

## SECTION 13150

### SWIMMING POOL

#### PART 1 – GENERAL

##### 1.1 SECTION INCLUDES

- A. Pool mechanical systems, including piping, circulation pump and filter.
- B. Miscellaneous pool testing, safety, and control equipment as required by the Department of Public Health.
- C. Pool start-up, closing, and instruction of Owners personnel.

##### 1.2 REFERENCES

- A. ASTM D1785 – Specification for Standard specification polyvinyl chloride (PVC) plastic pipe schedules 40, 80, and 120.
- B. ASTM D1784 – Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
- C. ASTM D2564 – Specifications for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
- D. ASTM D2855 – Practice for Making Solvent-Cemented Joints with PVC Pipe and Fittings.
- E. NSF – Seal for Potable Water.

##### 1.3 DEFINITIONS

- A. The term “pool” as used in this Section shall refer to the lap pool and activity pool.
- B. The term “Architect / Engineer” as used in this Section shall refer to the pool filtration system design only.

##### 1.4 SYSTEM DESCRIPTION

- A. Provide all labor and materials necessary for renovation of the existing pool filtration systems. The above will be complete will all equipment as indicated on the construction documents. Construction shall be in accordance with State and Local Codes.

##### 1.5 SUBMITTALS

- A. Product Data: Provide Manufacturer's/Installer's written installation instructions.

- B. The Contractor shall submit for approval to the Architect/Engineer complete lists, including descriptions catalog cuts, etc., and where applicable dimensioned shop drawings of all material, fixtures and equipment to be furnished and installed under this specification. Submittal shall adequately and completely describe the equipment, including where necessary or requested complete construction and installation dimensions, complete capacity and performance data, all accessory and auxiliary equipment, and all pertinent details of manufacture. Shop drawings for equipment shall be submitted and approval of shop drawings shall be obtained before proceeding with fabrication. Shop drawings shall not be "doctored" reproduces of Architects/Engineers drawings.
- C. Shop Drawings:
1. Submit shop drawings as required by Parts 2 and 3 of this Section.
  2. The drawings accompanying this specification are essentially diagrammatic in nature and show the general arrangement of all equipment and piping. Because of the small scale of the drawings, it is not possible to show all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions of all his work and shall arrange such work accordingly, furnish all fittings, pipe and accessories that may be required to meet such conditions. Where conditions necessitate a rearrangement, the Contractor shall obtain the Architect/Engineer's approval. Locate all valves for maximum operation accessibility.
- D. Operation and Maintenance Manuals: Submit 4 copies of the operation and maintenance manuals for the filter, pump and heat exchanger.
- E. Required Submittals:
1. Pump, Strainer
  2. Variable Frequency Drive
  3. Gauges, Flow Sensors
  4. Piping Materials, Valves
  5. Shop Drawings:
    - a. Filter
  6. Test Results:
    - a. Piping Pressure Testing
  7. Guarantees Warrantees:
    - a. Standard (1) Year
    - b. Filter Tank (15)
  8. Close Out Documents:

- a. O&M Manuals
- b. As Built Drawings
- c. Owners Certification Of Instruction

#### 1.6 QUALITY ASSURANCE

- A. Qualifications of Pool Contractor: Work of this Section shall be performed by a contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. References will be required by the Owner.
- B. Performance Criteria: Certain sections of the Specifications contain performance criteria rather than product descriptions. It shall be the obligation of the contractor to insure that all criteria are satisfied and the burden or proof of conformance shall rest with the contractor. The Architect / Engineer shall require past performance records and, if required, inspection trips of similar facilities to substantiate conformance with these criteria. The Architect / Engineer shall be sole judge of conformance. The Pool Contractor is cautioned that he will be required to provide a finished product meeting all stated criteria and meeting or exceeding Department of Health requirements.

#### 1.7 REGULATORY REQUIREMENTS

- A. All applicable local building and health codes.
- B. National Electrical Code (NEC)
- C. National Sanitation Foundation (NSF): Seal of approval program.
- D. Illinois Department of Public Health Swimming Pool and Bathing Beach Code

#### 1.8 REQUIRED PERMITS

- A. Illinois Department of Public Health by Architect / Engineer.
- B. Local Building Department: Pool Contractor.

#### 1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials and equipment to the Work Site in original packages fully identified, with manufacturer's label.
- B. Protect plastic pipe from exposure to chemicals (aromatic hydrocarbons, halogenated hydrocarbons and other esters and ketones) that might attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.

#### 1.10 WARRANTY

- A. Warranty: Provide one (1) year warranty covering all pool workmanship, material and equipment.
- B. All standard manufacturer's warranties shall apply to all equipment and products

provided by this Contractor.

Filter Tank shall have a fifteen (15) year warranty.

## PART 2 - PRODUCTS

### 2.1 FILTRATION SYSTEM

#### A. General:

1. Purpose of the bid is to purchase and have installed a complete filtration and recirculation system for each pool. It is intended to limit the bidding to a style of product and company that has a proven history and record of performance.
2. Due to the specialized nature of certain components required for this project, these specifications, in some instances refer to various components by trade or manufacturers name.
3. Whenever a proprietary (trade) name is used within this Specification Section, it is used for informational purposes to describe a standard of required function, dimension, appearance and quality. References to materials by trade name, make or model number shall not be construed as limiting competition.

#### B. Quality Assurance:

1. Due to the specialized nature of the specified work and products, all bidders shall be required to have a minimum of five (5) years of operating history. The equipment described herein shall be products of a manufacturer regularly engaged in the fabrication of filtration and circulating systems for at least fifteen (15) years and shall be a professional engineering corporation.
2. The owner requires that filters bear the National Sanitation Foundation (NSF) seal for Standard #50. This NSF listing is required by the owner regardless of local health department regulations.
3. The specified filter system shall have had an NSF listing for at least two (2) years prior to the project bid date.
4. As assurance that each item of apparatus is properly sized to perform in conjunction with each other, the owner requires bidders to use the filter manufacturer as a single source of supply for the items of equipment as listed and described herewith.
5. The "EQUIPMENT SUPPLIER" shall be:
  - a. Neptune-Benson, Inc.; Coventry, Rhode Island; 1-800-832-8002

#### C. Guarantee:

1. The "EQUIPMENT SUPPLIER" shall guarantee that the equipment to be furnished is of the correct capacity, that the various parts are designed to operate correctly and in conjunction with each other, that if the installation is made in accordance with the project drawings and operated in accordance with the suppliers instructions, the system will perform the prescribed functions correctly, the water entering the pool will be clear, bright, free from suspended matter visible to the unaided eye, and will be sanitary to the satisfaction of all authorities having jurisdiction.

#### D. Filter Requirements

1. Each filter system under this section shall consist of a Defender regenerative media filter as detailed on the drawings or equal.
2. It is the intent of these specifications to describe a filter system complete with all accessory items supplied and warranted by one manufacturer.
3. The primary components of the system consist of the main filter tank, flexible tube filter elements, element assembly, bump mechanism, vacuum transfer system, sight glass, pressure gauge panel, inspection (viewing) window, valves and automatic regeneration controller.
4. All components and related subassemblies shall be factory assembled and tested prior to shipment.

#### E. Filter System Capacity:

1. Each system shall consist of the regenerative media filter tank(s) with a total effective filter surface area as shown on the drawings and operate at a rate not exceeding 1.5 gallons per minute per square foot of filter area.

#### F. Filter Tank:

1. The filter tank shall not be less than the diameter noted on the drawings with a 60 inch side shell, suitable for 50 psi working pressure and hydrostatically tested to 75 psi. Tank shell shall be not less than 1/4 inch thick. Bottom dished head shall be not less than 1/4 inch thick. Top flat head shall be not less than 1 1/2 inch thick. All material to be Type A-36 carbon steel. Type 304L stainless steel with no interior or exterior coatings is acceptable.
2. All welding shall be performed by qualified operators. Joints shall be butt or fillet welded inside and out by manual or automatic process. Welded joints shall have complete penetration and fusion with little or no reduction of the thickness of the base metal. Welds shall be free of coarse ripples, grooves, overlaps, abrupt ridges or valleys. All welded surfaces shall be chipped and brushed clean, when necessary, leaving no slag or splatter.
3. Tank legs shall be constructed of 6" x 2 1/2" channel legs 1/4" thick. 24", 27" and 33" filters shall have (3) legs. 41", 49" and 55" filters shall have (4) legs. The material shall be Type A-36 carbon steel. Bearing plates shall be 10" x 5" x 1/4" type 304L stainless steel. Each bearing plate shall have (2) 5/8" drilled holes to secure to the

floor with the ½" x 4 ½" stainless steel concrete anchors provided. The legs shall be designed with bolted connections to minimize overall tank heights for shipping and access into the mechanical room.

4. The tank head shall be bolted to the shell with 7/8 inch diameter T304 stainless steel studs and nuts, 9" on center around the tank perimeter.
5. Tank shall be equipped with a UL listed grounding lug.
6. Tank shall incorporate connections for filter influent, effluent and drain sizes as showing on drawings; 1 1/2" vacuum transfer piping, 4" viewing window, and lift shaft gland.
7. Tank shall include brackets for mounting of automatic controller, gauge panel, filter / regulator, vacuum transfer blower and vacuum hose rack.
8. Tank shall include integrally mounted hydraulic lifting device (David). The Davit Assembly shall be designed to lift the filter head and include a pivot mechanism allowing the head to rotate 180° for access to tube sheet (model SP-24-42-327 excludes David requirement.)

G. Flexsol 3000 interior Lining:

1. All interior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue and primed as soon as is practical on the same day blasting is done.
2. When priming has dried the lining process will begin. If prime has sat for over twenty-four hours, a refresher coat will be applied.
3. Flexsol 3000® shall be a elastomeric polyurethane, 100 percent solid plural component lining. Hardness shall be 70 durometer on the shore D scale. Break tensile strength shall be 24600 psi with elongation of 25-30 percent.
4. Application of Flexsol 3000® lining shall be done by experienced applicators using a high pressure, high temperature plural component system. All wetted surfaces including flange faces, manway rings and manway covers shall be lined to 120 mils +/- 5 mils DFT.
5. Hardness shall be verified after curing to ASTM D 2240 standard.
6. Flexsol 3000® lining shall meet the NSF toxicity standard unconditionally and shall be approved for use with the NSF approved filter.
7. Flexsol 3000® lined vessels shall carry a ten (10) year limited non-prorated warranty.
8. The filter manufacturer shall bear the responsibility for suitability of lining and shall be the sole source for the specified warranty.

H. Exterior Coatings:

1. All exterior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue and primed as soon as practical on the same day blasting is done.
2. When priming has dried the coating process will begin. If prime has sat for over twenty-four hours, a refresher coat will be applied.
3. Two coats of high solids enamel shall be applied for a total developed film thickness of 5-8 mils.
4. Manufacturer is to supply min. 16 oz. of high solids enamel touch-up paint.

I. Internal Components:

1. Internally, the filter shall consist of flexible tube elements, filter assembly plate, stainless steel lift shaft and internal flow diversion assembly.
2. The filter elements shall be flexible tubes that provide the support structure for the media. The outer wall of each element shall be fabricated of multi-filament high strength polyester braid. Each element shall have an internal stainless steel spring, which acts a support structure for the braided filament.
3. The filter element assembly plate shall be fabricated of T304 stainless steel and provide both support for the top of the element cluster as well as water tight seal to prevent media from escaping the filter tank.
4. The lift shaft shall be fabricated from T304 stainless steel and provide the internal connection between the filter element assembly plate and the external bump mechanism.
5. The filter influent connection shall be fitted with a T316 stainless steel flow diversion assembly to eliminate disturbance to the filter elements during operation.
6. All stainless steel wetted internals shall be Type 304.

J. Bump Mechanism:

1. The bump mechanism shall include a pneumatically operated tire mounted externally on the filter tank head. The tire is alternately pressurized then depressurized causing the connected filter element assembly to move in an upward then downward fashion. This movement shall provide the means of dislodging the media and accumulated solids, which then recoat the filter element.

K. Vacuum Transfer System:

1. The vacuum transfer system shall be provided to allow the recharging of media into the filter for either bag or bulk media.
2. The vacuum blower shall include a 1.5 h.p. (for SP-27-SP-55) or .5 h.p. (for SP-24) TEFC 115/230v single phase motor 50/60 Hz.

3. An in-line filter with dual connections shall be provided to prevent dust and media from being drawn into the blower.
4. Provide three (3) 1 1/2" SCH 80 PVC ball valves: For the vacuum drain line, the blower inlet and the vacuum hose.
5. Provide 10 feet of 1 1/2" vacuum hose with fittings.

L. Automatic Controller (Alternate Only):

1. The automatic controller shall provide total control of the system's filtration and regeneration cycles, and provide all necessary equipment interlocks and timing mechanisms to execute the filter program.
2. The controller shall include an adjustable pressure switch, factory set to 50 psi. The switch shall stop the recirculating pump and close the pneumatic valves if air pressure falls to 50 psi.
3. The controller shall contain a microprocessor that will activate the following functions of the system:
  - a. Bump cycle/manual or automatic.
  - b. Precoat of filter elements.
  - c. Stopping and starting of the main recirculating pump.
  - d. Opening and closing of pneumatically operated valving.
  - e. Vacuum transfer system.
  - f. Heater cool down delay.
  - g. Auxiliary contacts to interlock chemical control or other equipment.
  - h. Keyed switch to activate a continuous, intermittent bump cycle for flex tube cleaning.
4. The controller panel shall display the following function:
  - a. Filter status.
  - b. Precoat status.
  - c. Recirculating pump status.
  - d. Vacuum transfer pump status.
  - e. System power.
5. The controller enclosure shall be NEMA 12.
6. The RMF automatic controller will provide signal power to the main recirculating pump motor starter. The unit is required to be a device or variable frequency drive (VFD) and is to be installed with control wiring by the electrical contractor.
7. The RMF shall be 120v, 1-phase, 30 amp rated and shall be UL labeled

M. Flow meter:

1. A digital flow meter shall be included with a 4-20mA 0-10 VDC analog output.
2. The flow meter shall be wired into the VFD to provide automatic speed control of the filter pump motor.
3. The VFD shall compensate for varying filter head losses by maintaining the specified flow rate with the 4-20mA output signal of the flow meter.

N. Filter/Regulator:

1. Each filter shall include a combination filter / regulator. The regulator shall be adjustable from 0 – 120 psi. 1/2 inch F.P.T. connections shall be provided for field installation of air lines.

O. Water Separator:

1. One water separator with automatic drain shall be included for each air compressor supplied. 1/2 inch F.P.T. connections shall be provided for field installation of air lines.

P. Air compressor:

1. The system will require (1) air compressor per mechanical room that shall include:
  - a. 30 gallon tank
  - b. 2 HP, electric motor 120v, 1 phase, 15 amp.
  - c. Air pressure gauge.
  - d. Pressure relief valve.
  - e. Belt guard.
  - f. Pressure switch.
  - g. Air filter.
  - h. 5.5 CFM @ 90 psi.

Q. Pneumatic Actuators:

1. Each filter shall include pneumatic actuators for (1) check valve, (1) effluent valve and (1) precoat valve.
2. The actuators shall be double acting with valve mounted drilling to ISO 5211.
3. The actuators shall include (2) 1/4 inch FPT ports for open / close connections. Flow control valves with quick connect fittings shall be provided at each port to allow speed control adjustment for the open / close function of the actuators.
4. Materials of Construction
  - a. Body: aluminum alloy, extruded acc. To ASTM 6063, anodized acc. To UNI 4522.
  - b. Ends: Die-cast in aluminum alloy acc. To ASTM B179, epoxy-polyester coated.
  - c. Pistons: Die-cast in aluminum alloy acc. To ASTM B179.

- d. Pinion: Nickel-plated steel.
- e. Slideways: Acetal resin (LAT LUB 731320T).
- f. Fasteners: AISI 304 Stainless steel.
- g. Springs: Epoxy coated steel, pre-compressed.
- h. Seals: NBR Nitrile rubber.
- i. Lubricant: MoS2.

R. Solenoid Valve:

1. Each filter shall include pneumatic actuators for (1) check valve, (1) effluent valve and (1) precoat valve.
2. The solenoid valves shall include lighted DIN connectors.
3. The solenoid valves shall be factory lubricated and shall not require any field lubrication.
4. The solenoid valves with multi-station manifold shall be located on the bottom of the automatic controller, factory wired and include quick connect fittings for attachment to the pneumatic actuators and bump mechanism.
5. The solenoid valves shall be SMC Series SY 7000.

S. Valves:

1. All Valves 3 inches – 12 inches shall be constructed with cast aluminum ASTM SI2A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel shaft. Valves 14 inches and larger shall be constructed with cast iron housing fully coated with nylon and nylon coated ductile iron disc. Valves shall be butterfly valves and shall be provided for the influent, effluent and precoat lines.

T. Media:

1. Media shall be expanded perlite with a median particle size of 37 microns. Percentage retained on a +150 Tyler Mesh shall not be less than 8% or more than 25%. Darcy permeability shall be between 1.2-1.85.
2. The media shall contain no more than 1 tenth of one percent (.001) or crystalline silicate.
3. The media shall be certified by the manufacturer for use in the Defender Filter. The media shall be NSF listed in Std. 61 and Std. 50.
4. The media shall be Celaperl 1400P as supplied by EP Minerals.

U. Warranty:

1. Defender filter tanks with Flexsol 3000 shall carry a 10 year fully rated warranty as regularly offered by the tank manufacturer.

2. Bump tire and internal tube elements shall carry a fully rated 3 year warranty.
3. Valve bodies shall carry a 5 year fully rated warranty.
4. Valve operators and system accessories including the RMF controller, quick exhaust valve and solenoid valve shall carry one year warranty as provided by the product manufacturer.
5. Unless otherwise specified, workmanship is to be guaranteed first class and carry a one (1) year warranty.

## 2.2 WATER TREATMENT SYSTEM

- A. Re-install existing chemical system as shown and scheduled on Contract documents. All in accordance with manufacturer's recommendations.
- B. Furnish Owner with written water treatment program complete with written basic water chemical analysis and verbal instructions as to operate of system.

## 2.3 PUMPS [FLOODED SUCTION]

- A. Furnish and install circulation pumps as manufactured by Marlow, Sulzer/Paco, Aurora or approved equal. See contract documents for horsepower, voltage, phase, flow rate, NPSH-A, pump and motor efficiency, VFD, flow meter and pipe size information.
- B. Furnish and install pressure and vacuum gauges where called for on Drawings and as required by Code. Pressure and vacuum gauges shall be Trerice #700 Liquid Filled, 0-60 PSI, vacuum 30 Hg – 30 PSI, all gauges with gauge cocks.
- C. To insure cavitations-free operation, each pump's NPSH requirements must be low enough to permit stable, continuous operation at 120 percent or greater of best efficiency point.
- D. Pump casing shall be close grain cast iron fitted with a replacement bronze case wear ring. Minimum 1/4 inch NPT suction and discharge gauge taps. Pumps with a specific speed greater than 1600 shall have double volute casings with suction splitter to reduce radial loading and shaft deflection.
- E. Pump impeller shall be of the enclosed type of cast bronze, lead free, zinc free, aluminum bronze and shall be statically and dynamically balanced. Impeller diameter shall be trimmed for the specified design conditions.
- F. Pumps mounted vertically to have recirculation line pipe from seal cavity to suction of the pump.
- G. Pumps to be mounted on a cast iron fabricated steel base, epoxy coated, and stainless steel hardware.
- H. Pump shall be fitted with a leakless mechanical seal. John Crane type 1 BUNA elastomers ceramic stationary seat carbon rotating stainless steel metal parts.

- I. Shaft to have a replaceable lead free, zinc free, bronze shaft sleeve.
- J. Pump to have an epoxy coating on all interior cast iron parts. All pump fasteners to be 300 series stainless steel and should have a never seize application to threads prior to assembly , or approved equal.
- K. Pump motor to 3-phase, 60 cycle, Totally Enclosed Fan Cooled, with horse power and voltage as shown on drawings, 1.15 service factor, inverter duty, NEMA (MG-1) section IV, Part 30.2.2.8, 200v or 208v motor must be single voltage, tri-voltage motor not acceptable on 200v or 208v service.
- L. All pumping components capable of pumping heavy chlorinated pool water.

## 2.4 STRAINERS

- A. Furnish and install hair and lint strainers where call for on drawings. Strainers to be of PVC or stainless steel construction with a clear acrylic lid as manufactured by Neptune Benson or Paddock Pool Equipment Co., Inc. Strainers shall be of the reducing type.
- B. Strainer baskets shall be stainless steel construction with 5/32 inch perforations. Provide each strainer with two strainer baskets.

## 2.5 VARIABLE FREQUENCY DRIVES

- A. The Variable Frequency Drives (VFD's) shall employ a Pulse Width Modulated (PWM) output waveform. Drive efficiency shall be 97% or better at full speed/load. The same manufacturer shall supply the Variable Frequency Drives for both Feature and Filter pumps. The Pump Supplier shall be responsible for providing as a system, the pumps, VFD's, flow meter and the set-point controller.
- B. The VFD shall be manufactured by Benshaw SG series, ABB, Model ACH 550, Square D Altivar Model 61 or approved equal. All items in this specification must be adhered to strictly. Any deviation must be submitted and approved in writing ten working days prior to bid date.
  - 1. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
  - 2. The drive manufacturer shall supply the drive and all necessary options as herein specified. VFD's that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.
  - 3. VFD's with Filter Packages will include: Non-fused main disconnect, chemical pump, Heater, inter lock relay, Backwash Timer, Filter Alarm light on door Auto/Off Backwash Selector Switch, and 115V Control Transformer.
  - 4. Drives to operate automatically with a 4 to 20 ma PID loop with the flow meter and show actual flow rate in GPM on the keypad.

5. With a certified start up you will receive a 2-year warranty on all parts and labor.

C. Reference Standards:

1. Standar 519-1992, IEEE Guide for harmonic content and control
2. UL508C
3. ICS 7.0, AC Adjustable Speed Drives
4. IEC 16800 Parts 1,2 and 3
5. NEC 430.120, Adjustable-Speed Drive Systems
6. IBC 2006 Seismic-referencing ACS 7-05 and ICC AC-156

D. Qualifications:

1. VFDs and options shall be UL listed as assembly. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.
2. CE Mark – The VFD shall meet product standard EN 61800-3 for the First Environment restricted level. (RFI / EMI Filter spec).
3. The entire VFD enclosure, including the bypass shall be seismically certified and labeled in accordance with the IBC 2006 International Building Code:
  - a. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
  - b. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
  - c. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion by a certified lab.

E. Submittals shall include the following information:

1. Outline dimensions, conduit entry locations and weight.
2. Customer connection and power wiring diagrams.
3. Complete technical product description including a complete list of options.
4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
  - a. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5% impedance reactors, no exceptions.

- F. The VFD Package as specified herein shall be enclosed in a UL Listed Type enclosure, (enclosures with only NEMA ratings are not acceptable.)
1. Environmental operating conditions: 0 to 40<sup>0</sup> C (32 to 104<sup>0</sup> F) continuous. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
  2. Enclosure shall be UL rated and shall be UL listed as a plenum rated VFD.
- G. All VFDs shall have the following standard features:
1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
  2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
  3. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients.
  4. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120.
  5. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus.
- H. Serial Communications
1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet).
  - I. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the entire VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted. No Exceptions.
  - J. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

## 2.6 POOL VALVES AND PIPING MATERIALS

A. Products:

1. Provide valves of same manufacturer throughout where possible and practical.
2. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

B. Valve Connections: Provide valves suitable to connect to adjoining piping as specified for pipe joint. Use pipe size valves.

C. Use of Valves:

1. Pipe sizes 3" – 12", Butterfly.
2. Miscellaneous valves ½" – 2", PVC True Union Ball Valves.
3. All chemical lines and equipment – PVC True Union Ball Valves.

D. Butterfly Valves:

1. Butterfly valves 3" – 12" shall be wafer or lug bodies and shall be suitable for use between ANSI 125 or 150 lb. Flanges.
2. Bodies of the flangeless design shall be provided with at least four (2) bolt guides to center the valve in the pipeline.
3. All butterfly valves shall have a cast iron body epoxy coated, ductile iron nylon 11 coated discs, stainless shaft with Buna-N or EPDM seat minimum 150 PSI rating.
4. All butterfly valves 4" – 6" shall have 10 position locking handle, butterfly valves 8" – 12" shall have gear operators and chain operators as required.
5. All valves shall be as manufactured by Bray Valve (713) 894 5454 or equal as approved by the Architect / Engineer.

E. Ball Valves:

4. PVC True Union Ball Valves, Dual Union, Eslon, Assahi, or equal.

F. Check Valves – (where required): Shall be cast iron body, stainless steel spring trim, bronze split disc, seal material Buna-N. (CHEXX) Model as manufactured by Metraflex, Chicago, Illinois, or Mueller Steam Specialties as indicated on Contract documents.

F. Modulating Float Valves: Shall be used in the surge tank as specified on Contract documents. The valves shall be constructed with stainless steel rods and PVC floats allowing 20% maximum flow when fully closed. As manufactured by Neptune Benson or equal as approved by the Architect / Engineer.

## PART 3 – EXECUTION

### 3.1 PIPING AND PIPE FITTINGS – HANGERS AND SUPPORTS

- A. Work Included: Pipe, fittings, connections, wall penetrations, hangers and supports, equipment bases and supports.
- B. Use the prescribed pipe type in the following areas. All plastic pipe flanges shall be scheduled 80 PVC with neoprene gaskets where required.
  - 1. All piping shall be schedule 80 or pressure rated PVC solvent weld.
  - 2. All chemical piping, schedule 80 PVC, solvent weld.
  - 3. Heater connections shall be Type “L” copper piping on the heater influent and effluent lines from the bypass to the heater, with cast brass or wrought copper fitting and 95/5 soldered joints.
- C. Hangers and Supports: Submit hanger locations and weights, hanger details on Shop Drawings.
  - 1. All mechanical room piping must be properly supported.
  - 2. It shall be the Contractor's responsibility to properly support piping at all valves, pumps, equipment, overhead areas, etc.
  - 3. Use of the proper hanger for the conditions is essential. All piping must be supported laterally as well as vertically hung.
  - 4. All piping 8” or larger must be properly supported from the floor only.
  - 5. All piping connections and support hardware shall be stainless steel inside balance tanks.
- D. Piping:
  - 1. Cut all pipe with mechanical cutter without damage to pipe.
  - 2. Placing and laying: Inspect pipe for defects before installation. Clean the interior of pipe thoroughly of foreign matter and keep clean during laying operation.
  - 3. Threaded joints: After cutting and before threading, the pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite or inert filler and oil or with an approved graphite compound applied to make threads only. Threads shall be full-cut and not more than 3 threads on the pipe remained exposed. Use Teflon II tape on the make threads of all threaded pipe joints. Caulking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection of exposed piping. Unions will be permitted where access is provided
  - 4. Solvent welded joints shall be made in accordance with the manufacturer's printed instructions and the following minimum standards:

- a. All fittings shall fit easily on the pipe before applying cement. The outer surface area of pipe and inner wall of fitting shall be dry and clean. Cleaner is to be applied to the outer surface of the pipe and to the inner surface of the fitting. Cement is to be applied to the outer surface of the pipe, or on the male section of fittings only. When the outside surface area of the pipe is satisfactorily covered with cement allow ten (10) seconds open time to lapse before inserting pipe end into fittings. After full insertion of pipe into fitting, turn fitting around the pipe end approximately 1/8 to 1/4 of a turn. Wipe off excess cement at the joint in a neat cove bead. Follow manufacturer's instructions on solvents.
  - b. All joints shall remain completely undisturbed for a minimum of 10 minutes from time of jointing the pipe and fitting. If necessary to apply pressure to a newly made joint, limit to 10% of rated pipe pressure, during the first 24 hours after the joint has been made.
  - c. Full working pressure shall not be applied until the joints have set for a period of 24 hours.
5. Make provisions for expansion and contraction by way of swing joints or snaking.
- E. Protect plastic pipe from exposure to aromatic hydrocarbons, halogenated hydrocarbons, and most of the esters and ketones that attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.
- F. No installation shall be made that will provide a cross connection or interconnection between distribution supply for drinking purposes and the swimming pool that will permit a backflow of water into the potable water supply. Pipe openings shall be closed with caps or plugs during installation. Equipment and pool fittings shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At the completion of work the fittings, materials and equipment shall be thoroughly clean and adjusted for proper operation.
- G. Pipe Identification
1. Provide identification on all piping located in mechanical equipment, chlorine, acid rooms, heater courts, etc.
  2. Identify the pool that the line is serving (with multiple pools only), contents, direction of flow.
  3. Mark at least once on each line and at 20 ft. intervals on long pipe runs. Consult Health Department Code for minimum marking requirements.
  4. Color code per Health Department requirements. If code does not identify color coding requirements consult Architect/Engineer.
  5. Brady, B-946, custom legend, self-sticking markers and arrows or equal.

### 3.2 TESTING/FIELD QUALITY CONTROL

- A. This Section requires the following tests to be performed by the Contractor.

B. Testing and Flushing of Piping:

1. Contractor shall be responsible for discovering leaks and making necessary repairs.
2. After the piece is installed, the joints completed, test all pool piping per the Illinois Plumbing Code, Section 890.1930, Test Methods. Joints shall remain airtight under this pressure for a period of twelve hours. Provide test results to the Architect / Engineer.
3. Leaks shall be repaired and tested repeatedly until leakage or infiltration is approved.

C. Water Treatment:

1. Obtain a chemical analysis of the source/pool make-up water supply and submit to Architect / Engineer. Include the following:
  - a. Total alkalinity / PPM
  - b. Calcium hardness / PPM
  - c. Chlorine / PPM
  - d. PH
  - e. Iron
  - f. Copper
2. Treat and balance pool water prior to turnover of pool to the Owner (using chemicals provided by the Owner).
3. Pool water: balance to establish a total alkalinity level of 60-125 PPM and calcium hardness level of 180-375 PPM (3 times alkalinity level).
4. Stabilize pool water by shocking to 20 PPM of chlorine for initial sanitation.
5. Consult with Architect / Engineer for special waters to establish balanced levels.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

- A. The Pool Sub-contractor shall supply the services of an experienced swimming pool operator instructor for a period of not less than four (4) hours after the pool has been filled and initially placed in operation. During this period the Owner's designated representatives shall be thoroughly instructed in all phases of the pool's operation.
- B. Prior to this instructor leaving the job, he shall obtain written certification from the Owner's designated representative acknowledging that the instruction period has been completed and all necessary operating information provided.
- C. Pool Sub-contractor shall deliver two complete sets of operating and maintenance instructions for the swimming pool equipment to the Architect / Engineer. Including, but not limited to the following:
  1. Bound together in a complete manual.

2. Accurate parts list.
3. Pool start-up instructions.
4. Narrative on the pool operation through all sequences.
5. All valves must be permanently tagged along with valve legend and explanation.
6. Trouble shooting information.
7. A schematic piping diagram as installed.
8. All piping in Mechanical Room to be labeled with description of line and arrows indicating direction of flow.

#### 3.4 CLEAN UP AND PROTECTION

- A. After work of this Section has been complete, clean up work areas and remove all equipment excess materials and debris. Protect pool from damage until time of Final Acceptance. Remove and replace finishes that are chipped, cracked, abraded, improperly adhered, or otherwise damaged.

END OF SECTION