

G. Chain Wheels and Guides: Chain wheels and guides shall be Figure 804 as manufactured by the Walworth Company, Figure F-5680 as manufactured by Clow Corporation, Series W or LWG as manufactured by DeZurik Corporation, or equal. Chain wheels and guides shall be galvanized or cadmium-plated. Chains shall be of the size recommended by the valve manufacturer and shall extend to within 4 feet of the operating floor. Chains shall be heavily galvanized or cadmium-plated. Where chains hang in normally traveled areas, appropriate "L" type tie-back anchors shall be provided and located as directed by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Apply a shop coat finish of an asphalt varnish to:
   1. Interior surfaces of all valves except corrosion resistant or specially coated valves as required.
   2. Exterior surfaces of buried or submerged valves.
   3. Miscellaneous piping appurtenances.

B. Apply coats of paint filler and enamel to parts customarily finished at the shop, or other treatment customary with the manufacturer.

C. Apply a shop coat of grease or other suitable rust resistant coating to ferrous surfaces obviously not to be painted.

3.2 INSTALLATION

A. Install valves and accessories in strict accordance with manufacturer's instructions and recommendations, as shown on the Drawings and as directed by the Engineer.

B. Install valves with stems upright or horizontal, not inverted.

C. Carefully erect all valves and support them in their respective positions free from distortion and strain.

D. Independently support all valves connected to pumps and equipment, and in piping systems that cannot support valves.

E. Repair any scratches, marks and other types of surface damage etc. with original coating as supplied by the factory.

3.3 ADJUSTING

A. Check and adjust all valves and accessories for smooth operation.

END OF SECTION

SECTION 15140

PIPE HANGERS AND SUPPORTS

PART I - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals and install a complete system of pipe hangers, supports, concrete inserts and anchor bolts including all metallic hanging and supporting devices for supporting non-buried piping as shown on the Drawings and as specified herein.

B. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility for providing them. Pipe supports indicated on the Drawings are shown only to convey the intent of the design for a particular location and are not intended to represent a complete system.

1.02 RELATED WORK

A. Concrete is included in Division 3.
B. Miscellaneous metal is included in Section 05500.
C. Wood Structures in Division 6 – Wood and Plastic.
D. Field painting is included in Division 9.
E. Pipe and fittings are included in respective sections of Division 15.
F. Valves and appurtenances are included in Section 15100.
G. Hangers and supports pertaining to HVAC and Plumbing systems are included in their respective Sections.

1.03 SUBMITTALS

A. Submit to the Engineer in accordance with Section 01300, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

B. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or support are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support. Provide detailed information on anti-seize compound.

C. Submittals shall include complete piping drawings as submitted for each piping submittal indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances including structural fasteners.

D. Types and locations of pipe hangers and/or supports shall also be shown on the piping layouts for each piping submittal as specified in the respective Division 13

and 15 pipe sections. Service conditions for each piping system, including service temperatures, and operating and test pressures, are tabulated in the piping sections.

E. Submit complete design data for pipe support systems to show conformance with this Section.

F. Support System Design:
   1. All aspects of the analysis and design shall comply with the provisions of ANSI B3 1.1 and the referenced standards.
   2. Support arrangements shall be coordinated to eliminate interference with similar systems to be installed under HVAC, Plumbing and Electrical; to account for structural expansion joints and to maintain access for both personnel and for the removal of equipment. Support systems shall not include the use of monorail or bridge crane support. Nor shall they rely on the horizontal structural struts.
   3. Commercial hardware and custom supports shall comply with the requirements of this Section.
   4. Expansion joints shall comply with the provisions of Section 15120.
   5. The design of the support system shall include flexible couplings in addition to those shown on the Drawings required to control stresses imposed upon the piping or connected equipment caused by thermal expansion of the piping.

1.04 REFERENCE STANDARDS

A. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
   2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

B. American Society for Testing and Materials (ASTM)
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

C. American National Standards Institute (ANSI)
   1. ANSI B31.1 - Power Piping.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All hangers, supports and appurtenances shall conform to the latest applicable requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Section.

B. All hangers. supports and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the

ultimate tensile strength of the material, assuming 10-ft of water filled pipe being supported.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

1.06 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no drainage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

PART 2 PRODUCTS

2.01 GENERAL

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems shown on the Drawings. It shall be the responsibility of the Contractor to develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 15 pipe specifications.

B. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces and all probable external forces such as equipment, pipe and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500 and shall be furnished and installed under this Section.

C. The Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support maybe used.

D. Where flexible couplings are required at equipment tanks, etc, the end opposite to the piece of equipment tank, etc, shall be rigidly supported, to prevent transfer of system forces to the equipment. No fixed or restraining supports shall be installed between a flexible coupling and the piece of equipment.

E. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or electro-galvanized coated, except where field welding is required, where cold-applied galvanizing may be used. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16 inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe and pipe within outdoor structures shall be of Type 304 stainless steel.

G. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

H. All uninsulated non-metallic piping such as PVC, CPVC, etc shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc supports required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gauge minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than ½ inch wide.

I. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide protection shields as specified in at each support location.

J. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by; wrapping pipe with 1 1/16 inch thick neoprene sheet material and galvanized protection shield; isolators similar to Elcen figure number 228; or copper plated or PVC coated hangers and support All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields, similar to above methods.

K. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron, steel and stainless steel piping shall be supported at a maximum support spacing of 10-ft with a minimum of one support per pipe section at the joints.
2. In so far as is possible, floor supports shall be given preference. Typical concrete supports are shown on the structural drawings. Base elbow and base tees shall be used where possible.
3. Support spacing for steel and stainless steel piping 2-in and smaller diameter and copper tubing shall not exceed 5-ft.
4. For all stainless steel piping, provide neoprene isolators between the pipe and support components.

5. Supports for multiple runs of plastic piping shall be continuous wherever possible. Individually supported plastic pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3-ft. Multiple, suspended, horizontal plastic pipe runs, where possible, shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy; the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of galvanized steel construction. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC; Husky-Burndy Model SCR or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.
6. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar.
7. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.
8. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from other piping or from metal stairs, ladders and walkways, unless specifically directed or authorized by the Engineer.
9. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
10. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

L. Unless otherwise specified herein, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-SP-58 and -69; and shall be as manufactured by Anvil International, Portsmouth, NH; Carpenter & Patterson, Inc., Woburn, MA; F&S Central, Brooklyn NY; and Unistrut Northeast, Woburn, MA; or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

M. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the Engineer.

N. Expansion anchors shall be equal to Kwik-Bolt as manufactured by the McCullock Industries, Minneapolis, MI or Wej-it manufactured by Wej-it Expansion Products, Inc., Bloomfield, Co. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.

0. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter. Hanger rods shall be attached to concrete structures using concrete insert similar to F&S Figures 180,571 or 150; or continuous concrete inserts per F&S. Inserts shall be malleable iron, or steel with galvanized finish. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members where necessary and approved by the Engineer, expansion anchors shall be used for attaching to concrete structures.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Except as otherwise specified herein, pipe hangers shall be of the adjustable clevis type similar to Anvil Figure Numbers 65,260 and 590 as required.

C. Where pipes are near walls, beams, columns, etc, and located an excessive distance from ceilings or underside of beams, welded wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84 or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this Section. Channel shall be similar to F&S Figure 710, rods, concrete inserts, 1C~clamps, beam clamps, welded beam attachments and expansion shields shall be as specified in Paragraph 2.02 above.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to F&S Figures 158, 419, 160A, 160B as required. Material of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods as specified herein.

B. Pipes 3 inch in diameter and larger shall be supported by adjustable stanchions similar to F&S Figure 427. Stanchions shall provide at least 4 inch adjustment and be flange mounted to floor.

C. Pipes less than 3 inches in diameter shall be held in position by support fabricated from steel "C' channel, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures P1109 thru P1126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support.

D. Where shown on the Drawings, pipe shall be supported using concrete anchor posts. Pipe shall be securely fastened to the posts using suitable metal straps as required and as approved.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 139; or "C" channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc, using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

B. Pipe shall be attached to supports using methods specified herein to meet the intent of this Section.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base bend support shall be instilled at the bend to carry the load. The base bend shall be fastened to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the Engineer.

B. Where shown on the Drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to the concrete supports with suitable metal bands as required and approved by the Engineer. A felt insert shall be used to isolate the piping from the poured concrete.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut system as specified in Paragraph 2.08 below, they shall be supported in one of the following methods.

1. For pipes ¼ inch to 2 inches in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. Tile hanger ring shall be steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Patterson

Fig. No.81 or 8ICT. The anchor flange shall be galvanized malleable iron similar to Carpenter and Patterson Figure No.85.

2. For pipes equal to or greater than 2 inches in diameter, extended pipe clamps similar to Carpenter and Patterson Figure No.267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to steel support members using welding lugs similar to Carpenter and Patterson Figure No.220.
3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be steel similar to Carpenter and Patterson Figure No.126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated piles prior to installing riser clamps. Insulation shall not be damaged by clamp installation.
4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12 feet shall be supported by base elbows/tees, clamps, brackets, wall rests and pipe collars, all located as required to ensure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 10 feet. The support system shall consist of a framework suitably anchored to floors, ceilings or roofs.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. All components shall be of steel.

C. For piping 3 inches and smaller, the framework shall be as manufactured by the Unistrut Corporation; Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum or equal. For piping larger than 3 inches, the support frame shall be fabricated from structural steel shapes and secured through the use of expansion anchors.

D. The assemblies shall be furnished complete with all nuts, bolts and fillings required for a complete assembly including end caps for all unistruts members.

E. The design of each individual flaming system shall be the responsibility of the Contractor. Shop drawings, as specified above shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

F. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural steel shapes in accordance with applicable provisions of Section 05500, or unistrut-type frame; have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and be subject to the approval of the Engineer.

1. Pipe support systems shall meet all requirements of this Section and all related Sections.

2. Complete design details of the pipe support system and system components shall be submitted for review and approval as specified in PART I. No hanger or support shall be installed without the written approval of the Engineer.
3. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.9 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. All mild steel surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be as specified in Division 9.
B. All pipe hangers and supports and supporting systems that are not of galvanized steel or stainless steel shall be finish painted as specified in Division 9.

PART 3 EXECUTION

3.01 INSTALLATION

A. Proceed with the installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.
B. The installation of pipe support systems shall in no way interfere with the operation of the hoists, access hatches, etc.
C. The installed systems shall not interfere with maintenance and operational access to any equipment installed under this Section, or any other related Section.
D. All pipes, horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the Engineer.
E. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, thermal expansion and contraction, vibrations and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.
F. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings (within four pipe diameters) and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
G. Inserts for pipe hangers and supports shall be installed on forms before concrete is placed. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.
H. Continuous metal inserts shall be embedded flush with the concrete surface.

I. Apply anti-seize compound to all nuts and bolts. Supports installed without the approved compound shall be dismantled and correctly installed, at no cost to the Owner.

3.02 TESTING

A. All pipe support Systems shall be tested for compliance with this Section. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired or augmented under this Section to the satisfaction of the Engineer.

END OF SECTION

Scope of Work

Furnish, install and test all mechanical systems and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of work.

Contents of Division

Section No.	Section Title
16402	Electrical Work

SECTION 16402

ELECTRICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Include Conditions of the Contract and applicable parts of Division 1.

B. Examine all other sections of the Specifications for requirements which affect the work of this Section, whether or not such requirements are particularly mentioned herein.

C. Coordinate the work of this Section with the related work of other trades, and cooperate with such trades to assure the steady progress of all work of this Contract.

D. The intent of this project is to require the upgraded facilities to be completed and fully operational.

1.2 SCOPE

A. The work covered by this Specification consists of furnishing all labor, materials, equipment, supplies, devices, electrical apparatus, modifications to existing underground electric utility service conduit at the pump station, wiring and conduit for relocated pump control panel, wiring modifications and new conduit for pump station wet well back-up high level switch and wet well level transducer (existing devices being reused), wiring and conduit for the reconnection of existing, repositioned pump control panel alarm outputs to the existing wireless Alarm dialer equipment, provision of new lighting and convenience outlets, and the performance of all operations necessary for the installation, relocation, and wiring of electrical facilities in and about the structures and around the grounds, as indicated on the Contract Documents.

B. This work shall include all costs involved modifying the existing power service conduit at the pump station (including any utility company charges) , and any costs involved with any other special utilities on the project.

C. Without limiting the scope of work, the following is included in this project:

1. Relocation of existing pump motor controls, etc. as applicable.
2. New conduit and associated field wiring for alarm inputs from the relocated pump control panel and for the existing back-up high level alarm switch and wet well level transducer to the relocated pump control panel.
3. Modified conduit and wiring associated with providing new expansion fitting on the existing underground service to the pump station, including any utility charges.
4. Provision of new panel board breakers in existing panelboard for new Surge Protective Device (SPD).

5. Provision of new manufacturer's labels for existing pump control panel and necessary panel modifications to indicate and provide a unit appropriate for 208 Volt, 3 phase, 4 wire, 60Hertz power.

6. Provision, installation and wiring of new run time meters to be installed on the existing pump control panel, one for each pump.

7. Provision of new surge protective device including associated conduit and wire.

8. Provision of lighting fixtures, receptacles, switches and appurtenant components and wiring and conduit.

9. Any and all required conduits and conductors, fully installed, to provide all systems fully operational, whether such are shown in detail or not.

10. All removals, relocations, etc. of electrical equipment required in association with the project

12.. Obtain and pay for all required permits, inspections, etc.

1.3 WORK OF OTHER SECTIONS

A. Refer to project index.

1) Pumps and motors and appurtenances are provided under another specification section.

2) Owner provides portable electric heater for plug-in use at the facility.

1.4 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings in accordance with the requirements of the General Conditions and in the manner described therein. Shop drawings shall indicate specifications section and paragraph requiring equipment indicated.

a. Shop drawings are required on all major pieces of equipment in the following list, but not necessarily limited thereto: breakers; contactors; relays of all types involved; push button and selector switch stations; pull, junction, and terminal boxes; disconnect switches; wiring devices, run time meters, lighting fixtures, surge protective device, conduits; etc.

B. Samples:

1. Submit samples of all materials requested by the Engineer. Samples shall be prepared and submitted in accordance with the requirements of General Conditions, all postage and transportation costs being paid by the Contractor submitting same.

C. Record Drawings:

1. In accordance with requirements of the Supplementary General Conditions, the Contractor shall furnish and keep on the job at all times one complete set of blue line prints of the electrical work, on which shall be clearly, neatly and accurately noted, promptly as the work progresses, all electrical changes, revisions and additions to the work. Wherever work is installed otherwise than as shown on the Contract Drawings, such changes shall be noted.
2. The Contractor shall indicate on these prints the daily progress by coloring in the various apparatus and associated appurtenances as they are installed.
3. No approval of requisition for payment for work installed will be given unless supported by record prints as required above.
4. At the conclusion of work, prepare record drawings in accordance with the requirements of the Supplementary General Conditions.

D. Operating Instructions and Maintenance Manual:

1. The Contractor shall instruct, to the Owner's satisfaction, such persons as the Owner designates in the proper operation and maintenance of systems and their parts.
2. Parties indicated above sign affidavits stating that the above instructions were given by the Contractor.
3. Furnish three (3) copies of operating and maintenance manuals and forward same to the Engineer for transmittal to the Owner.
4. The operating instructions shall be specific for each system and shall include copies of posted specific instructions.
5. For maintenance purposes, provide shop drawings, parts lists, specifications and manufacturer's maintenance bulletins for each piece of equipment. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment so that service or spare parts can be readily obtained.

E. Manufacturer's Data:

1. Within ten days of award of Contract, the Contractor shall submit for Engineer's approval a complete list of manufacturer's names of all materials and equipment proposed for the project.
2. After approval of the above list, the Contractor shall submit for Engineer's approval complete detailed manufacturer's data consisting of bulletins, shop drawings, and parts lists of the materials and equipment to be furnished, as required.
3. Shop drawings and manufacturer's data submitted must bear the Contractor's stamp stating that the shop drawings and data have been checked and meet the plans and specifications before being submitted for Engineer's approval, or they will not be considered and will be returned for resubmission. If the shop drawings and data show proposed variations

from the requirements of the plans and specifications because of standard practice or other reason, specific mention shall be made of such variations in the letter of transmittal.

4. The Contractor shall assume the entire cost and responsibility for any changes in the work, which may be occasioned by approval of materials other than those specified.

5. Errors, omissions and coordination of shop drawings shall be the sole responsibility of the Contractor whether or not the shop drawings are approved.

6. In the event that any specified manufacturer's number has been superseded by a new number since the writing of this specification, the new manufacturer's number shall be immediately submitted to the Engineer for approval. It shall be the responsibility of the Contractor to notify the Engineer of any superseded manufacturer's numbers mentioned in these specifications.

1.5 QUALITY ASSURANCE

A. Applicable Standards, Permits and Codes

1. The installation shall comply with all laws applying to electrical installations in effect in Salem, New Hampshire, and with regulations of any other governmental body or agency having jurisdiction with regulations of the National Electrical Code where such regulations do not conflict with those laws, with the regulations of the electrical utility company involved, with the telephone utility (if applicable), and with ASHRAE Standard 70, as amended.

2. File all required notices and plans. Obtain and pay for all permits, inspections, licenses, and certificates required for work under this Section.

3. If any portion of the electrical plans or specifications conflict with the laws or ordinances with regard to type of materials, equipment or fixtures to be used, the Contractor shall bring it to the Engineer's attention at least seven days before submitting the bid. Otherwise the cost of all work necessary to make the installation comply with said laws or ordinances shall be paid by the Contractor and shall become a part of this Contract.

1.6 EXAMINATION OF SITE AND CONTRACT DOCUMENTS

A. Before submitting prices or beginning work, thoroughly examine the site and Contract Documents.

B. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and Contract Documents prior to executing the Contract would have revealed.

1.7 DRAWINGS

A. The Contractor shall refer to the Contract Drawings etc., and the site and floor plans and details for a full comprehension of the extent and detail of the work to

be performed. These drawings are intended to be supplementary to the specifications, and any work indicated, mentioned or implied in either is to be constructed as specified by both.

B. All work shown on the Drawings is intended to be approximately correct to the scale of the drawings, but figured dimensions and detailed drawings are diagrammatic and are not intended to show every detail of construction or the exact location of equipment. Where building construction makes it advisable or necessary to change the location of equipment, the Contractor shall perform such work without cost to the Owner on written request of the Engineer. Any doubt as to the intended location of equipment shall be resolved by the Engineer before proceeding with the installation.

C. The intent is to obtain an electrical installation of all systems, complete in every detail within and about the building, and with all facilities properly interconnected with power and telephone. The Contractor shall complete the systems in accordance with the best trade practice and to the satisfaction of the Engineer. Upon completion, the electrical systems and all equipment throughout the structures shall operate properly and adequately and function as intended.

D. In any discrepancy between requirements of any Section, between notes on the drawings, between drawings, between details in the specifications, or between drawings and specifications, that which is in the best interest of the Owner shall apply.

1. Testing by Contractor: Provide equipment and personnel for operating test of electrical system.

2. Changes by Contractor: The contract drawings indicate the extent and schematic arrangement of the conduit and wiring systems. If changes from the drawings are deemed necessary by the Contractor, submit details of such changes within 30 days of award of Contract. Make no changes without written authorization of Engineer. Where conduit routings are not indicated, coordinate with Engineer and Owner to insure no conflicts resulting from routings selected.

1.8 ELECTRICAL REFERENCE SYMBOLS

A. Standard symbols have been employed where such will meet the need. These are augmented and modified to illustrate as necessary. The chart on the Contract Drawings is intended to illustrate all symbols and explain the function and installation method of the device represented. When not clear, or where one has been inadvertently omitted, it shall be the responsibility of the Contractor to obtain a ruling on the intent before proceeding with any work.

1.9 TEMPORARY POWER

A. The Owner will permit the Contractor to utilize the facility electrical service for temporary power during construction. The Contractor is reminded there will be a period of time, while the expansion fitting is being installed on the service

conduit, that there will be no utility power available for use, and the Contractor will have to make other temporary power arrangements during that period by use of a portable generator the Contractor would provide.

B. The Owner will pay for the energy consumed while on temporary power and for power consumed, but the Owner reserves the right to charge the Contractor for such power.

C. The Contractor shall furnish his own extension cords and such lamps as may be required for their work, and shall pay for the cost of temporary wiring of construction offices or shanties used by them and any temporary wiring of a special nature for light and power required other than that mentioned above.

D> The Contractor may use the Owner's existing standby generator for power during the period of time that the utility service is interrupted to install the new expansion fitting on the service conduit. The Contractor shall arrange to provide refill of the unit fuel tank after the use of the generator, utilizing a fuel supplier acceptable to the Owner. Operation of the generator shall be monitored by the Contractor at all times during its operation.

1.10 GUARANTEE

A. Contractor's guarantee for items furnished covers and includes:

1. Faulty or inadequate design of equipment provided.
2. Improper installation.
3. Defective workmanship and materials.

B. Warranties of Manufacture

1. Not less than one year.
2. As specified.
3. As normally supplied if greater than one year.

1.11 ALTERATIONS

The Contractor shall execute any alterations, additions, removals, relocations or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the drawings and specifications.

Removal of existing electrical equipment and materials is required.

Renovations in existing areas may not be limited to those noted in Contract Documents. Review the existing building and site to determine the full scope of alterations/removals required by the Contract prior to bidding.

Any existing wiring discontinued under this project shall be completely removed.

1.12 SCHEDULING

The Electrical Subcontractor shall schedule his work in accordance with Contract Requirements. Work may be required to be scheduled during other than normal working

hours. If this occurs this contractor shall provide a suitable work force to accommodate the schedule requirements at no added cost to the Owner.

The facilities may be required to be in use by the Owner during construction.

1.13 BID ALLOWANCES AND BID ALTERNATES (if any)

Items indicated as bid allowances shall be carried at the allowance values stated in the Contract Documents in the preparation of the bid.

Items indicated as bid alternates shall be indicated in the bid documents submitted.

The payment to the Electrical Subcontractor for work and/or materials and/or Subcontractor invoices will be limited to the actual, documented costs incurred under the allowance. If costs exceed allowance values, the Electrical Subcontractor must obtain formal approval as with any change order before exceeding the stated allowance amounts.

1.14 EQUIPMENT/MATERIAL REMOVED BY THE CONTRACTOR

Any electrical equipment, etc. removed shall remain the Owner's property, except for any items specifically noted herein. Te exception to this is any material that the Owner indicates should be disposed of in which case this Contractor shall dispose of in a lawful and legal manner.

Bidder must field verify scope of removals/demolition of electrical installations.

1.15 HAZARDOUS MATERIALS

The Contractor under this specification section shall review all associated Contract Sections and Conditions to determine whether his work will encounter hazardous materials (asbestos, lead based paint, PCB's, etc.) and shall take all steps to insure his employees are properly trained and equipped for any work he must provide where such materials are known to or found to exist within the existing facility.

If hazardous materials are encountered their removal will be by an appropriately qualified firm and the costs of such removals/abatement will not be the responsibility of the Electrical Subcontractor.

1.16 SINGULAR WORDING

Where the specifications refer to a singular equipment item and that item is part of the installation requirements for both pump station locations involved in the project it shall be understood that the item must be provided for each location involved in the overall project.

1.17 ARC FLASH WARNING STUDY AND LABEL REQUIREMENTS

All new and/or modified electrical equipment including control panels, switchboards, panel boards, meter socket enclosures, MCC, VFD assemblies, etc., must have an Arc-Flash Hazard Analysis (AFHA) conducted, and shall be field marked to warn qualified personnel of potential electric arc flash hazards. Warning labels shall be clearly visible and shall be provided in accordance with NEC 110.16 and NFPA 70E.

All work shall be performed in strict compliance with all applicable local and state codes. In addition, all practices shall be in accordance with the latest editions of the National Electrical Code (NEC) of the NFPA, the National Electrical Safety Code, and OSHA.

Provide an ANSI Z535.4 compliant(size 4 in. x 6 in.) thermal transfer or equivalent type two color die cut arc flash label as provided by Dura-Label or Brady for each work location analyzed and included in this project. Material type shall be suitable for the locations; ie: indoor, outdoor, chemical resistant, etc.

If the equipment will be energized prior to the application of the final labels, provide temporary labels until the final labels are applied. Temporary labels do not need to be of the materials specified above. Temporary labels shall be suitable for the environment(example: 110 pound paper or 30 pound paper in a plastic "page protector"). [Note: label information to meet required criteria outlined herein for permanent labeling. Once final labels are available, remove temporary labeling and provide permanent labels as indicated.]

The label shall have either an orange header with black lettering and the wording, **"WARNING, ARC FLASH HAZARD"**, or red header with white lettering and the wording, **"DANGER, ARC FLASH HAZARD" .** Include the ANSI Safety Symbol in the header as recommended. The Danger signal wording shall be provided for all incident energy values calculated greater than 40 Cal/ sq. cm; Warning to be used for all incident energy values calculated less than 40 Cal/ sq. cm. These labels shall include the following information:

1. Location designation
2. Shock Hazard Information including: Nominal Voltage, Limited Approach, Restricted Approach, and Prohibited Approach.
3. Flash protection boundary
4. Hazard/Risk category (HRC) including PPE Catagory
5. Incident energy
6. Working distance
7. Reference actual listing of clothing and glove requirements.

Labels shall be machine printed, with no field markings. The size of the lettering is to be in accordance with ANSI-Z535.4 recommendations for a safe viewing distance of 3 feet minimum based on favorable viewing conditions and information to be included.

Arc Flash labels shall be provided in the following manner and all labels shall be based on recommended over-current device settings. Coordinate the data provided with the Arc Flash Study results and the ANSE labeling requirements.

Quantities outlined below are considered minimum quantities necessary. Provide additional labeling as may be required by Regulatory or Inspection Agencies at no added cost to the project.

1. For each transformer, 480 and applicable 240 and/or 208 volt panelboard, individually mounted circuit breaker and safety disconnect device, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided at the top of each vertical section (see footnote below).
3. For each low voltage switchboard, one arc flash label shall be provided at the top of each vertical section (see footnote below)
4. For each low or medium voltage switchgear, one arc flash label shall be provided at the top of each vertical section (see footnote below)
5. For medium voltage switches one arc flash label shall be provided at the top of each vertical section (see footnote below)
6. For each motor power terminal box, 25 horsepower and larger, one arc flash label shall be provided
7. Additional arc flash labels to address installations and specific equipment requirements shall be provided on an individual evaluation basis
8. General Use Safety Labels shall be installed on equipment in coordination with Arc Flash Labels. The General Use Safety Labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off before servicing.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials, devices, and equipment, unless specifically excerpted, shall be new.

B. Service: Existing electrical service is 208/120 Volt, 3 phase, 4 wire , 60 Hertz.

2.2 IDENTIFICATION

A. All materials shall bear UL labels where such have been established for the particular device.

B. All devices shall show make, type, serial number (where applicable), voltage, amperage, wattage, motor ratings, and all other pertinent data.

C. All wire shall have make, type of insulation, size, and voltage rating clearly marked upon it.

2.3 SLEEVES/JUNCTION BOXES/ANCHORS

A. The Contractor shall provide for all sleeves, openings, anchors, supports, conduits, and boxes.

2.4 CONDUITS

A. Exterior Below Grade:

1. Buried conduit shall be Schedule 40 PVC or rigid galvanized steel. Where steel is used, it shall be double coated with bitumastic dried at least 24 hours between coats before installation. Where PVC is used it shall not extend above grade or floors and all elbows and/or offsets shall be rigid galvanized steel.

B. Interior, dry locations.

1. Where interior conduits are required, they shall be rigid aluminum or rigid galvanized steel conduit.

2. Fittings, boxes and related items for interior work shall be cast type as manufactured by Crouse-Hinds or approved equal where installed on surfaces of walls or ceilings. Material shall match the conduit. Bell style boxes will not be accepted.

3. Minimum size conduit for light and power wiring, where required, shall be 3/4", unless otherwise specifically noted.

C. Exterior above grade.

1. Rigid Galvanized Steel conduit shall be used for new installations. IF work modifies existing conduit and it is PVC, Schedule 80 PVC will be permitted for the modification,

D. Conduits in wet well (if any)

1. Conduit installations that enter the wet well and that are not a part of the pump station equipment shall be PVC coated galvanized steel with matching associated fittings.

E. General:

1. The use of nonmetallic conduit or raceway within a building is not permitted for new installations.

2. Rigid aluminum conduit shall be manufactured by Reynolds, Alcoa, or equivalent.

3. Liquid-tight flexible metallic conduit shall be used to tie in all motors or similar equipment and it shall be UL listed for ground bonding.

4. PVC coated Rigid Galvanized conduit shall be approved equal to Rob Roy Industries Plasti-Bond Red with 40 mil PVC exterior coating and with urethane (red) interior coating.

5. PVC conduit shall be Schedule 80 by Cantex Products or approved equal.

6. EMT conduit and fittings are not approved for use on this project.

7. All terminations of conduits shall have smooth, rounded bushings. All conduit 1" or larger shall have insulation which may be integral with the bushing connector, or an insulated bushing may be added.

8. All rigid conduit joints shall be threaded. Do not use any type of clamp on fittings.

9. Provide expansion fittings where underground conduits rise to above grade at any building or other structure and elsewhere as required by Code. Fittings shall be of the same material/construction as the conduit.

10. Provide fire stopping on all conduits that penetrate fire rated walls, ceilings, or floors.

11. Where conduits pass between the exterior of structures and the interior of structures, the Contractor shall provide suitable sealing per NEC Article 300, 300.7 (A).

12. Where conduits leave any Classified area they shall have seal fittings rated for the classification of the area involved. The Wet Well is a Classified area.

2.5 WIRE AND CABLE

A. All cable and wire shall comply with the latest requirements and specifications of the NFPA and/or the Insulated Power Cable Engineers Association (IPCEA) and shall be as manufactured by General Cable, General Electric, Anaconda, Phelps Dodge, or approved equal, unless otherwise specified or indicated.

B. All conductors used in the wiring system shall be soft-drawn copper wire having a conductivity of not less than 98% of that of pure copper, unless otherwise indicated or specified. Wire No. 10 AWG or smaller may be solid and wire No. 8 AWG and larger shall be stranded.

C. All wire and cable shall be stamped approximately every two feet to indicate voltage, type, temperature rating, UL listing, manufacturers' name, size, etc.

D. All underground conductors shall enter manholes, building walls, or termination points through a protective galvanized steel conduit sleeve of appropriate size.

E. All cable and wire shall be: 600 volt; installed in approved raceways or conduits; not less than No. 12 AWG (except that No. 14 AWG may be used for control wiring).

F. Insulation for cable and wire shall be as follows:

All Areas	XHHW-2 -

G. All branch circuit wiring from panelboards to any outlet on the circuit over 50' but under 100' shall be No. 10 AWG for the first half of the circuit, over 100' but under 175', use No. 8 AWG for the first half. All exit or emergency wiring shall be No. 10 AWG as a minimum. (The intent being that maximum voltage drop at the most remote device on any circuit shall not exceed 3%).

H. The following color code shall be used for all conductors. The colors must be fast, fadeless, and capable of withstanding cleaning.

	208/120 Volt: 3 phase
Phase A	Black
Phase B	Red
Phase C	Blue

Neutral	White
Bond	Green

I. All circuit wires shall be tagged in cabinets, etc., with 1/16" thick tags securely fastened to the conductors with a heavy type of linen wrap at time wires are pulled in and tested. Circuit numbers shall be indicated on the tags. Tags shall not be removed for any reason.

J. At least 8" loops or ends shall be left at each outlet for the installation of devices or fixtures in the future. All wires in outlet boxes not for the connection to fixtures at that outlet shall be rolled up, connected together, and taped.

K. Wires and cables shall be carefully handled during installation.

L. When a lubricant is necessary for pulling wires, it must be listed by UL and be of such consistency that it will leave no obstruction or tackiness that will prevent pulling out old wires or pulling in new wires or additional wires. No soap flakes or vegetable soaps will be permitted.

M. Conductors shall be continuous from panelboard to outlet and from outlet to outlet. No splices shall be made except within junction or outlet boxes.

N. Splices and tapes in wires No. 8 AWG and larger shall be made with Burndy "Polytap" or equal solder less connectors designed for the purpose. All connections between wires on circuits operating at not over 120 volts AC at fixtures and boxes shall for general purpose receptacles be made with UL approved 600 volt wet location listed pressure connectors equal to ideal "Wire-Nut" or "Wing-Nut". Instrument and control wires shall be connected through terminal block connections.

O. Type NM, NMC, AC, or similar cables shall not be permitted on this project. All wiring is to be in conduit.

P. All conductors and connections shall be free of grounds, shorts, and opens.

Q. Instrumentation cables (if any) shall be per instrument manufacturer's specifications.

2.6 OUTLET BOXES

A. All boxes shall be held to wood surfaces by wood screws. On metal surface, boxes shall be held by metal-to-metal screws or by machine bolts.

B. Exposed boxes shall be the same as outdoor boxes.

C. Any outside boxes mounted exposed shall be cast metal type with integral threaded hubs approved equal to FS style conduit boxes. Box material shall be the same as the associated conduit.

2.7 PULL BOXES AND JUNCTION BOXES (In Buildings)

A. Pull boxes, cabinet boxes and junction boxes shall be constructed of code gauge sheet metal of a material that matches the associated conduit and of not less than the minimum size recommended by the National Electrical Code. Boxes shall be furnished with screw-fastening covers. Where several feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number and panel designation. Where pull boxes must be used in finished areas, the Engineer shall be

consulted for the location, style of cover, and finish of box. The location shall always be as inconspicuous as possible. Where shown on the drawings, sizes of pull boxes, terminal boxes and junction boxes shall be followed or next larger standard trade size shall be used. Add pull boxes when such are deemed advantageous.

2.8 PULLING CABLES

A. All raceways are to be equipped with conductors. Swab all conduit before cable is drawn into them. Any crushed raceways shall be replaced before drawing in cable. Where cable pulling compounds are required, materials specifically intended for that purpose may be utilized.

2.9 DISCONNECTS

A. Where shown on the Drawings, or when NEC required whether or not shown, install disconnect switches appropriate for the application. When serving motors, they shall be motor rated. Those for equipment outdoors or in damp or wet areas shall be in NEMA 4X stainless steel or reinforced nonmetallic Krydon enclosures, or as otherwise indicated on Contract Drawings. Those located exterior to buildings shall be capable of being padlocked in the "ON" and in the "OFF" positions.

B. Switches shall be heavy duty, quick make and break type. They may be non-fused by a solid copper bar, silver plated on motors over 2 HP. For small motors (1/3 HP and less), a toggle switch, motor rated, may be used; otherwise, they shall be similar to Square D type HU in NEMA 12 or 4X enclosures as noted. Manual starters with overload protection built in are approved when NEC is acceptable.

2.10 OVERCURRENT PROTECTION SERVICES

A. Overcurrent protection for motors is to be in the starters. There is to be protection in each phase wire. Overcurrent protection of conductors is by thermal and magnetic molded case circuit breakers in the panelboards. Where combination starters are used, the breaker is to be a motor circuit protector with only magnetic trips. These must be supplied from a branch circuit protected by a thermal and magnetic trip breaker.

2.11 WIRE CONNECTORS AND DEVICES

A. All wire joints shall be made with a pressure squeezed connector such as T & G Stakon and Ideal, or bolted clamp such as made by Dossert. UL listed and wet location labeled twist-on type wire nuts are also permitted for general lighting and receptacle circuits, only. Make up to terminals shall be mechanical squeeze connector. Wherever only a screw connector is available, install a conductor terminal like T & G Stakon spade or donut and designed for the application and compression set to the conductor.

B. Cover all joints made with non-insulated clamp devices with Scotch brand plastic electrical tape. Type #88 may be used at any joint and shall be used whenever the temperature of joint or the room is below 50 degrees F. In the summer, or when temperature is above 60°F, new type #33 plus may be used. Triple wrap joints, each wrap having a 50% overlay.

2.12 SWITCHES AND PLATES

A. Switches shall be specification grade, 20 amperes at 120/277 volts, with ivory handle, such as Bryant 4901-I, for SPST applications. All switches shall have clamp type terminals screw set.

B. Mount all switches vertically, wall-surface, and at a height of 4'-0", unless otherwise specified.

C. All switches must have machine screw held wire and be back wired. Automatic grips will not be permitted. All switches must be classed as heavy duty.

D. All plates for flush mounted devices in dry, areas are to be nylon plates, one piece construction for all grouped switches. Exterior plates shall be cast, waterproof type with gasketed cover. Plates in wet or damp areas shall match boxes.

F. Switches and plates shall be a product of Bryant or Hubbell.

2.13 CONVENIENCE AND OTHER OUTLETS AND PLATES

A. Convenience outlets shall be duplex, specification grade, ivory face, side wired binding screw type, two pole, three wire, rated 20 amperes at 120 volts, Bryant 5362-I or equal. Materials for plates shall be the same as those for Switches, 2.13 above. Mount all outlets a minimum of 36" AFF except where specifically indicated otherwise.

B. Ground Fault Receptacles shall be Bryant GFR 53 FTI, 20 Ampere. Each receptacle noted as "GFI" is to be an individually protected GFI unit.

C. Outdoors, in any wet or damp location, and elsewhere as shown, use weatherproof covers, TayMac or approved equal, Extra Duty Rated, conforming to Article 406.8 for receptacles in use while not attended.

D. Automatic grip set outlets are not permitted.

E. On exposed FS and FD boxes, use covers matching the box.

F. Outlets and plates shall be a product of Bryant or Hubbell.

2.14 MOTORS

A. These specifications relating to motors and motor control apply to all motors and controls furnished by this Section or any other section.

B. Each section supplying motor driven apparatus will be responsible for supplying an electric motor of sufficient size for the duty performed. These shall not be oversized beyond a normal safety factor, except that standard design ratings for next above motor size required will be used. Unless otherwise specified, all motors shall have open frames, Class B insulation, and continuous duty classification based on a 40° F ambient temperature of reference.

C. Motors 1/2 HP and larger shall generally be, and those smaller may be, 200 volts, three phase, 60 Hertz. Motors 1/3 HP or smaller shall be 120 volt, single phase, 60 hertz. All motors shall have oversized terminal boxes. Pump motors will be 3 phase to operate with VFD included in the existing pump control panel.

D. Motor Control. Each motor, or group of motors, requiring a single control shall be provided with a suitable controller and devices which shall perform the functions as

specified for the respective motors in other sections of these specifications. All controllers shall conform to the adopted standards and recommended practices of the Industrial Control Standards of the National Electrical Manufacturers Association and the Standards for Industrial Control Equipment of Underwriter's Laboratories, Inc.

E. Thermal Overload Protection. Each motor shall be provided with an overload protective device, integral with either the motor or controller. Unless otherwise specified, the protective device shall be of the manually reset type. Manual controllers for motors shall be specifically designed for the purpose, and shall have a HP rating adequate for the motor. Automatic control devices such as thermostats or float switches that control motors directly are satisfactory, provided they are designed for that purpose and have an adequate HP rating.

F. All motors shall be high efficiency type, with operating efficiencies qualifying for installation credit by participating utility companies in the area. Any utilized in conjunction with VFD's or Solid State Soft Starters shall be inverter duty rated.

2.15 UTILITY SERVICES

A. The existing service will be modified by installation of a new expansion fitting on the conduit riser from underground to the meter on the exterior of the pump station. There will be no service rating increase or voltage change of the service by this project.

2.16 ELECTRICAL SERVICE AND DISTRIBUTION SYSTEM

A. The electric utility company shall provide secondary voltage of the characteristics as shown on the Drawings. The Contractor's Work will begin where the utility company's work ends.

B. All costs chargeable by the utility company for the service modifications shall be included in the bid and paid by the Contractor.

C. The Contractor shall furnish all labor, materials, etc. necessary for the service modification noted above.

D. The Contractor shall notify the utility company in writing, with a copy to the Engineer, no later than ten days after signing construction contracts, as to when the building power service conduit modification will be required.

2.17 UNDERGROUND ELECTRICAL SERVICES

A. Underground service shall comply with all the requirements of the National Electrical Code, local utility company, and local enforcing authority.

B. Secondary service is existing and not expected to require conductor replacement. IF such conductor replacement does become necessary, it shall be provided by the Contractor and included in the Contractor's bid.

C. No service conduit presently underground is planned for replacement.

2.18 PRIMARY POWER SERVICE

A. Primary power to the site is existing and no modifications are planned.

2.19 METERING

A. There is no plan to modify the existing metering under this project.

2.20 PANEL BOARDS

A. The facility panelboard is existing and other than provision of one new 3 pole breaker rated per the new SPD manufacturer's recommendation, and reuse of other circuits as is or as noted, not changes are planned for this panel.

2.21 BALANCING OF LOADS

A. The Contractor shall balance all loads between phases in all panels, etc., around the neutral. Neutral conductors shall be the same size as phase conductors unless specifically noted otherwise. Common neutrals shall not be installed.

B. All circuits shall be distributed among the phases so as to restrict any phase load imbalance to less than 10% at any panel board.

C. After completion of the installation, record under full load conditions the current flow in each phase feeder. Upon request, submit four copies to the Engineer giving name and location of each panel, etc.

2.22 LIGHTING FIXTURES

A. Wire directly to an outlet box for each lighting fixture in and on the structures. General building wire is to be used to these outlets. From outlet to fixture use minimum No. 14 AWG silicon rubber insulated, color coded wire to connect to the fixture socket, ballast, or driver supply leads. Add a bond wire to ground all fixtures.

B. The lighting fixtures listed on the Drawings are to indicate quality, appearance, lamping and photometric characteristics acceptable. Alternative fixtures may be proposed for the project where they provide the equivalent characteristics, quality and appearance, and subject to the Engineer's approval. The Subcontractor must provide manufacturer's point-by-point lighting print-outs with manufacturer's fixture cuts for any proposed fixture substitutions. Proposed substitutes must be approved by Addenda no less than 14 working days (Monday - Friday) before bid opening, otherwise they will be rejected.

2.23 LAMPS, DRIVERS AND ACCESSORIES

A. There are no fluorescent fixtures specified for this project.

B. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) compliant and the LED drivers, modules, and housing shall be products of the same manufacturer.

C. LED drivers shall include the following features unless otherwise indicated:

a. Minimum efficiency: 85% at full load.

b. Minimum Operating Ambient Temperature: -20 degrees C. (-4 degrees F).

c. Input voltage: 120 - 277 V (+/- 10%) at 60 Hz.

d. Integral short circuit, open circuit, and overload protection.

e. Power Factor not less than 95%.

f. Total Harmonic Distortion: No greater than 10 %.

g. Comply with FCC 47 CFR Part 15.

D. LED modules shall include the following features unless otherwise indicated:

a. Comply with IES LM-79 and LM-80 requirements.

b. Minimum CRI 80 and color temperature 3000 degrees Kelvin unless otherwise indicated in the fixture schedule.

c. Minimum rated life: 50,000 hours per IES L70

2.24 EMERGENCY LIGHTS, EXIT SIGNS

A. Provide new emergency lighting at pump station locations. See fixture schedule on Contract Drawings. There are no exit signs involved on this project.

2.25 WIRING OF MECHANICAL AND OTHER EQUIPMENT

A. The Contractor shall wire all power to, providing and installing local disconnects for, all mechanical equipment and other equipment per Contract Drawings. This shall include but not be limited to: Wiring of pump control panel including power feed and connection of all loads and controls that are not part of the assembled and wired control panel, and also wet well level devices, conduit, etc.

2.26 FIRE AND SECURITY SYSTEMS, Etc.

A. There are no new fire alarm or security systems in this Contract.

2.27 FUSES (if any)

A. Provide a complete set of fuses for each fusible switch. Time current characteristic curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation; submit coordination data for approval. Fuses shall have a voltage rating not less than circuit voltage.

B. Cartridge Fuses, Current-limiting Type (Class R): UL 198E, Class RK-1 time-delay type. Associated fuse holders shall be Class R only.

C. Cartridge Fuses, Current-limiting Type (Classes J and L): UL 198C, Class J for 0 to 600 amps and Class L for 601 to 6000 amps.

2.28 TELEPHONE

A. There is no telephone utility wiring required for this project.

2.29 INSTRUMENTATION AND CONTROL SYSTEM

A. The Contractor under this section shall provide all required wiring and conduits for these systems and associated equipment. This includes wet well back-up alarm switch and level transducer, and any pump control panel signals to the existing alarm system.

2.30 PUMP CONTROL PANEL MODIFICATIONS

A. Refer to note on Contract Drawings for the work involved in modifications and relocation of the Pump Control Panel.

2.31 WIRELESS ALARM DIALER

A. Owner's existing alarm system is retained and reused for this project.

B. Rewire and reconnect alarms from relocated pump control panel.

2.32 LEVEL CONTROL SYSTEM

A. The existing level control system is reused under this project.

B. Provide conduit, junction boxes, seal fittings, etc. to reconnect the existing level control devices to the relocated pump control panel.

2.33 SURGE PROTECTIVE DEVICE

A. Provide an install a new SPD for the electrical service as noted on the Contract Drawings. Unit shall be Type 2 with manufacturer's recommended over-current protection and disconnect device, rated for 208/120 volt, tree phase service. It shall have UL Suppression Voltage Ratings of 330 L-N and L-G, 330 N-G, 700 L-L, and an MCOV of 150, The unit shall have a surge capacity of 320 kA/phase, and shall be UL 1449 Third Edition Listed, UL 1283 R/C. It shall have form C contacts for future use and shall include a surge counter, 6 digit LCD, with test function, reset and no-maintenance Eprom memory. Unit shall be NEMA 1 enclosed and as manufactured by Advanced Protection Technologies, a division of ASCO or an approved equal manufacturer.

2.34 ELECTRIC HEATER(S)

A. Owner will provide electric heaters after project is complete. Design is based on maximum 1500 W, 120 Volt, plug-in style.

2.35 NAMEPLATES

A. Provide nameplates for all items of equipment on all switchgear, motor control centers, panelboards, controllers, selector switches, starters, safety switches, push-button stations, feeder switches and relay and equipment enclosures.

B. Nameplates shall be black laminated plastic or bakelite, approximately 3/4" x 2-1/2" x 1/16", with four edges neatly beveled. Lettering shall be engraved, white, with a height of approximately 3/16" x 1/4".

C. Provide two holes in nameplate and secure to equipment with non-ferrous screws. If adequate space is not available on item to which nameplate is to be affixed nameplate may be installed adjacent to and as close to the item as possible, and in a position where it is readily visible.

D. Notations on nameplates shall be exactly the same as corresponding notations that appear on the Drawings. Submit proposed engraving list for approval before obtaining.

E. Provide placards per NEC at the utility service breaker, ATS, and generator service breakers indicating where all means of disconnect for power to the facility are physically located.

2.36 EQUIPMENT SUPPORTS

A. Provide all structural supports required for proper attachment of all equipment. Wall mounted equipment may be directly secured to vertically orientated strut that is secured to the walls with approved anchors.

B. Maintain at least 1/2" air space between equipment and supporting walls. Groups or arrays of equipment may be mounted on adequately sized stainless steel channels, angles or bars. Prefabricated stainless steel channels equal to those manufactured by Unistrut or Kindorf are acceptable.

C. Equipment suspended from ceilings shall be supported by adjustable threaded stainless steel rods of adequate strength. No hangers may be secured to furred or suspended ceilings or attached to or carried through duct work.

D. All hardware items shall be stainless steel.

2.37 DELIVERY, STORAGE AND PROTECTION

A. The Contractor shall be responsible for the work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment which are not immediately installed after delivery to the site. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material.

B. Each Contractor shall protect work and material of all trades from damage that might be caused by that Subcontractors work or workers and shall make good a damage thus caused.

PART 3 - INSTALLATION

3.1 GENERAL

A. The entire work provided in this specification shall be constructed and finished in every respect in a workmanlike and substantial manner.

B. The Contractor shall obtain detailed information from the manufacturer of apparatus as to the proper method of installing and connecting same.

C. Before installing any of the work, the Contractor shall see that it does not interfere with the clearances required.

D. Work installed by the Contractor which interferes with or modifies the building design shall be changed as directed by the Engineer, and all costs incidental to such changes shall be paid by the Contractor.

E. In any and all cases of discrepancy in figures, plans or specifications the matter shall be immediately submitted to the Engineer for decision.

3.2 SITE VISITS

A. The Contractor will be required to visit the site as the work progresses and to carefully investigate the structural and finished conditions affecting all details of the work, and shall arrange such work required to meet such conditions.

3.3 CUTTING AND PATCHING

A. It is the duty of the Contractor to furnish and install all sleeves required in the performance of this Contract and it shall be the duty of the Contractor to provide the required openings during project construction.

3.4 ALUMINUM CONDUITS

A. Aluminum conduits may be installed where noted in the specifications.

3.5 INTERIOR CONDUIT SYSTEMS

A. The Contractor shall coordinate with Engineer and Owner as to locations, sizes and number of conduit sleeves to be installed through cast concrete.

B. Exposed runs of conduit shall have supports not more than 8'-0" apart and shall be installed with runs parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of cast metal fittings or symmetrical bends. Conduit bends and offsets shall be avoided where possible, but where necessary, shall be made with an approved hickey or conduit bending machine. Conduit which has been crushed or deformed in any way shall not be installed. Expansion fittings shall be used to provide for expansion joints. Wooden plugs inserted in masonry or concrete shall not be used to secure conduits or boxes. Conduits shall be supported on approved types of aluminum wall brackets, ceiling trapeze, straphangers or pipe straps, secured by means of toggle bolts in hollow masonry units, expansion bolts in concrete or brick, machine screws on metal surfaces, and wood screws on wood construction. Conduit shall be installed in such a manner as to insure against trouble from the collection of condensation, and all runs of conduit shall be so arranged as to be devoid of traps wherever possible. The Contractor shall exercise the necessary precautions to prevent the lodgement of dirt, trash, or plaster in conduits, fittings or boxes during the course of installation. A run of conduit which has become clogged shall be entirely freed of the accumulation or shall be replaced.

C. Conduits shall be securely fastened to all sheet metal outlets, junction boxes, pull boxes, and panelboards with galvanized locknuts and bushings, care being taken to establish a firm mechanical and electrical contact between the box and the conduit.

D. Flexible conduit shall be installed only where necessary to overcome vibration at motor connection, and shall be as short as possible between the motor terminal box and the junction box on the branch circuit rigid conduit. All flexible conduit shall be of the liquid-tight type similar to "Sealtite", with malleable iron fittings.

E. All rigid metallic conduit shall utilize threaded fittings.

F. Pull boxes, junction boxes and cabinet boxes shall be constructed of code gauge sheet metal (to match conduit material) of not less than the minimum size recommended by the National Electrical Code. Boxes shall be furnished with screw fastened covers. Where pull boxes are used in finished areas, the Engineer

shall be consulted as to the location, type of cover, and finish of box and cover. Locations shall be as inconspicuous as possible.

3.6 CONDUCTORS

A. A complete system of conductors shall be installed in the raceway system, except where otherwise noted. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes. Compression type connectors properly taped shall be utilized for all splices.

3.7 OUTLETS

A. Outlets shall be installed in locations as indicated on the Contract Drawings. The Contractor shall study the general building plans in relation to the spaces surrounding each outlet in order that the work may fit the other work required by these specifications. Where necessary, the Contractor shall relocate outlets so that installed fixtures are symmetrically located according to room layout and will not interfere with other work or equipment.

3.8 DEVICE PLATES

A. Device plates shall be installed on each outlet to suit the device installed therein. Plates shall normally be installed vertically, with an alignment tolerance of 1/16".

B. Device plates shall not leave any sharp corners exposed.

3.9 GROUNDING

A. The existing grounding electrode system is not modified under this project.

B. Ground wires shall be grouped and bonded to panel boxes, not to system neutrals. The ground terminals or receptacles shall be bonded to outlet boxes with #12 AWG bare or green insulated wire, or other suitable means per the National Electric Code.

C. Where flexible metallic conduit is used, it shall be suitable for grounding service.

D. All electrically powered equipment shall be grounded.

E. Conduit and/or raceway shall not be utilized as the bonding conductor.

3.10 EXPLOSION PROOF REQUIREMENTS

A. Where encountered, equipment shall be Class 1, Division I, Group C, D rated. The wet well within the facility area is considered so rated.

3.11 PULLING CABLES

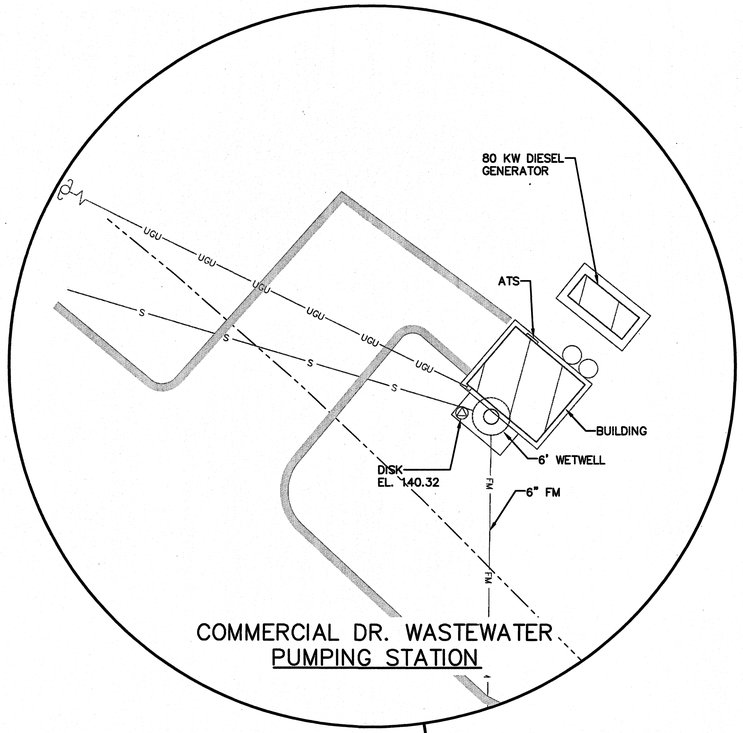
A. Cables shall be installed utilizing pulling equipment designed for the types of wireways or conduits installed. Where lubricating material is required, it shall be a material manufactured for and designated by UL label as suitable for the types of insulation involved on the conductors. Care shall be taken during cable pulling so as not to cause kinks or sharp bends in the conductors. If insulation on conductors is cut or knicked during pulling, the conductors involved shall be removed and replaced at no added cost to the Owner. During pulling, the maximum strain applied to the conductors shall not exceed 50% of the ultimate strength of the conductors.

3.12 EXAMINATION AND APPROVAL OF WORK

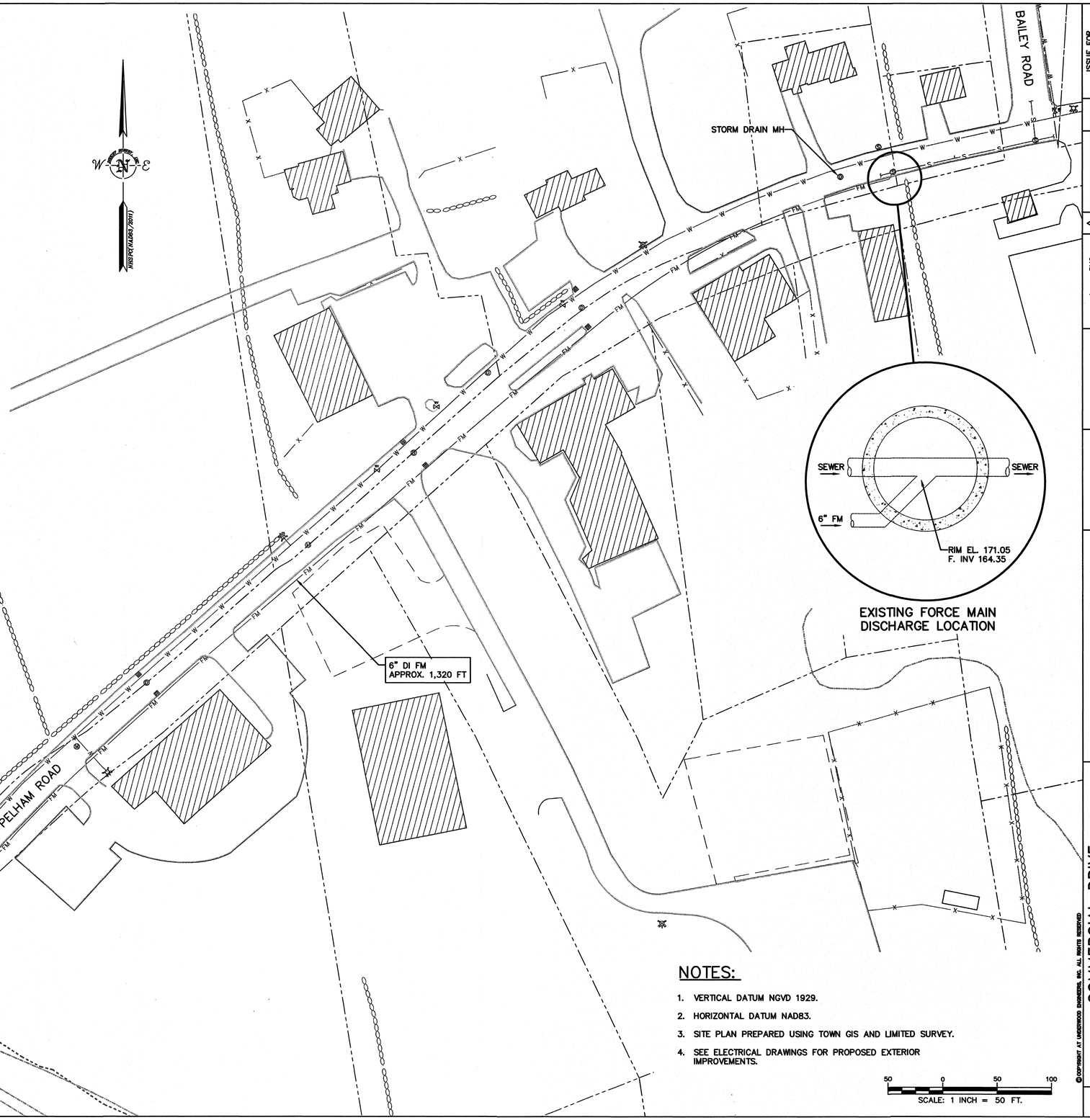
A. No work shall be covered before examination and approval by the Engineer and by all inspectors and authorities having jurisdiction. Replace any imperfect or condemned work with work conforming to requirements and satisfactory to the Engineer, without extra cost to the Owner. If work is covered before due inspection and approval, the Contractor shall pay all costs of uncovering and reinstating the work.

END OF SECTION

I. DRAWINGS



COMMERCIAL DR. WASTEWATER
PUMPING STATION



EXISTING FORCE MAIN
DISCHARGE LOCATION

NOTES:

1. VERTICAL DATUM NGVD 1929.
2. HORIZONTAL DATUM NAD83.
3. SITE PLAN PREPARED USING TOWN GIS AND LIMITED SURVEY.
4. SEE ELECTRICAL DRAWINGS FOR PROPOSED EXTERIOR IMPROVEMENTS.

50 0 50 100
SCALE: 1 INCH = 50 FT.

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL
Date 12/3/2016 By WSC
CONSTRUCTION
Date 12/7/2016 By WSC
RECORD DRAWING
Date - By -

Drawn/Chk. RMG
Designed JMC
Checked WSC
Approved WSC
Date 12/3/2016
Book No. -
Project No. 2387
Dwg. ID 1612_BASE_P
Scale AS SHOWN

STATE OF NEW HAMPSHIRE W. STEVEN CLIFTON No. 5432 REGISTERED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE JEFFREY M. CLIFTON No. 14592 LICENSED PROFESSIONAL ENGINEER

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COMMERCIAL DRIVE
PUMPING STATION SITE PLAN

COMMERCIAL DRIVE
PUMPING STATION IMPROVEMENTS

TOWN OF SALEM, NEW HAMPSHIRE

DWG NO C1

SHEET 1 OF 4

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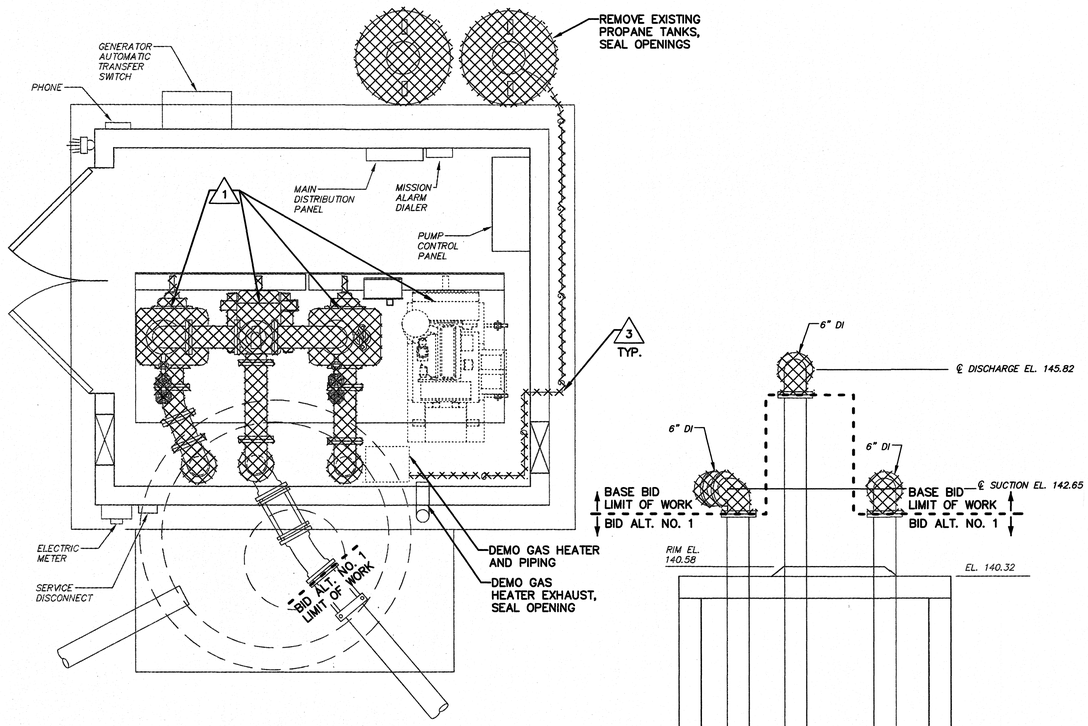
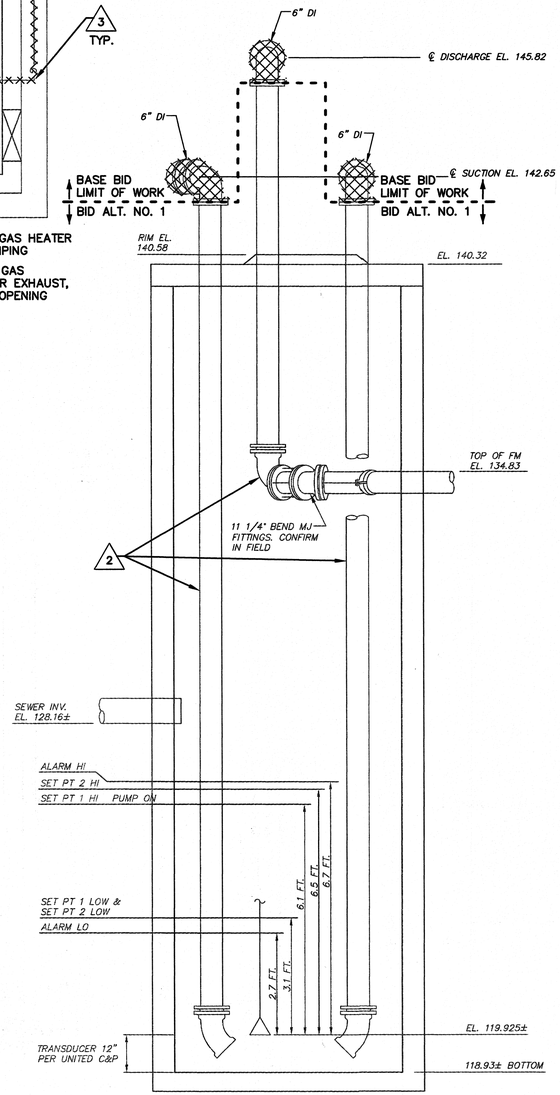


PLAN VIEW



6 FT ø WET WELL ELEVATION VIEW

DEMO NOTES:

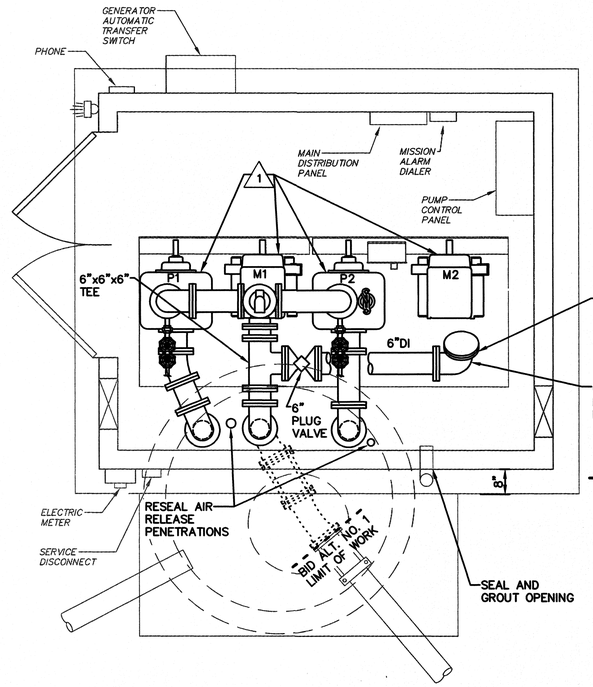
1. DEMO EXISTING PUMPS AND MOTORS, AIR RELEASE VALVES AND PIPING, AND BACKUP AUXILIARY PUMP MOTOR. EXISTING PUMP SKID TO REMAIN.
2. REMOVE AND DISPOSE OF EXISTING SUCTION AND DISCHARGE PIPING. CONFIRM LENGTHS AND FITTINGS PRIOR TO REMOVAL. BASE BID INCLUDES REPLACEMENT OF EXISTING PIPING, FITTINGS, CHECK VALVES, AND 3-WAY DISCHARGE PLUG VALVE TO LIMIT SHOWN ON PLANS. BID ALT. NO. 1 INCLUDES COMPLETE REPLACEMENT OF SUCTION AND DISCHARGE PIPING.
3. SEAL ALL PENETRATIONS WHERE EQUIPMENT AND PIPING IS REMOVED.

GENERAL NOTES:

1. CONTRACTOR CAN UTILIZE EXISTING GENERATOR AND TOWN ELECTRIC SERVICE DURING EXECUTION OF WORK. ALL COSTS TO UTILIZE THESE UTILITIES SHALL BE BY CONTRACTOR.
2. CONTRACTOR CAN UTILIZE ONE PUMP AND MOTOR TO MAINTAIN FLOW. A BACKUP PUMP SHALL BE AVAILABLE AT ALL TIMES.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING WASTEWATER FLOWS AT ALL TIMES. CONTRACTOR SHALL BE CAPABLE OF MAINTAINING FLOWS UP TO 360,000 GPD (250 GPM) THROUGHOUT CONSTRUCTION.
4. THE CONTRACTOR SHALL CONFIRM ALL DIMENSIONS IN FIELD PRIOR TO DEMOLITION AND CONSTRUCTION.

COMMERCIAL DRIVE P.S. DEMO PLAN

SCALE: 1/2" = 1'-0"



PLAN VIEW

EMERGENCY BYPASS NOTE:

PRIOR TO REMOVING BLIND FLANGE FOR EMERGENCY PUMP CONNECTION, CONFIRM VALVE IS CLOSED TO PREVENT DRAINING FORCE MAIN.

PROPOSED NOTES:

1. FURNISH AND INSTALL NEW PUMPS AND MOTORS ON EXISTING PUMP SKID. PROVIDE NEW CHECK VALVES, 3-WAY DISCHARGE PLUG VALVE, EMERGENCY BYPASS CONNECTION AS SHOWN, SUCTION AND DISCHARGE GAUGE KIT, AIR RELEASE VALVES WITH STAINLESS STEEL FITTINGS AND PIPING TO LIMITS SHOWN. CONTRACTOR TO UTILIZE EXISTING PUMP CONTROL PANEL, LEVEL CONTROL AND SETPOINTS.
2. BID ALT. NO. 1: FURNISH AND INSTALL NEW SUCTION AND DISCHARGE PIPING AND FITTINGS AS REQUIRED TO CONNECT NEW PUMPS TO EXISTING FORCE MAIN DISCHARGE.

PUMPING EQUIPMENT:

PUMPS (P1 AND P2): THE PROCESS DESIGN HAS BEEN BASED UPON GORMAN-RUPP CO. T6A-B-4, 15 HP, 12.38"

DISCHARGE: 6 INCH
POWER: 208/120V, 3 PH, 4 WIRE, 60 HZ

CONDITIONS OF SERVICE:

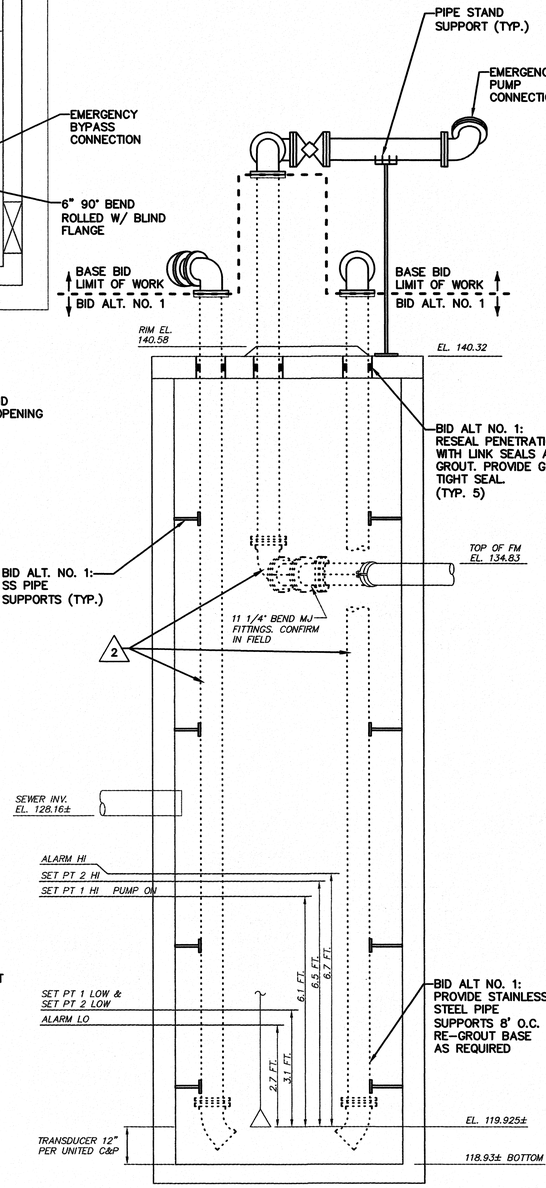
2 PUMPS (P1 AND P2) EACH CAPABLE OF 250 GPM @ 55' TDH.

GENERAL NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SCHEDULING THE WORK SUCH THAT THE EXISTING PUMP STATION WILL REMAIN OPERATIONAL AT ALL TIMES. THE CONTRACTOR SHALL EXECUTE THE WORK IN A MANNER SUCH THAT NO LOSS IN PUMP STATION CAPACITY OR PROCESS PIPING WILL OCCUR. THE CONTRACTOR SHALL PROVIDE BYPASS PUMPING AS NECESSARY TO MAINTAIN EXISTING PUMP STATION FLOW UP TO 360,000 GPD (250 GPM).
2. CONTRACTOR SHALL INSTALL NEW PUMPS IN ACCORDANCE WITH MANUFACTURER'S DRAWINGS AND INSTALLATION REQUIREMENTS.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD PRIOR TO SUBMITTING SHOP DRAWINGS. THE CONTRACTOR SHALL USE SHOP DRAWINGS FOR ACTUAL DIMENSIONS OF EQUIPMENT AND ADJUST LAYOUT ACCORDINGLY.
4. CONTRACTOR SHALL COORDINATE WITH ELECTRICAL PLANS.
5. ALL NEW AND EXISTING PIPING, PUMPS, VALVES AND SUPPORTS THAT ARE NOT STAINLESS STEEL OR GALVANIZED SHALL BE PAINTED IN ACCORDANCE WITH 09912. THE EXISTING PUMP SKID SHALL BE PREPPED AND PAINTED IN ACCORDANCE WITH PUMP MANUFACTURERS RECOMMENDATIONS.

COMMERCIAL DRIVE P.S. PROPOSED PLAN

SCALE: 1/2" = 1'-0"



6 FT ø WET WELL ELEVATION VIEW

0 1' 2' 4' 8'

SCALE: 1/2" = 1'-0"

ISSUE FOR			
APPROVAL	Date 12/3/2018	By WSC	
CONSTRUCTION	Date 12/7/2018	By WSC	
RECORD DRAWING	Date -	By -	

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed JMC
Checked WSC
Approved WSC
Date 12/3/2018
Book No. -
Project No. 2367
Dwg. ID 2367_Pumi Sta
Scale AS SHOWN

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PROCESS PLAN - DEMO & PROPOSED

COMMERCIAL DRIVE PUMPING STATION IMPROVEMENTS

TOWN OF SALEM, NEW HAMPSHIRE

DWG NO P1

SHEET 2 OF 4

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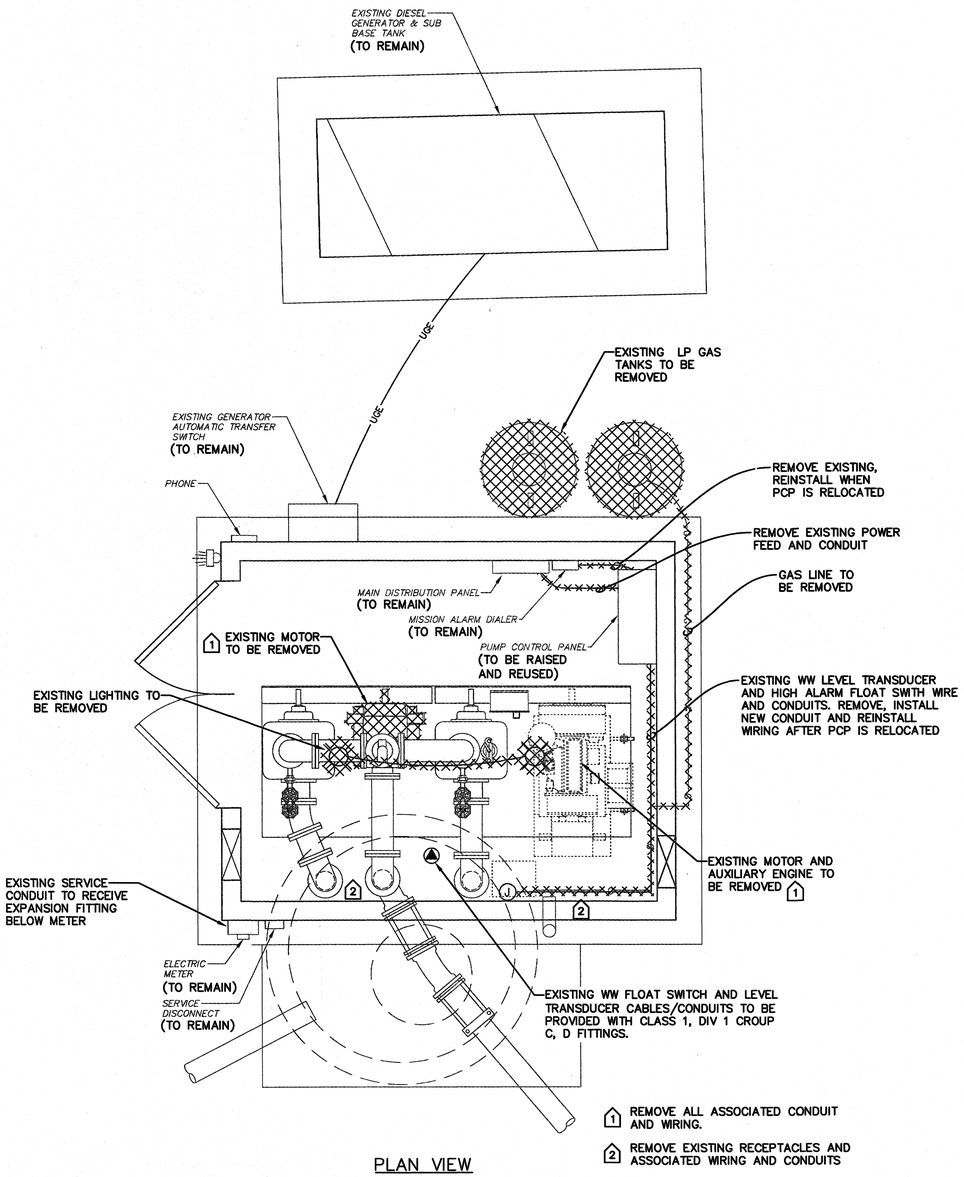
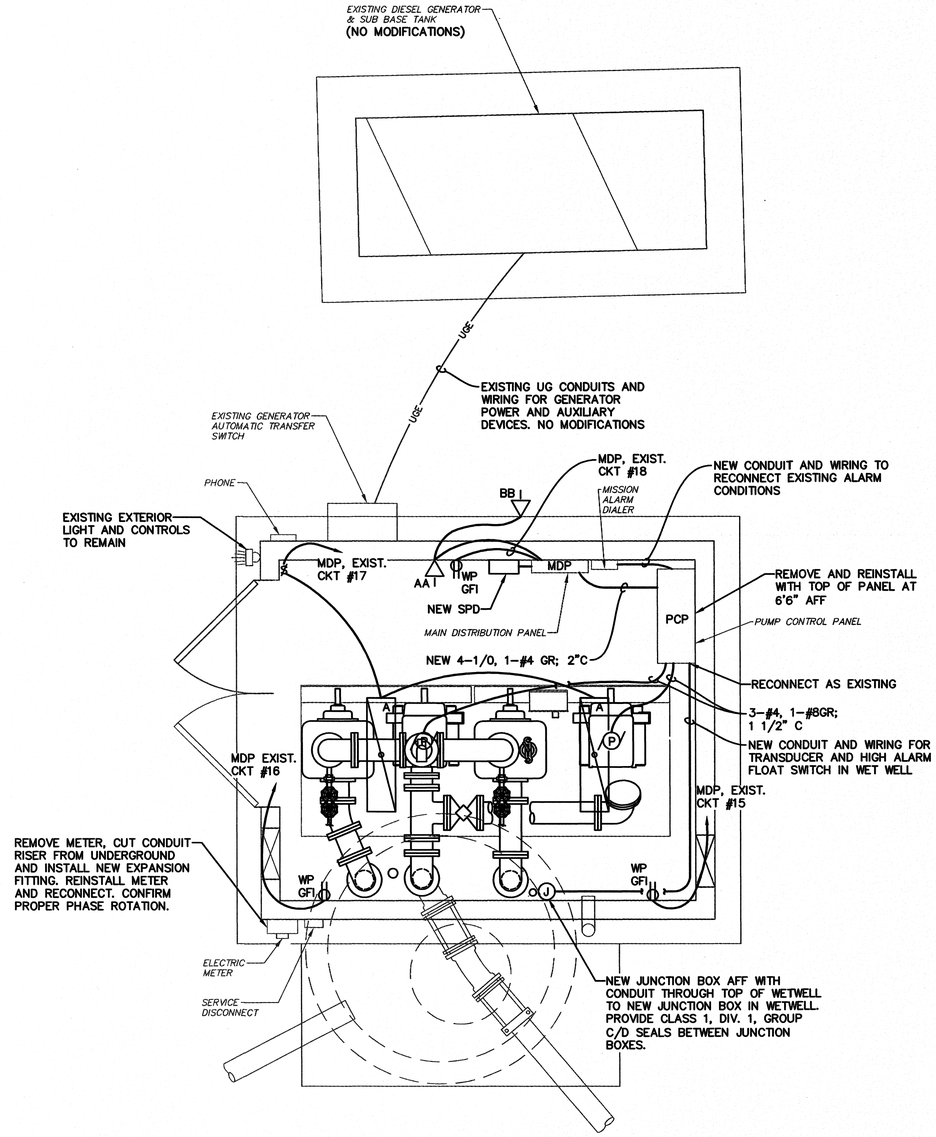


PLAN VIEW

COMMERCIAL DRIVE P.S. DEMO PLAN
SCALE: 1/2" = 1'-0"



PLAN VIEW

COMMERCIAL DRIVE P.S. PROPOSED PLAN
SCALE: 1/2" = 1'-0"

0 1' 2' 4' 8'
SCALE: 1/2" = 1'-0"

ISSUE FOR			
APPROVAL	By	LFC	
Date	12/3/2018		
CONSTRUCTION	By	LFC	
Date	12/7/2018		
RECORD DRAWING	By	-	
Date	-		

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed LFC
Checked LFC
Approved LFC
Date 12/3/2018
Book No. -
Project No. 2387
Dwg. ID 2387_Pump Sta Elec
Scale AS SHOWN

LEE F. CARROLL No. 7620 REGISTERED PROFESSIONAL ENGINEER THE STATE OF NEW HAMPSHIRE

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ELECTRICAL PLAN - DEMO & PROPOSED

COMMERCIAL DRIVE
PUMPING STATION IMPROVEMENTS

TOWN OF SALEM, NEW HAMPSHIRE

DWG NO E1

SHEET 3 OF 4

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LEGEND:

A	LED LIGHT FIXTURE, LETTER INDICATES TYPE
AA	EMERGENCY LIGHT FIXTURE, LETTERS INDICATE TYPE
$	SINGLE POLE SWITCH, 20A, 120/277V, 48" AFF
	DUPLEX RECEPTACLE, 36" AFF
J	JUNCTION BOX

ABBREVIATIONS:

WP	WATER PROOF
GFI	GROUND FAULT CIRCUIT INTERRUPTER
CKT	CIRCUITS
SPD	SURGE PROTECTIVE DEVICE
PCP	PUMP CONTROL PANEL
RTM	RUN TIME METER
AFF	ABOVE FINISHED FLOOR

MODIFICATIONS TO EXISTING PANEL MDP:

EXISTING PANEL IS GENERAL ELECTRIC, 208/120 VOLT, 3 PHASE, 4 WIRE, 60 HZ WITH A MAIN BREAKER RATED 200A, A 150A, 3 POLE FEEDER BREAKER FOR THE PUMP CONTROL PANEL, 7 – 1 POLE BREAKERS FEEDING AUXILIARY CIRCUITS AND 11 – POLE SPACES.

EXISTING CIRCUIT #17 IS IDENTIFIED AS "LIGHTS"
EXISTING CIRCUIT #15 IS IDENTIFIED AS "BACK WALL RECEPTACLE"
EXISTING CIRCUIT #16 IS IDENTIFIED AS "GAS HEATER"
EXISTING CIRCUIT #18 IS IDENTIFIED AS "RECEPTACLE"

THE ABOVE THREE CIRCUITS WILL BE USED FOR THE IDENTIFIED NEW RECEPTACLES

PROVIDE 1 – 3 POLE, BREAKER RATING PER SPD MANUFACTURER RECOMMENDATION, FOR NEW SPD

NO OTHER PANEL CHANGES ARE FORESEEN.

MODIFICATIONS TO PUMP CONTROL PANEL (PCP):

EXISTING PCP IS TO BE COMPLETELY DISCONNECTED WITH PRESENT WIRING FOR MOTORS REMOVED, CONNECTION TO POWER SOURCE REMOVED, CONNECTIONS TO ALARM UNIT REMOVED AND WET WELL (WW) LEVEL DEVICE CABLES REMOVED. IT IS THEN TO BE RELOCATED VERTICALLY WITH TOP OF THE PCP AT 6'6" MAXIMUM ABOVE PUMP STATION FINISHED FLOOR.

NEW CONDUIT AND WIRE IS TO BE INSTALLED FROM EXISTING PANEL MDP TO POWER THE PANEL.

NEW CONDUIT AND WIRE IS TO BE INSTALLED FROM EXISTING ALARM UNIT TO PCP TO RECONNECT EXISTING ALARMS AS WAS PREVIOUSLY EXISTING.

NEW CONDUIT AND WIRE IS TO BE INSTALLED FROM RELOCATED PANEL TO WET WELL LEVEL CONTROL DEVICES, INCLUDING JUNCTION BOXES ETC., PER TYPICAL SKETCH ON CONTRACT DRAWINGS. THERE ARE NO WIRING DIAGRAMS FOR THE EXISTING LEVEL CONTROL CONTROLLER, ETC. SO CONTRACTOR SHALL MAKE DETAILED SKETCH OF THIS WIRING AND PROVIDE TO OWNER AS PART OF HIS WORK. CONTRACTOR SHALL ALSO DETERMINE WHETHER EXISTING BACK-UP HIGH LEVEL FLAT SWITCH IS INTRINSICALLY SAFE, AND IF IT IS NOT THE CONTRACTOR SHALL INCLUDE PROVISION OF AN INTRINSICALLY SAFE BARRIER DEVICE FOR THIS SWITCH.

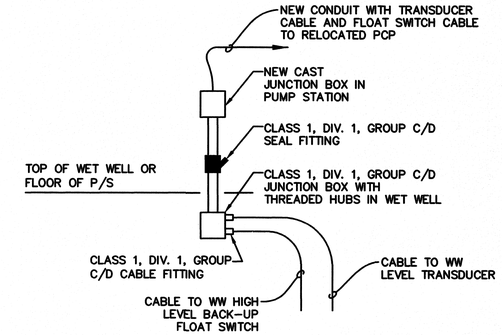
THE CONTRACTOR SHALL PROVIDE NECESSARY CONDUIT AND COMPLETE NEW WIRING FOR RELOCATED PCP TO THE TWO NEW 15HP PUMP MOTORS.

THE CONTRACTOR SHALL CONTRACT WITH RE PRESCOTT, MANUFACTURER OF THE PCP, FOR NEW LABELS AND OTHER NEEDED MODIFICATIONS TO HAVE THE PANEL PROPERLY RATED FOR 208V, 3 PHASE, 4 WIRE, 60 HZ ELECTRICAL SERVICE.

THE CONTRACTOR SHALL PROVIDE AND INSTALL RUN TIME METERS FOR EACH PUMP ON THE FRONT OF THE PCP. BASED ON RE PRESCOTT DRAWING 226833. THE PUMP #1 RTM SHALL BE WIRED IN PARALLEL WITH RELAY CR1 AND THE PUMP #1 GREEN INDICATING LIGHT AND PUMP #2 RTM SHALL BE WIRED IN PARALLEL WITH RELAY CRZ AND PUMP #2 GREEN INDICATING LIGHT. METERS SHALL BE SIX DIGIT WITH HOURS AND TENTH OF HOURS AND SHALL NOT BE RESETTABLE.

LIGHTING FIXTURE SCHEDULE

TYPE	MAKE/MODEL	LAMPING	MOUNTING
A	LITHONIA ZL1N-L48-3000 LM-FST-MVOLT-40K-80 CRI-WH	LED INCLUDED	CEILING SURFACE
AA	HIGH LITES RL-9-SX WITH 2-12W HALOGEN HEADS AND S-2 MOUNTING SHELF	INCLUDED	WALL, 12" BELOW CEILING
BB	HIGH LITES 928-G-6 WITH 2-12W HALOGEN HEADS AND VERS-4X SHIELD	INCLUDED	WALL, 6" BELOW EAVE-AIM AT GENERATOR



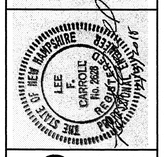
MODIFICATIONS TO PUMP CONTROL PANEL (PCP):

CABLES SHALL NOT SPLICE IN WET WELL JUNCTION BOX. IF NOT OF ADEQUATE LENGTH TO RUN CONTINUOUSLY TO PCP, THEY MAY BE SPLICED IN JUNCTION BOX WITHIN P/S.

ISSUE FOR
APPROVAL Date 12/5/2018 By LFC
CONSTRUCTION Date 12/7/2018 By LFC
RECORD DRAWING Date - By -

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed LFC
Checked LFC
Approved LFC
Date 12/5/2018
Book No. -
Project No. 2387
Dwg. ID 2387_Pump Sta Elec
Scale AS SHOWN



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ELECTRICAL NOTES & DETAILS

COMMERCIAL DRIVE
PUMPING STATION IMPROVEMENTS

TOWN OF SALEM, NEW HAMPSHIRE

DWG NO E2

SHEET 4 OF 4