



## SECTION 33 32 13.13

### GUIDE SPECIFICATIONS FOR PACKAGED SEWAGE LIFT STATIONS, WET WELL TYPE

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#### **PART 1 GENERAL**

##### 1.1 SECTION INCLUDES

###### A. Sewage/Non-Potable Water

###### 1. Pump Stations

i. Extent of packaged pump station work required by this Section is indicated on Drawings and Schedules and by requirements of this Section.

1. Under this Section the Contractor shall furnish and install one (1) pre-packaged, pre-assembled pump station complete with submersible pumps, precast concrete pump chamber with integral valve vault structure, slide rail pump removal system, discharge piping with required supports and fittings, discharge check and plug valves, access hatches, valve vault access ladder, liquid level controls, duplex pump control panel, internal wiring and other required appurtenances.
2. The pre-packaged pump station shall be manufactured and pre-assembled off site to ensure product quality and consistency. The pre-package pump station manufacturer or their distributors shall provide sole-source responsibility to the owner through the warranty period.

##### 1.2 RELATED SECTIONS

- A. 03 00 00 Concrete
- B. 33 00 00 Utilities

##### 1.3 REFERENCES

Where applicable, the latest editions of the following standards shall form a part of this specification to the extent referenced. The publications are referenced to in the text of this guide specification by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

ACI INTERNATIONAL (ACI)

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 309R	Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Code Requirements for Environmental Engineering Concrete Structures and Commentary
ACI 517.2R	Accelerated Curing of Concrete at Atmospheric Pressure

AMERICAN NATIONAL STANDARDS INSTITUTE (ASTM)

ASTM A 36	Specification for Carbon Structural Steel
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Specification for Concrete Aggregates
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM C 40	Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C 117	Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 150	Specifications for Portland Cement
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 192	Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 566	Test Method for Total Evaporable Moisture content of Aggregate by Drying
ASTM C 595	Specification for Blended Hydraulic Cements
ASTM C 617	Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 805	Test Method for Rebound Number of Hardened Concrete
ASTM C 857	Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C 858	Specification for Underground Precast Concrete Utility Structures

ASTM C 890	Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
ASTM C 891	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures
ASTM C 920	Specification for Elastomeric Joint Sealants
ASTM C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C 1037	Practice for Inspection of Underground Precast Concrete Utility Structures
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Concrete
ASTM C 1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1231	Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders
ASTM C 1240	Standard Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete due to Alkali-Silica Reaction
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

Manual of Standard Practice

Placing Reinforcing Bars

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)

NPCA QC Manual

Quality Control Manual for Precast Concrete Plants

## 1.4 GENERAL REQUIREMENTS

Precast concrete units shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units similar to that indicated in the project specifications or drawings for at least 10 years with annual sales of more than \$40 million. In addition, the manufacturer shall employ a professional engineer registered in the state where the product is to be installed.

## 1.5 SUBMITTALS

The following items shall be submitted unless specified otherwise herein.

### A. Preconstruction Submittals

1. Upon request by the customer, submit quality control procedures established by the precast manufacturer's Quality Control Manual

### B. General

1. Submit Four (4) copies of complete project submittals for the Engineer's review and Approval. The submittal shall be assembled in a permanent binder, complete with index and cover, clearly identifying the Project Title, Customer, Project Engineer and submittal date. The submittal shall be compiled in a logical and organized manner.
2. Partial or incomplete submittals will not be reviewed, but instead will be returned as "Incomplete- Revise and Resubmit".
3. Product Data: Submit manufacturer's specific technical product data, including installation and start up instructions, furnished specialties and accessories, and pump characteristic performance curves with selection points clearly indicated. Provide structural calculations stamped by a Professional Engineer registered in the State the project is being installed.

### C. Drawings

1. Submit manufacturer's assembly-type shop drawings indicating dimensions, mechanical & electrical components, complete bill of materials, structural layout & reinforcing per calculations and structural weights. Structural reinforcing drawings shall be stamped by a Professional Engineer registered in the State the project is being installed.
2. The drawings for precast concrete units shall be furnished by the precast concrete producer for approval. These drawings shall show the design loads and standards have been met. Installation and construction information shall be included on shop drawings upon request. It is the responsibility of the project's engineer-of-record to verify that the design assumptions are suitable for the proposed application.
3. For custom made precast concrete units, in addition to the requirements in B.1, the drawing for submittal shall show locations and dimensions to all penetrations and special embed items. Product dimensions and thicknesses shall be shown, and the drawing shall be to a common architectural scale with the precast producer's information in the title block.

### D. Precast Concrete Unit Data

1. Anchorage, Lifting Inserts and Devices
  - i. For anchors, lifting inserts and other devices, the precast concrete producer shall provide product data sheets and proper installation instructions upon request.

## 2. Accessory Items

- i. For items including, but not limited to sealants, gaskets, pipe entry connectors, steps, racks, and other items installed before or after delivery, the precast concrete producer shall include proper installation instructions and relevant product data upon request.

## E. Design Data

1. The precast concrete producer shall supply submittals showing design loading and material specifications for supplied products. At a minimum, the following shall be shown on the submittals:
  - i. Live load used in design
  - ii. Vertical and lateral earth loads used in design
  - iii. Depth of soil fill on the structure
  - iv. Water table depth used in calculations
2. Upon request, the precast concrete producer shall supply precast concrete unit design calculations and concrete mix design proportions and appropriate mix design test data. Structural design calculations shall be sealed by a licensed professional engineer in the state of this project.

## F. Test Reports

1. Upon request, the precast concrete producer shall supply copies of material certifications and/or laboratory test reports, including mill tests and all other test data, for Portland cement, blended cement, pozzolans, ground granulated blast-furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project
2. Upon request, the precast concrete producer shall submit copies of test reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the project conditions. Such tests may include compressive strength, plastic air content, temperature of freshly mixed concrete, and slump of freshly mixed concrete. Special tests for precast concrete items shall be clearly detailed in the specifications
3. Upon request, the precast concrete producer shall supply copies of in-plant QA/QC inspection reports.

## 1.6 DESIGN

All components of the pre-package submersible pump station with integral valve vault shall be designed for all stresses that may occur during continuous operation, and for any additional stresses that may occur during fabrication or erection. Workmanship shall be high quality in all respects. All equipment shall be constructed of materials that will maintain their functional integrity during continuous handling, and in contact with the liquids and atmosphere, likely to be encountered in this application. The following items shall be accounted for in the precast unit design.

### A. Precast Concrete Unit Design

1. Design standard precast concrete units to withstand design load conditions in accordance with ACI 350. Design must also consider stresses induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete units shall be indicated on the shop

drawings, and designed by a licensed professional engineer.

2. The structural design shall take into account discontinuities in the structure produced by openings.
3. The Precast Pump Station with Integral Valve vault shall be designed to support its own weight as well as the minimum superimposed loads tabulated below. All additional equipment shall be accounted for in the design of the elements.

- i. Pump Station with Integral Valve Vault

1. Top Slab
    2. Live Load & Impact Load – AASHTO HS20
    3. Floor Slab (valve vault & base)
    4. Live Load – 200 psf
    5. Exterior Walls
    6. All exterior walls below finished grade shall be designed for an equivalent fluid pressure of 81.6 psf caused by saturated earth pressure. The top of the pressure diagram is assumed to originate at finished grade. In addition to the soil pressure, a Live Load Traffic Surcharge shall be applied according to the AASHTO Specification.
  4. The structures shall be designed to prevent floatation without the benefit of skin friction and the weight of mechanical equipment when the ground water level is at finished ground surface. The factor of safety against uplift calculated as a ratio of the total resisting force (excluding skin friction and the weight of the equipment) to the total hydrostatic uplift force shall be at least 1.15. The net uplift force shall be transferred to the anti-buoyancy collar.

## B. Joints and Sealants

1. Joints and sealants between adjacent units shall be of the type and configuration indicated on the shop drawings meeting specified design and performance requirements.

## C. Concrete Mix Design

1. Concrete type
  - i. For non machine cast products, the concrete shall be self-consolidating concrete which produces minimal bugholes and does not segregate.
2. Concrete Proportions
  - i. Selection of proportions for concrete shall be based on current self-consolidating concrete mix design techniques. At a minimum, ACI 211.1 shall be used.
  - ii. Upon request the precast concrete producer shall submit a mix design for each strength and type of concrete that will be used. Submitted mix designs shall include the quantity, type, brand and applicable data sheets for all design constituents as well as documentation indicating conformance with applicable reference specifications.
3. Durability and Performance Requirements
  - i. Concrete Compressive Strength
    1. Precast concrete units shall have a 28-day compressive strength of 5000 psi for SCC.
  - ii. Water-Cementitious Ratio

1. Concrete that will be exposed to freezing and thawing shall contain air and shall have a water-cementitious ratio of 0.45 or less. Concrete which will not be exposed to freezing, but which is required to be leak resistant, shall have a water-cementitious ratio of 0.48 or less. For corrosion protection, reinforced concrete exposed to deicer salts, brackish water or seawater shall have a water-cementitious ratio of 0.40 or less.

iii. Air Content

1. The air content of concrete that will be exposed to freezing conditions shall be within the limits given below

Nominal Maximum Aggregate size (in)	Air Content %	
	Severe Exposure	Moderate Exposure
3/8	6.0 to 9.0	4.5 to 7.5
1/2	5.5 to 8.5	4.0 to 7.0
3/4	4.5 to 7.5	3.5 to 6.5
1	4.5 to 7.5	3.0 to 6.0
1-1/2	4.5 to 7.0	3.0 to 6.0
* For specified compressive strengths greater than 5000 psi, air content may be reduced 1%		

## 1.7 QUALITY ASSURANCE

The precast concrete producer shall demonstrate adherence to the standards set forth in the plant Quality Control Manual. The precast concrete producer shall meet the requirements written in subparagraph 1.7.A. The Precast Concrete Pump Station Manufacturer shall have a minimum of ten (10) years successful experience in the design and the assembly of factory-built, prefabricated, pre-assembled Pump Stations. In addition, the Manufacturer shall have made no less than ten (10) Pump Stations similar to the one on this project. Evidence shall be submitted to verify these requirements are met prior to being deemed an acceptable manufacturer.

### A. Qualifications, Quality Control and Inspection

1. The precast producer shall maintain a permanent quality control department.
2. The precast concrete producer shall have a quality control program which is audited for compliance annually by persons outside that plant's employee structure.
3. Upon request, the precast concrete producer shall supply a copy of their quality control manual.

### B. Quality Control

1. The precast concrete producer shall show that the following quality control tests are performed as required and in accordance with the ASTM International standards indicated
  - i. Concrete Testing



1. Slump: A slump test shall be performed at least once per day per mix design used. Slump tests shall be performed in accordance with ASTM C 1611 for self-consolidating concrete.
2. Temperature: The temperature of fresh concrete shall be measured each time a slump, air content, or compressive strength tests are made. Temperature shall be measured in accordance with ASTM C 1064.
3. Compressive Strength: At least four compressive strength specimens shall be made each day for each mix design unless otherwise specified. In accordance with ASTM C 31, C 39, C 192.
4. Air Content: Tests for air content shall be performed if the mix design specifies air entrainment. The air content will be measured in accordance with ASTM C 231. The Air Content shall be measured once per day per mix design.
5. Density (Unit Weight): Tests for Density (Unit Weight) shall be performed monthly for each mix design used at a minimum. Tests shall be in accordance with ASTM C 138

#### ii. Aggregate Testing

1. A full set of aggregate tests shall be performed on each aggregate at least annually by an independent testing agency or an in house test lab. These tests will include gradations (ASTM C136), Soundness (ASTM C 88), Organic Impurities (ASTM C 40), Sand Equivalent for fine aggregates only (ASTM D 2419)
2. Potential reactivity shall be performed once per each aggregate source, and when aggregate sources change (ASTM C 1260 or C 1293)
3. Monthly, at a minimum, gradations shall be performed per ASTM C 33.
4. Aggregate Moisture tests: Moisture tests on aggregates shall be performed in accordance with ASTM C 70 or ASTM C 566. Fine aggregate moisture content tests shall be performed at least once per day if there are no moisture meters, otherwise it shall be performed once per month. Alternatively the speedy moisture test is acceptable (ASTM D 4944).

#### iii. Preplacement Check

1. All products shall be inspected for accuracy prior to placing concrete. Checks shall include, but not be limited to, form condition and cleanliness, form dimensions, joints, release agent, blockouts, inserts and locations, lifting devices, reinforcing steel size, spacing, clearances and proper placement.
2. Preplacement checks shall be documented and initialed by the inspector. A drawing with verifications of the above criteria can be used as documentation.

#### iv. Postplacement Check

1. All products shall be inspected for accuracy after the concrete forms have been removed. Checks shall include, but not be limited to, dimensional checks, finishing, insert locations, squareness, honeycombing, cracking, marking, coatings, racking, hole size and location. Postplacement checks may require a corrective action report.

2. Postplacement checks shall be documented and initialed by the inspector. A drawing with verifications of the above criteria can be used as documentation.

2. Copies of the test results and Inspections above shall be available upon request.

C. Outside Inspection

1. The customer or customer's agent (specifier) may place an inspector in the plant when the units covered by this specification are being manufactured. The precast concrete producer shall give notice of 3 days prior to the time the precast concrete units will be available for plant inspection

D. All equipment and materials furnished in the pump station shall be new and free of defects. All equipment shall be the manufacturer's latest and proven design.

E. All electrical materials, devices, and equipment shall be UL listed wherever applicable.

F. All equipment and installations shall meet the National Electric Code.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Handling

1. Precast concrete units shall be handled and transported in a manner to minimize damage. Lifting devices or holes shall be consistent with industry standards. Lifting shall be accomplished with methods or devices intended for this purpose as indicated on the shop drawings. Upon request, the precast concrete producer shall provide documentation on acceptable handling methods for the product.

B. Storage

1. Precast concrete units shall be stored in a manner that will minimize potential damage.

C. Delivery

1. Precast concrete units shall be delivered to the site in accordance with the delivery schedule. Upon delivery to the jobsite, all precast concrete units shall be inspected by the customer's agent for quality and final acceptance.

D. Final Acceptance

1. Upon final acceptance, the customer's agent acknowledges and understands the appropriate methods for handling the accepted precast concrete unit(s). Upon acceptance by the customer or customer's agent, the precast concrete manufacturer is not responsible for replacing damaged product resulting from improper handling practices on the job site.

## 1.9 PLANT CONDITIONS

Any plant producing precast concrete units for this specification shall have a written, implemented, comprehensive safety and environmental program. Upon request, documentation shall be provided to show the safety program meets the following minimum requirements.

A. Safety Program Requirements

The safety program shall include the following written and documented parts as a minimum.

1. Housekeeping
2. Lock-Out Tag-Out
3. Machine Guarding
4. Risk Assessment
5. Personal Protective Equipment
6. Contractor and Visitor Safety
7. Cranes and Lifting Equipment Safety
8. Ergonomics and handling Safety
9. Fall Protection

B. Health and Safety Management System Requirements

The health and safety management system shall be used to manage the safety program and all measureable aspects.

C. Environmental Management System Requirements

The Environmental Management System shall encompass the following:

1. Air Pollution Control
2. Water and Wastewater Management

D. Recordable rate

1. The recordable rate shall be below the industry average. If the industry average is not readily available, assume a value of 6 recordable injuries per 200,000 hours worked as the industry average.

### 1.10 Single Source Responsibility

- A. To ensure that all equipment required for the installation of the pre-package pump station is properly coordinated and will function as a unit in accordance with the intent of these specifications, the Contractor shall obtain all the equipment specified under this section, from a single supplier with whom the responsibility for the proper function of all equipment, regardless of manufacturer, as an integrated and coordinated system shall be vested. This requirement is to establish unit responsibility for all the equipment with the equipment supplier. The use of the word responsibility relating to the equipment supplier is in no way intended to relieve the Contractor's ultimate responsibility for equipment coordination, installation, operation, and guarantee.
- B. Factory pre-assembly: During fabrication and before shipment, all equipment shall be fully factory installed to verify all proper clearances. All installed equipment, unless crossing structural joints, shall remain in the precast structure during travel to the jobsite and final re-assembly.
- C. When contracted to do so, the manufacturer can furnish the services of an experienced service technician to check the installation, and provide with the Owner, a certificate indicating that the pre-packaged submersible pump station has been installed in accordance with the manufacturer's recommendations.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturer: Oldcastle Precast Inc.

1. This specification is based on the precast concrete OneLift™ pump station product line manufactured and pre-assembled by Oldcastle Precast of Avon, CT (OneLift Model RC509). The OneLift™ is chosen as the basis of design for; quality manufacturing, compact size, single structure differential settlement elimination, ease and speed of installation, and overall project timeline savings.
2. Substitutions: Not permitted.
  1. Alternative systems based upon a built-in-place, field erected pump station utilizing separate precast structures, or cast-in-place concrete shall not be accepted.

### 2.2 PRODUCTS

#### A. Precast Concrete Pump Station Sections with Valve Vault

1. The Pump Station with Integral Valve Vault shall be composed of precast reinforced concrete units, rectangular in shape with rounded corners. The precast structures shall be monolithically cast, and have minimum interior dimensions of 5' wide by 9' long with 2.5' radius corners (RC509) , or 6' wide by 11' long with 2' radius corners (RC611). The precast base section will be supplied with an extended buoyancy collar to withstand upward buoyant forces with ground water at grade. Overall structure heights shall be as shown on the contract drawings, and range from 10'-10" to 24'-10", in product-standard 2', 3' & 4' increments.
2. Exterior Walls shall be a minimum of 6 inches thick, integral valve vault common wall and floor shall be a minimum or 4 inches thick, station floor and buoyancy footing shall be a minimum of 8 inches thick, and the roof slab with hatches shall be a minimum of 12 inches thick.
3. The Integral Valve Vault shall be located in the pump station structure as shown on the contract drawing, to conserve site space and to eliminate the possibility of differential settlement. Conventional means, utilizing two (2) separate structures for the pump station and the valve vault **will not be accepted as an equal.**
4. The Precast Structures shall be comprised of product-standard: base, riser sections, integral valve vault, optional vault riser shims as required, and station cover.
5. The Pump Station Manufacturer shall have a production facility in which all work associated with structural fabrication, mechanical/electrical pre-assembling and product final inspection of the pump station will be performed. The building shall keep the pump station components protected from the elements and kept at an ambient temperature of at least 45 degrees Fahrenheit. No concrete shall be batched and placed when the ambient temperature is below 50 degrees Fahrenheit.
6. All wall penetrations shall be formed utilizing hole-formers or cored drilled holes for manhole boots, and galvanized threaded couplings with waterstops for electrical connection.

7. All cast wall openings for ductile iron, PVC or galvanized steel pipe shall incorporate adjustable rubber manhole boots for a watertight seal.
8. All Precast components shall be fabricated on steel forms with machined rings to form accurate bell and spigot joint surfaces to ensure watertight joints.
9. The Horizontal joints between precast sections shall be sealed with a vulcanized butyl rubber joint material conforming to AASHTO M-198. The joint material shall be "Conseal CS-102" as manufactured by Concrete Sealants, or approved equal.
10. All surfaces of the precast structures shall be smooth, even, and free from roughness, irregularities and other defects. The surfaces shall be suitable for receiving exterior treatments as specified elsewhere herein.
11. (optional) An antimicrobial concrete additive shall be used to protect the structure against deterioration from harsh H<sub>2</sub>S environments. The product shall be an EPA-registered liquid, integral concrete admixture for the prevention of microbial-induced corrosion (MIC) typically found in concrete tanks, pipes, manholes, and other structures/elements in sewage and drainage systems. The admixture shall molecularly bond to cement hydration products and ruptures the cell membrane of harmful bacteria and other microorganisms on contact through an electro-physical mechanism. The admixture shall create a concrete surface that is not conducive to the growth of harmful microorganisms. Dose rate of additive shall be per manufacturers' recommendations, but should not be less than 1-gallon per cubic yard of concrete mix. All concrete used for the structural components and non-structural components (including fill concrete, common interior wall and floor of integral valve vault) shall include the admixture as described above.
  - i. The "Integral Antimicrobial Admixture" shall be MasterLife AMA 100, as manufactured by BASF Corporation, Cleveland, OH, or engineer-approved equal.
12. (optional) A Crystalline Waterproofing Additive shall be used. The system shall cause the concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete, surface to surface, from deterioration due to acidic environmental conditions.
  - i. Dose rate of additive shall be per manufacturers' recommendations. All concrete used for the structural components and non-structural components (including fill concrete, common interior wall and floor of integral valve vault) shall attain a minimum 28-day compressive strength of 5,000 psi.
  - ii. The Waterproofing Additive shall be Xypex Admix C-500, as manufactured by XYPEX Chemical Corporation, Richmond, B.C., Canada, or approved equal.
13. (optional) An exterior damp-proofing coating shall be factory applied to the below grade vertical surfaces of the structure. Damp-proofing material shall be cold-applied solvent based asphalt mastic brush or roller applied at a rate of 1-gal per 25SF. Damp-proofing material shall meet ASTM# D-4471 Type 1 and Federal Spec# SS-A-694d(AF). Damp-proofing shall be Karnak 83AF or approved equal.

#### B. Pump Removal Rail System

1. The pump station shall be supplied with a stainless steel guide rail pump removal system, to facilitate emergency and routine maintenance in removing and re-installing the submersible pumps from the top of the station. The guide rail system will include lower guide brackets incorporated in the pump base elbow, 316-stainless upper guide brackets, 316-stainless intermediate guide brackets as may be required per the pump manufacture, and 304stainless steel Sch40 guide rails of size and quantity as dictated by the select pump manufacturer and model.

2. Guide rail components shall be assembled and installed plumb to the pump station structure, and shall allow for pump removal and re-installation without interfering with the access hatch or frame. All assembly hardware shall be 316-stainless steel.

#### C. Hazardous Location Compliance

1. The wet well and the area within 2 feet of the wet well has been classified as a Class 1, Division 1, A Hazardous Location as defined by the National Electrical Code. All electric wiring and motors located within the subject area shall be in strict compliance with these standards. The shop drawings carry the manufacturer's certification that all equipment located in the subject area meets the requirements of NEC Class 1, Division 1 Criteria and the Underwriter's Laboratory (UL).

#### D. Pump Station Access Frame and Cover

1. Furnish and install (1) aluminum pump access hatch, [REDACTED] (30" x 48" for RC509, 36" x 54" for RC611) nominal interior dimension, flush with precast cover, [REDACTED] (300psf, H20 AASHTO) load rating with 316-stainless steel hardware. Cover will be minimum ¼" diamond plate with stainless steel slam lock and weather plug, lift handle which sits flush with cover, recessed pad lock clip (pad lock by others), hold open arm to lock cover in 90-degree position, heavy duty stainless hinges. Frame to be angle style with continuous 1 ½" anchor flange and full slab-height skirt to show no exposed concrete when hatch is open, exterior surfaces in contact with concrete to receive one coat bituminous paint.
2. Pump access hatch to be supplied with integral safety grating system. The safety grate shall be made of 6061-T6 aluminum and designed per the "Specifications for Aluminum Structures". The grating shall be designed to withstand [REDACTED] (300psf, H20 AASHTO) loading. Each grate shall be supplied with a heavy duty, stainless steel pneu-spring for ease of operation when opening. Each grate shall be provided with a permanent hinging system; which will lock the grate in the 90-degree position once opened. Grate shall be coated with an OSHA type safety orange color, base coat is a thermosetting epoxy powder coat finish with a minimum thickness of 2-4 mils. The top coat is a mar-resistant, TGIC polyester powder coating with a minimum thickness of 2-4 mils. Each coat shall be baked at 350-375 degrees F until cured.
3. Access hatches to be manufactured by EJ, East Jordan, MI, or approved equal.

#### E. Valve Vault Access Frame and Cover

1. Furnish and install (1) aluminum valve vault access hatch, 30" x 36" nominal interior dimension single door, flush with precast cover, [REDACTED] (300psf, H20 AASHTO) load rating with 316 stainless steel hardware. Cover will be minimum ¼" diamond plate with stainless steel slam lock and weather plug, lift handle which sits flush with cover, recessed pad lock clip (pad lock by others), hold open arm to lock cover in 90-degree position, heavy duty stainless hinges. Frame to be channel style with 1 ½" NPT drain port in the bottom of the channel, continuous 1 ½" anchor flange and full slab-height skirt to show no exposed concrete when hatch is open, exterior surfaces in contact with concrete to receive one coat bituminous paint. Hatch will be supplied with a heavy duty, stainless steel pneu-spring, for ease of operation when opening cover.
2. Access hatches to be manufactured by EJ, East Jordan, MI, or approved equal.

#### F. Aluminum Vault Ladder

1. The valve vault shall be supplied with an aluminum (6061-T6) wall-mount access ladder. The ladder shall be fastened to the concrete with 316 stainless expansion bolts and shall meet OSHA standard 1910.27 requirements.
2. The ladder rails & supports shall be all welded aluminum construction. Rails and wall

supports shall be solid 3/8" x 2 1/2" flat stock, and rungs shall have a 1-1/4" diameter with serrated surface extruded into the rung for slip resistance. The minimum design live load shall be a single concentrated load of 200 lbs.

3. Rung spacing shall be uniform and not exceed 12", the minimum clear length of rungs shall be 15-1/4", and the distance from the center line of the rung to the nearest permanent object shall not be less than 7".
4. The aluminum ladder shall be manufactured by EJ, East Jordan, MI, or approved equal.

#### G. Ladder Extension (Optional)

1. The ladder extension assembly shall be constructed of aluminum and stainless steel. The aluminum housing shall mount to the ladder by means of grade 316 stainless steel channel clamps secured to the ladder rungs with grade 316 stainless steel "U" bolts. The aluminum telescoping post shall extend 42" above the top of the housing and lock into position with a grade 316 stainless steel pin.
2. The safety extension post shall be manufactured by EJ, East Jordan, MI, or approved equal.

#### H. Polyvinyl Chloride (PVC) Piping and Fittings

1. All PVC pressure piping and fittings for water and wastewater treatment are to be Sch80. Corrosion resistant pressure pipe, IPS sizes, for use at temperatures up to and including 140°F. Pressure rating (120 psi to 1230 psi) varies with schedule, pipe size, and temperature.
2. The material used in the manufacture of the pipe and fittings shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type 1 Grade 1, with a Cell Classification of 12454 as defined in ASTM D1784, trade name designation H707 PVC. This compound shall be gray in color, and shall be approved by NSF International for use with potable and non-potable water (NSF Std 61). All sizes of PVC Schedule 80 pipe & fittings shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances, and all performance test requirements of ASTM D1785.

#### I. Polyvinyl Chloride (PVC) Ball Valves (Standard 2" & 3" PVC)

1. All ball valves shall be of the flanged model with one-piece capsule and shall open counterclockwise. The valves shall be rated for 250psi at 73 degrees F.
2. The ball valve shall be of full-port design to minimize flow restriction to the lowest possible pressure drop. Full flange face gaskets having a 50to 70 durometer A hardness shall be used.
3. Ball valve bodies shall be constructed of PVC, with Teflon seats and Viton seals.
4. PVC ball valves shall be manufactured by Haward, Nibco Inc., or approved equal.

#### J. Polyvinyl Chloride (PVC) Check Valves (Standard 2" & 3" PVC)

1. All check valves shall be of the flanged model with one-piece capsule. The valves shall be rated for 150psi at 73 degrees F.
2. Free oscillation of ball in guide ribs facilitates full port flow with minimum of turbulence and chatter. Full flange face gaskets having a 50to 70 durometer A hardness shall be used.
3. Check valve bodies and ball shall be constructed of PVC, with EPDM seals.
4. PVC check valves shall be manufactured by Hayward, Nibco Inc., or approved equal.

#### K. Ductile Iron Pipe and Fittings

1. All ductile iron pipe shall be designed in accordance with ANSI A21.50, and shall be manufactured in accordance with ANSI A21.51. Pipe for use with grooved end couplings shall have grooved ends in accordance with AWWA C606.
2. Pipe thickness class shall be Class 53 for use with threaded flanges, unless specified otherwise on the product drawings.
3. Flanged joints shall conform with ANSI A21.15, utilizing long-hub flanges which shall be screwed on tight by the foundry before they are faced and drilled.
4. Fittings shall conform to the requirements of ANSI A21.10 and shall be of a pressure classification at least equal to that of the pipe with which they are used. Flanged fittings shall be faced and drilled in accordance with ANSI A21.10.
5. All ductile iron piping and fittings shall be double-thick cement mortar lining and bituminous seal coat (black) on the inside and a bituminous seal coat on the outside, all in accordance with ANSI/AWWA A21.4/C104.

L. DI Pipe & Fitting Coating - Coal Tar Epoxy Black Exterior Coating (Optional)

1. All ductile iron piping and fittings shall be double-thick cement mortar lining and bituminous seal coat on the inside accordance with ANSI/AWWA A21.4/C104. Exterior pipe and fitting surfaces shall receive a compatible prime coating for coal tar epoxy top coat. Exterior top coat shall be Polyamide Epoxy coal tar high-build application which conforms to AWWA C210 performance requirements. Application rate shall be sufficient for 16DMT.
2. Coal tar epoxy coating shall be Tnemec Series 46H-413, of approved equal.

M. DI Pipe & Fitting Coating - Epoxy Exterior Coating – Select Color (Optional)

1. All ductile iron piping and fittings shall be double-thick cement mortar lining and bituminous seal coat on the inside accordance with ANSI/AWWA A21.4/C104. Exterior pipe and fitting surfaces shall receive a compatible prime coating for select 2-part epoxy top coat. Exterior top coat shall be Polyamidoamine Epoxy high-build application, applied at a rate sufficient for 6DMT per coat, and 2-coats required. Color shall be selected from manufacturer's standard color chart.
2. Epoxy exterior top coat shall be Tnemec Series N69, of approved equal.

N. Flange Type Couplings

1. Flange couplings shall be mounted on each pump base elbows to ensure proper pressure seal while providing a minimum of assembly flexibility. The flange couplings shall be fusion bond epoxy coated and supplied with 304-stainless assembly and mounting hardware for harsh & wet environments. The pipe gasket and O-ring seal shall be Nitrile (Buna N) NFS 61 Listed.
2. To ensure correct fitting of pipe and couplings, all flange couplings shall be furnished by the pipe supplier and shall be of the pressure rating of at least that of the pipeline in which they are to be installed.
3. The flange couplings shall be Smith-Blair Inc., model 912 or approved equal.

O. Grooved Couplings

1. Grooved couplings shall be supplied where shown on the product drawings and shall conform to AWWA C606. The couplings are designed for use on radius cut grooved pipe with minimum wall thickness of ANSI/AWWA C151/A21.51, Class 53 DIP, or a transition coupling may be required for connection of grooved end IPS steel pipe to grooved end AWWA ductile iron pipe.
2. The housing coating shall be coal tar epoxy, the gasket shall be Nitrile (red color code), and bolting hardware of 304-stainless steel.



3. The grooved coupling shall be Victaulic style 31/307, or approved equal.

P. Pipe supports

1. Piping shall be supported in the valve vault by means of adjustable (galvanized, stainless) steel floor supports stands which cradles the pipe/valve flanges. The support stands shall be floor mounted with 316-stainless expansion bolting hardware. Where piping enters and exits the vault structure; aluminum wall supports angles with 304-stainless U-bolts and 316-stainless expansion bolt wall-mounting hardware shall be utilized in (3) locations.
2. Piping shall be supported in the pump station by means of a common 304-stainless fabricated angle brace spanning the width of the station and mounted with wall brackets and 316-stainless hardware. Both vertical discharge pipes shall be supported from the brace by means of individual 316-stainless U-bolts and bolting hardware.
  - i. (1) Common pipe support assembly at mid length shall be required when the vertical discharge pipe lengths exceed 10'-0".
  - ii. (2) Common pipe support assemblies at equal spacing shall be required when the vertical discharge pipe lengths exceed 14'-0".

Q. Wall Penetrations

1. Where wall penetrations are called for on the plans; mechanical piping shall utilize cast or cored openings with flexible manhole boots. Flexible rubber boots shall consist of EPDM polymer compounds meeting ASTM C923 material performance requirements. Expansion banding and strap shall be 304-stainless material and the connection between boot and structure shall utilize an expansion wedge system with 304-stainless wedge and hardware components.
2. Electrical conduit penetrations will utilize galvanized electrical couplings assemblies with 2" wide minimum waterstop embedded in the structure at casting, or cored openings with mechanical rubber seals to fill the annular spacing between electrical conduit and precast wall structure. Mechanical seals shall be Link Seal by Thunderline Corp. or approved equal and shall utilize 304-stainless assembly hardware. Mechanical seals shall be employed when pump control panel or exterior junction box option is factory mounted to the station.

R. Check Valves Outside L&W (Standard)

1. The check valve shall have a heavy-duty body of ASTM A126 Class B cast iron with integral flanges faced and drilled to ANSI B16.1 Class 125 for horizontal installation as listed in the schedule or shown on plans. Valve clapper shall swing completely clear of the waterway when valve is full open, permitting a full flow through the valve equal to the nominal pipe diameter. Check valves shall comply with AWWA Standard C-508 latest revision. The valve shall have a bolted and gasketed cover to allow for clapper access without removing the flanged valve from line.
2. Pressure ratings: Class 125 flanged valve body shall be rated for a shell pressure of 250 PSI.
3. The check valve shall be supplied with adjustable outside lever and weight.
4. Manufacturer-paint all interior & exterior ferrous surfaces with fusion bonded epoxy coating, AWWA C550 Manufacturer standard color only applies.
5. Manufactured valve shall be Matco-Norco, mod. 120WC or approved equal.

S. Air-Cushioned Swing Check Valve (Optional)

1. The valve shall have a heavy-duty body of ASTM A126 Class B cast iron with integral flanges faced and drilled to ANSI B16.1 Class 125 for horizontal installation as listed

in the schedule or shown on plans. Valve body shall be full waterway type, designed to provide a net flow area of not less than the nominal pipe size area when swung open no more than 25 degrees. Valve shall have a replaceable bronze body seat.

2. Pressure ratings: Class 125 flanged valve body shall be rated for a shell pressure of 250 PSI.
3. Valve disc shall be faced with a renewable, resilient seat ring retained by a stainless steel screws
4. Disc arm shall be high strength ASTM A536 ductile iron or steel, suspended from and keyed to an 18-8 stainless steel shaft which is completely above the waterway and supported at each end by heavy bronze bushings. Shaft shall rotate freely without the need for external lubrication.
5. Shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing gland. O-ring type shaft seals are not acceptable.
6. Valve shall be supplied with an outside lever and adjustable counterweight to initiate valve closure. Final closure shall be dampened by means of a single, external, bronze air-cushion chamber directly mounted to the valve body on machined pads. The amount of air-cushioning shall be easily adjustable. Pre-charged air chambers and/or commercial air cylinders which pivot or are attached with fabricated brackets, are not acceptable.
7. Manufacturer-paint all exterior ferrous surfaces with (1) coat of 2-part epoxy primer and (1) finish coat of 2-part epoxy, or (2) coats of self-priming 2-part epoxy. Manufacturer standard color only applies.
8. Manufactured valve shall be GA Industries Figure 250-D or approved equal.

#### T. Plug Valve (Standard)

1. Plug valves shall be of the non-lubricated, quarter-turn, eccentric type with flanged ends and lever operated, in full conformance with the latest revision of the AWWA C517 Standard.
2. Valves sizes 3" to 6" shall have a minimum 175 PSI pressure rating. Plug Valves shall be round ported for reduced pumping costs and improved flow characteristics. The valves shall have the following minimum full open flow coefficients (Cv): 3"=569, 4"=982, 6"=1997.
3. Flange diameter, thickness, and drilling shall conform to ANSI B16.1 Class 125.
4. Valve shaft seals shall be of the self-adjusting U-cup design for reduced maintenance and replaceable without removing the cover from the valve.
5. Valves shall have bodies and covers of ductile iron per ASTM A536 for superior strength. Valve sizes 3" and larger shall have body seats of 95% welded nickel applied directly to the body and machined to a smooth finish. Sprayed, plated or removable seats are not acceptable. Valves shall have plugs made from ductile iron per ASTM A536 with a vulcanized synthetic rubber seat facing tested per ASTM D429 for all sizes.
6. Valves shall be provided with stainless steel thrust bearings on the upper and lower plug shaft to eliminate plug-to-body contact and ensure long lasting plug-to-seat alignment. Grit seals shall be provided on the upper and lower bearing journals to minimize the entrance of grit into the shaft seal and bearing areas.
7. Valves shall be coated internally and externally with 6-8 mils NSF approved two part epoxy paint for corrosion protection.
8. Valves shall be Golden Anderson Figure 517 "ECO-Centric" or approved equal.

#### U. Air/Vacuum Release Valve (Optional)

1. Air/Vacuum release valve shall be 2" and installed at high points in the main line or as directed by the design engineer. The valves shall be fully automatic float operated, designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall re-open during draining or if a negative pressure occurs. Combination Air Valves for both air release and air/vacuum functions.
2. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.
3. Valve sizes 2 in. and smaller shall have full size NPT inlets and outlets equal to the nominal valve size. The body inlet connection shall be hexagonal for a wrench connection and be supplied with brass gate valve for system isolation. The valve body shall have cleanout and drain connections on the side of the casting.
4. The valve shall be supplied back flushing attachments so that the interior body can be flushed periodically for proper operation.
5. A bolted cover with alloy screws and flat gasket shall be provided to allow for maintenance and repair. The resilient seat shall provide drop tight shut off to the full valve pressure rating. The seat shall be a minimum of .5in. thick on 2 in. and larger valves and secured in such a manner as to prevent distortion.
6. The valve body, cover, and baffle shall be constructed of ASTM A126 Class B cast iron. The float and guide shafts shall be constructed of Type 316-stainless steel. Resilient seats shall be Buna-N
7. The exterior of the valve shall be coated with a universal alkyd primer & paint.
8. The manufacturer shall demonstrate a minimum of five (5) years experience in the manufacture of water/wastewater air valves. Air/Vacuum Valves shall be manufactured by G.A. Ind., Crispin Valve, Val-Matic Valve or approved equal.

#### A. Gaskets, Bolts, Nuts

1. For flange joints, gaskets shall be a minimum of 1/8" thick full faced gaskets. Gaskets shall be of composition suitable for exposure to fluids within the pipe. Gaskets shall meet AWWA C110, C111, and C115 performance standards.
2. Flange joints shall be bolt-assemble utilizing the full faced gasket. Bolting hardware, number & size, shall conform to the same ANSI standards as the flange. Bolts and nuts shall be 316-stainless steel, heavy hex Grade B conforming to ASTM A493/494.

#### B. Station Vent

1. A passive station vent shall be supplied using 4" Sch80 PVC piping & fittings, and a stainless insect screen. The vent will be factory assembled and mounted to the exterior of the station, where the venting will rise above the station, and turn downward (gooseneck), and end with insect screen minimum 3' above finish grade.
2. (optional carbon canister) A passive station vent shall be supplied using 4" Sch80 PVC piping & fittings, and a top mounting carbon canister unit. The vent will be factory assembled and mounted to the exterior of the station, where the venting will rise above the station a minimum 3' above finish grade, and end with a top mounted carbon canister unit with rain shield. The canister housing shall be aluminum with 4" mounting flange, rain shield, with power coat finish. The replaceable canister shall contain a minimum of 12 pounds of activated carbon, and shall be safe for recyclable disposal.
  - i. The carbon canister assembly shall be Purafil PV40 Vent Scrubber or approved equal.

### C. Interior Junction Boxes for Pumps and Level Control Devices

1. The pump station shall be supplied with interior junction boxes for pump power/control and float conductor connections. The pump power/control junction boxes shall be rated NEMA 7 explosion-proof, and shall require one junction box for each pump. The float junction box shall be rated NEMA 4X and constructed of durable polypropylene for intrinsically safe float operation, where barrier relays are supplied in the pump control panel. The interior junction boxes shall be positioned together and accessible from the hatchway at grade. Interior conduits and fittings shall be utilized for passage of pump power/control and level control conductors to the junction boxes.
2. Pump and level control SJO jacketed cables shall be properly supported within the pump station via stainless strain reliefs (Kellums Grip) or other methods, so that cable weight is not transferred to the junction boxes.
3. Interior conduits and fittings between the wall-embedded electrical couplings and the interior junction boxes will be RGS construction and will be factory mounted. Interior conduit support assembly shall be a fabricated type 304 stainless steel Unistrut frame with all type 316 stainless steel fasteners. All final conductor connection in the junction boxes and final float positioning shall be completed on site by the site electrician.
4. Where submersible or ultrasonic type level control transducer device is used instead of, or in conjunction with, level control/emergency floats, the transduce cable shall have a dedicated conduit entrance to the station with dedicated conduit and cord bushing. The transducer shall run un-cut to the pump control panel and not require an interior junction box. The weight of the SJO jacketed cable and transducer shall be supported within the pump station via stainless strain relief (Kellums Grip) or other methods, so that cable weight is not transferred to conduit bushing. All final transducer positioning and connection to pump control panel shall be completed on site by the site electrician.
5. Conduit seal fittings shall be supplied outside of the pump station and prior to the control panel on site by site electrician.

### D. Interior Pump Cable Support and Float Junction Box (Optional)

1. The SJO jacketed pump power/control cables shall run un-cut from the submersible pumps to the pump control panel and not require any interior junction boxes. The weight of the pump cables shall be supported within the pump station via stainless strain relief (Kellums Grip), so that cable weight is not transferred to the associated conduit bushings.
2. An interior float junction box shall be required and rated NEMA 4X, and constructed of durable polypropylene for intrinsically safe float operation, where barrier relays are supplied in the pump control panel. The interior junction box shall be positioned to be accessible from the hatchway at grade. Interior conduit and fittings between the wall-embedded electrical coupling and the interior float junction box will be RGS construction, and will be factory mounted. Interior conduit support assembly shall be a fabricated type 304 stainless steel Unistrut frame with all type 316 stainless steel fasteners. All final conductor connection in the junction box and final float positioning shall be completed on site by the site electrician.
3. Where submersible or ultrasonic type level control transducer device is used instead of, or in conjunction with, level control/emergency floats, the transduce cable shall have a dedicated conduit entrance to the station with dedicated conduit and cord bushing. All final transducer positioning and connection to pump control panel shall be completed on site by the site electrician.
4. Conduit seal fittings shall be supplied outside of the pump station and prior to the control panel on site by site electrician.

#### E. Exterior Termination Cabinet (Optional)

1. A NEMA 4X, stainless steel, weather-tight pump station exterior termination cabinet shall be factory furnished and mounted to the exterior of the pump station with a minimum of 2' clearance between the bottom of the cabinet and the top surface of the pump station. The cabinet will house divided areas for both power/control and low voltage level control. The termination cabinet shall be 304 stainless steel with back plate, interior area dividers, power/control/low voltage terminals, continuous door hinge, quarter-turn latch hardware and pad locking hardware. The cabinet size will be 16"H x 16"W x 6"D minimum.
2. The pump power, pump control and float switch conductors shall be connected to suitable power and terminal blocks inside the cabinet. Pump and level control SJO jacketed cables shall be properly supported within the pump station via stainless strain reliefs (Kellums Grip) or other methods, so that cable weight is not transferred to the terminal strips.
3. The exterior termination cabinet shall be mounted to the pump station with a fabricated type 304 stainless steel Unistrut frame with all type 316 stainless steel fasteners.
4. Conduits, fittings and seal between the termination cabinet and pump station will be RGS construction and will be factory mounted. Conduits, fittings and seals between the termination cabinet and pump control panel shall be supplied and installed by the site electrician. All final conductor termination and filling of seal fittings, shall be completed on site by the site electrician.
5. The complete factory mounted termination cabinet may be removed from the station (via station mounting bolts) and shipped separately to the jobsite due to shipping height restrictions, for field reattachment by site electrician.

#### F. Station-Mounting of Pump Control Panel (Optional)

1. The duplex pump control panel shall be factory mounted to the exterior of the pump station with a minimum of 2'-6" clearance between the bottom of the control cabinet and the top surface of the pump station. Exterior conduit, fittings and seals shall be utilized for passage of pump and control cables from the pump station to the pump control panel. The control panel shall be mounted to the pump station with a fabricated type 304 stainless steel Unistrut frame with all type 316 stainless steel fasteners.
2. The pump power, pump control and float switch conductors shall be connected to suitable power and terminal blocks inside the control panel. Pump and level control SJO jacketed cables shall be properly supported within the pump station via stainless strain reliefs (Kellums Grip) or equal methods, so that cable weight is not transferred to the terminal strips.
3. Conduits, fittings and seal between the control panel and pump station will be RGS construction and will be factory mounted. Incoming control panel power supply & communication conduits, fittings and seals to the pump control panel shall be supplied and installed by the site electrician. All final conductor termination and filling of seal fittings, shall be completed on site by the site electrician.
4. The complete factory mounted pump control panel shall be removed from the station (via station mounting bolts) and shipped separately to the jobsite due to shipping height restrictions, for field reattachment by site electrician.

#### G. Perforated Trash Basket (Optional)

1. The trash basket shall be of the perforated screen style basket, having 2" (2mm) holes on 3" (77mm) centers. The basket shall be of .080" (2mm) [REDACTED] (aluminum, stainless steel), with tracking angles as part of the basket frame. The

guide rails shall be [REDACTED] (extruded aluminum channels, stainless steel pipe rail) sized to facilitate easy operation of the basket. A basket stop shall be supplied loose for site installation at the exact location, once the inlet pipe is installed.

2. The basket and rail system shall be wall mounted with adequate leg-length to facilitate removal without hatch interference. The basket system shall be supplied with 1/4" (7mm) T-304 stainless steel lifting cable with stainless safety hook of adequate length, so that an additional 10' of cable will be coiled and hung from a dedicate stainless hook in the access hatchway.
  - i. (The B1A series aluminum trash basket system shall be manufactured by Halliday Products, Inc. or approved equal.
  - ii. The B4A series T304 stainless trash basket system shall be manufactured by Halliday Products, Inc. or approved equal.)

#### H. Bar Screen Trash Basket (Optional)

1. The trash basket shall be of the bar screen style basket, having 2" (51mm) clear opening between 1/4" (7mm) thick bars and solid sides. The basket shall be constructed of [REDACTED] (aluminum, stainless steel), with (4) 2 1/2" solid wheels and 1/2" stainless steel axles. The heavy duty guide rail system shall be of 3" (77mm) [REDACTED] (aluminum, stainless steel) structural channel, sized to facilitate easy operation of the basket. A basket stop shall be supplied loose for site installation at the exact location, once the inlet pipe is installed.
2. The basket and rail system shall be wall mounted with adequate leg-length to facilitate removal without hatch interference. The basket system shall be supplied with 1/4" (7mm) T-304 stainless steel lifting cable with stainless safety hook of adequate length, so that an additional 10' of cable will be coiled and hung from a dedicate stainless hook in the access hatchway.
  - i. (The B1B series aluminum bar screen system shall be manufactured by Halliday Products, Inc. or approved equal.
  - ii. The B4B series T304 stainless bar screen system shall be manufactured by Halliday Products, Inc. or approved equal.)

#### I. Portable Stainless Hoist (Optional)

1. The pump station will be supplied with a portable stainless hoist to facilitate equipment removal and placement for periodic and emergency maintenance. The hoisting equipment shall be sized for [REDACTED] (300lbs, 1000lbs) max load rating and will include stainless wall socket(s), factory mounted to the pump station exterior wall(s) to adequately reach required equipment.
2. The portable hoist shall be all Type 304 stainless steel construction with marine grade brake winch and 1/4" T-304 stainless steel lifting cable with stainless safety hook. The davit arm shall adjust in 1" increments from 24" to 36" and the overall unit height shall be 60". The winch-end of the cable shall be supplied with a swedge-ball end for easy removal from the winch, and shall be supplied with an additional 10' of cable from the top of station elevation, to be coiled and hung from a dedicate stainless hook in the access hatchway. Each pump and/or trash basket as required shall have a dedicated lifting cable assembly.
3. The portable hoist shall be series DB as manufactured by Halliday Products, Inc. or approved equal.

#### J. Gauge Assembly (Optional)

1. A discharge gauge assembly shall be supplied on each pump discharge pipe line as they enter the valve vault for monitoring system performance. The assembly shall be equipped with a 1/2" process connection, 1/2" isolation ball valve, stainless diaphragm

seal, 4 ½” pressure gauge and an aluminum wall support with stainless connection hardware. Discharge pressure range shall be [REDACTED] (0-15psi, 0-30psi, -60psi, 0-100psi, other).

2. All gauge and diaphragm seal assemblies shall be of a 1 piece welded design with a full scale accuracy of ±1.0%. The gauge shall have a P.E.T. resin case, 4.5” diameter, glycerin fill fluid, with a 316 stainless steel movement, bourdon tube and connection welded to a 1 pc 316ss diaphragm seal. The fill fluid shall be DC200 silicone. Threaded connections between the gauge and the diaphragm seal will not be accepted. The diaphragm seal shall be all 316 stainless steel including diaphragm and have a ½” NPT male 316ss lower connection. The assembly shall be factory assembled and calibrated.
3. The gauge assembly shall be connected to each discharge line by means of dedicated welded and threaded boss, or by means of pipe saddle with ½” outlet. Drilling and tapping discharge piping; utilizing only the pipe wall thickness for threading, will not be acceptable.
4. The gauge & seal assembly shall be XR-81 by Ametek, PTR50 by Winters, or approved equal.

## 2.3 MATERIALS

Except as otherwise specified, material shall conform to the following section.

### A. Materials

Cement	ASTM C 150 (Type I, II, III, or V) ASTM C 595 (for Blended Cements)
Silica Fume	ASTM C 1240
Fly Ash and Pozzolans	ASTM C 618
Ground Granulated Blast-Furnace Slag	ASTM C 989
Water	ASTM C 1602 (the use of reclaimed/recycled water shall be permitted)
Aggregates	ASTM C 33 (and aggregate specifications)
Air Entraining Admixtures	ASTM C 260
Accelerating, Retarding, Water Reducing Admixtures	ASTM C 494
Corrosion Inhibitors	ASTM C 1582
Reinforcing Bars	ASTM A 615 or ASTM A 706
Plain, Welded Wire Reinforcement	ASTM A 185
Deformed, Welded Wire Reinforcement	ASTM A 497

Epoxy Coated Reinforcing Bars	ASTM A 775
Epoxy Coated Welded Wire Reinforcement	ASTM A 884
Hot-Dipped Galvanizing for Inserts	ASTM A 152
Rubber Gaskets for Circular Pipe	ASTM C 443
External Sealing Bands for Pipe	ASTM C 877
Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections	ASTM C 990
Elastomeric Joint Sealants	ASTM C 920
Pipe Entry Connectors	ASTM C 923, ASTM C 1478
Nonshrink Grout	ASTM C 1107

## 2.4 MANUFACTURE

Manufacture shall conform to the producer's acceptable quality control manual

### A. Forms

1. Forms for manufacturing precast concrete units shall be of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Forms shall be constructed so that the forces and vibrations to which the forms will be subjected cause no damage to the precast concrete unit.
2. Forms shall be cleaned of concrete build-up after each use.
3. Form release agents shall be applied according to the manufacturer's recommendations and shall not be allowed to build up on the form casting surface.

### B. Reinforcement

1. Cages of reinforcement shall be fabricated by tying the bars, wires or welded wire reinforcement. The tolerances for concrete cover shall be 3/8 in. or as specified in the design. Welding shall be allowed only for ASTM A 706 rebar.
2. Positive means shall be taken to assure that the reinforcement does not move significantly during the casting operations

### C. Embedded Items

1. Embedded items shall be positioned at locations specified in the design documents. Inserts and other embeds shall be held rigidly in place so that they do not move significantly during casting operations.

### D. Concrete

1. Concrete Mixing
  - i. Mixing operations shall produce batch-to-batch uniformity of strength, consistency and appearance
  - ii. Batching weight and volume measurement devices shall be annually calibrated



by an independent testing laboratory or more frequently if batching irregularities or concrete inconsistencies are observed

2. Concrete placing

i. Concrete shall be placed in a manner in which it flows and consolidates without segregation or air entrapment. The freefall of concrete shall be kept to a minimum.

ii. Cold Weather Concreting

1. Recommendations for cold weather concreting are given in detail in ACI 306 R. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing temperatures. All concrete materials, reinforcement, and forms shall be free from frost. In cold weather, the temperature of the concrete at the time of placement shall not be below 45 degrees F. Concrete that freezes before it reaches a compressive strength of 500 psi shall be discarded.

iii. Hot Weather Concreting

1. Recommendations for hot weather concreting are given in detail in ACI 305 R. During hot weather excessive concrete temperatures and water evaporation shall be minimized. The temperature of concrete at the time of placing shall not exceed 95 degrees F.

3. Concrete Curing

i. Curing operations shall commence immediately following the initial set of the concrete and completion of surface finishing.

ii. Curing by moisture retention

1. Precast products shall be protected from drafts and wind to prevent plastic shrinkage cracking.
2. Moisture shall be prevented from excessively evaporating from exposed surfaces until adequate strength for stripping the precast concrete unit from the form is reached.

iii. Curing with Heat and Moisture

1. Concrete shall not be subjected to steam or hot air until after the concrete has attained its initial set. If hot air is used, precautions shall be taken to prevent moisture loss from the concrete. The temperature of the concrete shall not be permitted to exceed 150 degrees F. The temperature gain shall not exceed 40 degrees F per hour.

4. Surface Finish

i. The surface finish shall be as specified on the contract documents and/or approved shop drawings.

5. Stripping Precast Concrete Units from Forms

Precast concrete units shall not be removed from the forms until the concrete reaches the compressive strength for stripping required by design. Stripping strengths shall be routinely measured to ensure product has attained sufficient strength for safe handling.

6. Patching and Repair

i. Repairing Minor Defects

1. Defects that will not impair the functional use or expected life of the

precast concrete unit may be repaired by any method that does not impair the product

ii. Repairing Honeycombed Areas

1. When honeycombed areas are to be repaired, all loose material shall be removed and the areas cut back into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Proprietary repair materials shall be used in accordance with the manufacturer's instructions. Otherwise, the area shall be saturated with water. Immediately prior to repair, the area should be damp, but free of excess water. A cement-sand grout or an approved bonding agent shall be applied to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

iii. Repairing Major Defects

1. Defects in precast concrete products which impair the functional use or the expected life of products shall be evaluated by qualified personnel to determine if repairs are feasible and, if so, to establish the repair procedure.

7. Shipping Precast Concrete Units

- i. Precast concrete units shall not be shipped until they have reached at least 70% of their specified 28-day design strength, unless damage will not result, impairing the performance of the product.

## 2.5 WARRANTY

- A. The manufacturer of the lift station shall guarantee for one (1) year from the date of installation, or 15-months from the date of factory completion (whichever occurs first), that the structure and all equipment will be free from defects in design, material and workmanship.
- B. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall be solely responsible for the warranty of the station and all components.
- C. In the event a component fails to perform as specified or is proved defective in service during the warranty period, the manufacturer shall provide a replacement part without cost to the Owner. The Contractor shall further provide, without cost to the Owner such labor as may be required to replace, repair or modify major components such as the station structure, pumps, pump motors sewage piping manifold, etc.

## PART 3 EXECUTION

### 3.1 SURVEY

- D. The installation area shall be surveyed using the work print and a checklist to identify the work to be done and to determine that the plans are correct
- E. All underground facilities and structures such as gas, water, sewer, power, telephone cable, and so forth shall be located and identified. Location markings shall be placed by the affected utilities before construction
- F. The survey shall identify and obstacles such as overhead wires, building structures that will interfere with crane operations, work progress, or create a safety hazard.

- G. The survey shall give consideration to the soil structure so that proper shoring, sloping, or both may be planned in advance of the excavation work

### 3.2 PLANNING

- A. Permits required to do work in accordance with the detail plans shall be secured before starting the job. All permits or a record of the permits shall be retained on the job for immediate reference
- B. All utilities and owners of surface and subsurface facilities and structures in the area shall be given advance notification of proposed excavation. Every effort shall be made to avoid damage to the facilities of others. If any damage occurs, the owner of the damaged facility shall be notified immediately.
- C. Planning shall include the coordination of all responsible parties to ensure that arrangements for removal of excess and damaged material have been made.
- D. Should it appear that a structure location will interfere with traffic, review the situation with the engineer and notify appropriate authorities.
- E. Provide for access to call boxes, fire hydrants, etc.

### 3.3 SAFETY REQUIREMENTS

- A. Safety requirements for construction shall be in accordance with all federal, state, and local regulations.

### 3.4 EXCAVATING

- A. If unforeseen facilities or obstructions are encountered, stop excavation operations immediately. Expose the obstruction with wood handled digging tools and investigate them with caution. If there is any doubt as to the type of obstruction exposed, request positive identification from those suspected of owning the facility and then proceed as circumstances dictate.
- B. Inspect excavations after every rainstorm or other hazard-increasing occurrence, and increase the protection against slides and cave-ins, if necessary
- C. In dewatering excavations, make certain that the discharge is carried to a suitable runoff point. Also verify that the design accounts for the level of groundwater encountered.
- D. Excavation size shall be large enough to allow access around the structure after it is installed.
- E. All excavating shall be under the full guidelines for on-site OSHA regulations, and shall be under the supervision of an OSHA-certified safety coordinator.

### 3.5 SHORING

- A. Shoring for construction shall be in accordance with all federal, state, and local regulations

### 3.6 INSTALLATION

- A. General

Installation of the pump chamber sections and related equipment shall be done in accordance with written instructions supplied by the manufacturer. Installation oversight service (1-day) can be provided by the pump station manufacture (as may be required by the owner), when specifically stated as necessary site service. Additional days for factory technicians shall be paid for at the standard daily rate.

B. Assembly

1. The pump station shall be factory assembled and shipped to the job site as follows:
  - i. Wet well precast base assembly with interior fillet and extended base. Pump base elbow & slide couplings will be factory mounted.
  - ii. Precast concrete riser shims as required, shall include holes and factory installed rubber boots as required.
  - iii. Integral valve pit assembly shall include factory installed: piping, valves, supports, gauges, bypass, ladder, hatch drain to pump station – as required. Valve pit assembly may incorporate riser sections of 2' & 4' as may be required.
  - iv. Precast pump station top slab shall include aluminum access covers (300# or HS20 loading as required).
  - v. Miscellaneous items provided and field installed shall include: pumps, control panel, floats, vertical discharge piping, dresser couplings, and pump guide rails.

C. Site Access

The general contractor shall be responsible for providing adequate access to the site to facilitate hauling, storage, and proper handling of the precast concrete units.

D. Subgrade Bedding Materials and compaction

The installation contractor shall be responsible for ensuring that the subgrade is compacted to 95% of ASTM D558 density. The subgrade shall be a minimum of 6" in depth. A granular material shall be used to create a level surface for placing the precast concrete unit.

E. Installation

Precast concrete units shall be installed: to the lines and grades shown on the contract documents or otherwise specified; be lifted by suitable lifting devices at points provided by the precast concrete producer; in accordance with applicable industry standards. Upon request, the precast concrete producer shall provide installation instructions

Field modifications to the product shall relieve the precast producer of liability and warranty regardless if such modifications result in the failure of the precast concrete unit.

F. Leak Resistance

Where leak resistance is a necessary performance characteristic of the precast concrete unit's end use, joint sealant, pipe-entry connectors and other penetrations shall be sealed according to manufacturers requirements to ensure the integrity of the system.

### 3.7 BACKFILLING AND RESTORATION

- A. Do the backfilling as soon as possible after the structure has been placed.
- B. Backfill material shall be granular and free from large stones, rocks, and pavement. Expansive soil material shall not be used as backfill around the structure.

- C. Backfilling shall be achieved by lifts (layers) to the required compaction.
- D. Follow up inspections for settlements are required. Should settlement occur, the contractor shall be responsible for all necessary repairs.

### 3.8 FIELD QUALITY CONTROL

#### A. Inspection

- 1. Final field elevations and compaction properties shall be verified and documented.

### 3.9 SPARE PARTS

- A. Spare parts shall be provided in accordance with manufacturer's standard package, and shall be optional for the pump station.

### 3.10 O&M MANUALS

- A. Four (4) sets of Operation and Maintenance Manuals shall be furnished for the pump station. The manuals shall contain instructions that are comprehensive, and sufficiently detailed for the intended use.
- B. The Operation and Maintenance Manuals shall be assembled in a permanent binder, complete with index and cover clearly identifying the pump station name. The manuals shall be compiled in a logical and organized manner.
- C. The Manuals shall contain specific pump station instructions which will enable personnel to operate and maintain the pump station and all equipment associated with each individual system installed within the station.
- D. Manuals that are a compilation of generalized manufacturer's literature that are not solely applicable to the particular pumping station will not be accepted.
- E. The Manuals shall contain, but not be limited to:
- F. Pump service and maintenance instructions, as detailed in the pump specification section
- G. Duplex pump control panel programming and maintenance instruction and wiring diagrams, as detailed in the control panel specification section
- H. All pump station equipment service and maintenance instructions for equipment supplied in the package pump station product.
- I. AS-BUILT fabrication and assembly drawings.
- J. Start-up & training reports
- K. Product warranties
- L. Product contact information and project reference information.

END OF SECTION