SECTION 131213 - EXTERIOR FOUNTAINS

PART 1 - GENERAL

INTERACTIVE FOUNTAIN SYSTEM

1. DESCRIPTION. This work shall consist of furnishing and installing a complete interactive fountain system and foundation in accordance with the Plans and as directed by the Engineer. This includes but is not limited to mechanical vault, water reservoir vault, chemical vaults, fountain hardware, pumps, control panel, plumbing and wiring.

The fountain consists of (12) Pop-jet nozzles with integral RGB LED ring light with the showerhead spray pattern operating at a maximum display height of 6' and (13) Smooth Bore Pop-jet nozzles with integral RGB LED ring light, the Pop-jet nozzles will operate at a maximum display height of 6'.

2. MATERIALS. Interactive Fountain shall be as specified by the fountain designer and shall meet the specifications outlined in the Plans, details and specifications.

3. INSTALLATION. All work shall be free of blemishes or defects which could affect durability, strength, or appearance. The interactive fountain shall be installed true to line and grade as shown on the Plans or as directed by the Engineer.

The interactive fountain shall be installed at the location indicated in the Plans, to the configuration shown in the Plans, and in accordance with the manufacturer's recommendations. All locations shall be field approved by the Engineer prior to installation.

The Contractor shall protect all parts of the interactive fountain and maintain them in an undamaged condition until they are installed and accepted for payment.

4. MANUFACTURER. The interactive fountain equipment shall be as specified and designed by Delta Fountains:

Manufacturer: Delta Fountains
11494 Columbia Park Dr W # 4, Jacksonville, FL 32258
www.deltafountains.com
(904) 886-9030

5. METHOD OF MEASUREMENT. The quantity of Special Provision (Interactive Fountain System) to be measured for payment will be on a lump sum basis in the complete and accepted work, at the location(s) indicated in the Plans.

6. BASIS OF PAYMENT. The accepted quantity of Special Provision (Interactive Fountain System) will be paid for at the Contract lump sum price. Payment will be full compensation for installing a complete interactive fountain system and necessary foundation and anchoring materials and labor in accordance with the Contract Documents, and for
furnishing all labor, materials, equipment, tools, and incidentals necessary to complete the work including but not limited to any materials required for operation.

Payment will be made under:

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
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<tr>
<td>900.645 Special Provision (Interactive Fountain System)</td>
<td>Lump Sum</td>
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1.1 SUMMARY

A. Work of this Section includes all labor, materials, equipment, tools, incidentals, and services necessary to design, engineer, manufacture, supply, and install the Stationary Fountain with related mechanical and electrical systems complete including all components, hardware, and accessories as indicated on the Contract Drawing and specified herein:

1. Discharge and suction piping systems.
2. Electrical conduit and wiring systems.
3. Subterranean Vault
4. Mechanical and electrical equipment with components and accessories.
5. Manufacture of primary fountain equipment and components is a “Basis of Design”.
6. Include fountain system testing, adjustment, and operational training for Owner.
7. Custom fabricated fixtures.

B. Related Sections include the following:

1. Division 7, Section 071000 “Damp proofing and Waterproofing”
2. Division 13 Section 130112 “Operation and Maintenance of Fountains”
3. Division 13 Section 130500 “Common Work Results for Special Construction”
4. Division 13 Section 130812 “Commissioning of Fountains”
5. Division 22 Section 220110 “Operation and Maintenance of Plumbing Equipment”
6. Division 22 Section 220150 “Operation and Maintenance of Pool and Fountain Plumbing Systems”
7. Division 22 Section 221513 “Common Motor Requirements for Plumbing Equipment”
8. Division 22 Section 220516 “Expansion Fittings and Loops for Plumbing Piping”
9. Division 22 Section 220519 “Meters and Gages for Plumbing and Piping”
10. Division 22 Section 220523 “General-Duty Valves for Plumbing Piping”
11. Division 22 Section 220529 “Hangers and Supports for Plumbing Piping and Equipment”
12. Division 22 Section 220548 “Vibration and Seismic Controls for Plumbing Piping and Equipment”
13. Division 22 Section 220553 “Identification for Plumbing Piping and Equipment”
14. Division 22 Section 220650 “Schedules for Pool and Fountain Plumbing Systems
15. Division 22 Section 220700 “Plumbing Insulation”
16. Division 22 Section 220800 “Commissioning of Electrical Systems”
17. Division 22 Section 221116 “Domestic Water Piping”
18. Division 22 Section 221316 “Sanitary Waste and Vent Piping”
19. Division 22 Section 221423 “Storm Drainage Piping Specialties”
20. Division 22 Section 225200 “Fountain Plumbing Systems”
21. Division 26 Section 260500 “Common Work Results for Electrical”
22. Division 26 Section 260526 “Grounding and Bonding for Electrical Systems”
23. Division 26 Section 262816 “Enclosed Switches and Circuit Breakers”
24. Division 26 Section 265529 “Underwater Lighting”

C. Related Fountain System Work to be Provided by Other Separate Contractors:
   1. Paving systems.
   2. Earthwork including trench excavation and backfill.

1.2 REFERENCES AND STANDARDS

A. General: As Specified in Division 1.

B. “Rules Governing and Restricting the Use and Supply of Water”, City of Burlington, VT. Department of Environmental Protection, Bureau of Water and Sewer Operations, Division of Water Connections and Permits.

C. Other Standards and References:
   6. Underwriters Laboratories, Inc. (UL).
   7. National Sanitation Foundation (NSF).
   10. American Society of Mechanical Engineers (ASME).
   13. National Electrical Manufacturer’s Association (NEMA).
   15. Institute of Electrical and Electronic Engineers (IEEE).
   16. Insulated Power Cable Engineers Association (IPCEA).
   17. International Plumbing Code (IPC)

D. All work shall conform to the latest edition of the National Building Code and/or International Plumbing Code.
1.3 SYSTEM REQUIREMENTS

A. Design Requirements:

1. The fountain described in this Section shall be a fully automated, self-contained type stationary feature.
2. The work of this Section shall include design of equipment items for fabrication and installation of fountain equipment and components to suit Project requirements as approved by Owner. See Division 1 for additional provisions related to delegated design by Owner’s Engineer.

B. Performance Requirements:

The fountain consists of (12) Pop-jet nozzles with integral DMX programmable RGB LED ring light with the showerhead spray pattern operating at a maximum display height of 6’ and (13) Smooth Bore Pop-jet nozzles with integral DMX programmable RGB LED ring light, the Pop-jet nozzles will operate at a maximum display height of 6’. The nozzles are to be interchangeable with the ability to change the nozzle display at a later date, at the discretion of the owner. The pumps are sized to provide enough volume and head pressure assuming all of the nozzles were to be showerhead displays. The nozzles will be divided into three zones with each zone operating independently of the other two for display heights. An anemometer is incorporated into the controls system to limit the height of the nozzles based on wind speed input to the controller. The RGB lighting will be programmed in consultation with the owner for various shows for special events and holidays.

1.4 SUBMITTALS

A. General: Refer to and comply with Division 1 Section, for procedures and additional submittal criteria.

B. Installer Qualifications: Comply with Article "Quality Assurance" herein. Submit fountain system installer qualifications including resume and system identification of previous work experience on fountain systems of type indicated for Project and the following work:

1. Plumbing work.
2. Electrical work
3. Concrete and Waterproofing Work.
4. Other specific work; rock work, stainless steel, etc...

C. Product Data:

1. Submit manufacturers’ data for all equipment and individual components listed in “Part 2 - Products”.

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2. Submit a comprehensive electrical package to include a power diagram, logic diagram, process and instrumentation diagram, panel layout, component schedule, and cut sheets on all individual components in the control panel. The contractor shall furnish evidence that the building department has been contacted to assure local compliance and that any exceptions to local requirements or the National Electric Code have been addressed.

3. Submit for other items and materials of system not indicated in this Section including for items of conduit, wiring, electrical devices, piping and fittings, sealants and/or seals to confirm compatibility and conformance to Project wide requirements.

D. Shop Drawings: A concise plan, details, and section(s) shall accompany the submittal data on all components to assure compliance with the intended design as specified and shown on the Contract Drawings.

1. Include equipment and material handling instructions and interfacing requirements and coordination notes with other trades and contractors.

2. If family product data sheets are submitted for approval, cross out all items not appropriate and highlight the selections for the components to be submitted, include all options.

E. Samples for Verification: Submit for surface exposed elements of system as requested by Architect and highlight only the information that is pertinent.

F. Quality Control Submittals:

1. Test Reports: Fountain manufacturer’s test report must be included in the control panel information package. This report shall include results of the test on both motors and all lighting circuits and uncommissioning report indicating proper operation.

2. Field Reports: The manufacturer shall provide a field test report in the controls package. This report, which includes information on the field voltage, current, and resistance at all components, must be filled out by the installing electrical contractor and submitted to the manufacturer and the Architect for approval.

G. Contract Closeout, Operations and Maintenance: Submit manuals pertaining to the operations and maintenance of the fountain system prior to final approval of system installation. The manuals shall include specification sheets, operations and maintenance data, exploded diagrams, replacement part lists, copies of field and test reports, and warranty information. Comply with Division 1.

1.5 QUALITY ASSURANCE

A. General:
1. Insofar as possible, all materials and equipment used in the installation of this work shall be of the same brand or manufacturer throughout for each class of material or equipment. The specification has allowed for substitutions, however, the substitution process will be strictly adhered to. If the process is incomplete, or not within the time frame, no substitutions will be considered. Substitutions will not be partially approved. If any item is not approved, the entire submittal will be rejected, not for resubmission. There will be no consideration for alternates, after the bid. Conform to Reference Standards and other Project Manual Sections as applicable.

2. Piping materials shall bear label, stamp, or other markings of specified testing agency.

3. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workman shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with the specified requirements and methods needed for proper performance of the work in this Section.

B. Fountain Manufacturer: The fountain equipment described in this section shall be supplied by Delta Fountains, Jacksonville, Florida, (800) 641-6675, Fax: (904) 886-9089. All other fountain manufacturers requesting approval must comply with the requirements listed in the SUBMITTALS section under the Product Data paragraph. All manufacturers’ data on individual components listed in PART 2: Products, or pre approved equals where allowed, shall be submitted to the Landscape Architect and fountain consultant, prior to approval. Manufacturers requesting prior approval shall submit to owner, at least 10 business days prior to the bid date, all data on all individual components listed in PART 2: Products, for review by the owner and fountain consultant. All approvals will be issued in an addendum prior to the bid date.

C. Installer’s Qualifications: Plumbing and electrical work for fountain system installation shall be performed by firms with each having at least 5 years of successful commercial fountain installation experience on features similar to that required for the Project.

D. Water feature contractor qualifications:

1. The water feature installing contractor shall have five (5) projects of similar complexity in the past 3 years. In entering into a contract covering this work, the Contractor accepts the specifications and drawings and guarantees that the work will be performed in accordance with the requirements of the specifications and drawings or such modifications to said specifications and drawings as may be made in the contract documents. The Contractor, in accepting the contract, has verified the design, and will perform such work as is required to achieve the design intent.

2. The contractor shall currently be in the business of constructing custom water features and shall have a continuous 5 year record of no less than 5 successful projects of equal or greater scope.

3. The Contractor further guarantees that the workmanship and material will be of the best quality procurable and that none
but experienced workmen, familiar with each particular class of work, will be employed.

4. The Contractor further agrees to hold himself responsible for any defects which may develop in any part of the entire system, including equipment as provided for under this specification, due to faulty workmanship, design or material and to replace, make good, without cost to the Owner, any such faulty parts or construction which may develop at any time within one (1) year from the date of the final acceptance. Any repairs or replacements required because of defects, as outlined in this clause, are to be made promptly and approved in writing by the Landscape Architect.

E. Field Measurements: Verify dimensions with other work on Project which adjoins the equipment item(s) of this Section or to which work of this Section will be a part.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Fountain manufacturer shall adequately package all shipments to protect the material during shipment. Consolidate freight of like items when possible to ensure minimal shipments. All shipments to be freight on board, manufacturer’s plant, with fully insured freight allowed to the jobsite.

B. Handling and Unloading: All shipments shall be driver signed and counted to verify that all components listed on the packing slips are included in shipment prior to leaving the manufacturer’s premise.

C. Special Handling: Contractor to take necessary precautions in unloading, handling, moving, and storing all shipments, until it is installed in its final position, to protect all components from damage. Contractor to refer to all notes on the shop drawings for any additional instructions on handling fountain equipment.

D. Acceptance at Site: Contractor to schedule and arrange for delivery of all shipments. Contractor is responsible for preparations of all equipment necessary to safely facilitate the unloading of all shipments and moving it to the final location. Freight is F.O.B plant, full freight allowed to jobsite. Contractor to account for all items in each shipment for accuracy before signing for acceptance of shipment. All damages and shortages shall be clearly documented on the Bill of Lading and packing slip before the delivery driver leaves the premises. The manufacturer shall be promptly notified within 24 hours of any and all documented damages and shortages. By signing the bill of lading, it is mutually agreed that the goods listed are accepted in apparent good order, condition and correct quantity, except as noted, and are in proper condition for transportation according to the applicable regulations of the department of transportation (for truck load shipments). In cases where shipments that are damaged in-transit and are signed for in good condition, it will be the contractor’s responsibility to replace those damaged items. All shipments are subject to the manufacturer’s standard terms and conditions.
E. Storage and Protection: Contractor shall store all components in their original packages and protect all items from damage until final placement occurs. Contractor shall rotate all motor shafts ¼ turn each and every month during storage up to the time of first performance to ensure motor shaft integrity.

1.7 WARRANTY

A. Contractor and installer shall furnish warranty for fountain system installation for a minimum period of one year from date of Substantial Completion of the Contract as specified in Contract Conditions. Contractor shall include provisions of warranty to Owner not otherwise covered by manufacturer. Warranty to include the following:

1. Fountain system to be free of defects of materials and workmanship.
2. Fountain system performance to the designated water volumes, heights, patterns, and display features, as outlined in the design requirements in section 1.3(E)(3).
3. Adjustments and/or corrections to warranted equipment shall be made at factory as per standard warranty terms.

B. The manufacturer shall warrant all properly installed and maintained fountain equipment (except lamps) as provided in “Part 2 - Products” of this Section, free of defects in material and workmanship for a minimum period of 18 months from shipment or one year from 1st performance, whichever comes first. The fountain manufacturer, at their option, shall replace or repair any materials, components, or workmanship found to be defective within the warranty period when returned to the factory, freight pre-paid. No component may be returned for repair or replacement without an approved return materials authorization.

1. Extended Warranties: Fountain manufacturer shall furnish to Owner any extended warranty that is standard and usually available from item manufacture/supplier for an item of equipment.

1.8 MAINTENANCE AND EXTRA MATERIALS

A. Contractor shall supply chemical treatment materials of sufficient quantity, in addition to materials needed for system testing and adjustment, for use by Owner in maintenance of the system for a period of at least one month after Substantial Completion.

B. Contractor shall supply any other special tools or parts that would be needed for Owner’s maintenance of the fountain system.

C. Extra Materials - one additional replacement element is to be provided for all cartridge filters. Contractor to supply 30 day supply of chemicals.
PART 2 - PRODUCTS

2.1 COMPONENTS

A. Mechanical Components: The major mechanical components of the stationary fountain are as follows:

1. DFFP-400, 4 Hp, Self-priming, ETL listed full-rated filter pump. One piece plastic case constructed with basket strainer, easy on/off two piece lid for tool free access to removable basket strainer. Chemical and UV resistant with re-enforced suction and discharge connections. The motor shall be 208V, 3 phase, 3500 R.P.M. The pump shall operate at a minimum of 150 GPM at 65' TDH and shall have 4" suction and 4" discharge ports. Filter pump is pre-plumbed and pre-wired in the equipment vault including all necessary check valves, isolation/flow control valves, true union type, and vacuum switch gauge panel assembly as shown on the drawings.

2. DFCF-200, 200 SQ. FT. Cartridge filter. heavy-duty abs constructed with cam & ramp lid for easy access to removable, washable filter media. Include one spare element.

3. DFWMUA-100, 1" water make-up assembly, type 304, schedule 40 stainless steel constructed with 110V, bronze, slow closing solenoid valve, water hammer arrestor and (3) 1" heavy-duty bronze constructed ball valves. The water make-up assembly is pre-plumbed ready for installation by the contractor. PVC or copper construction is not acceptable. The contractor shall connect in-line on fresh water make-up line and provide back-flow preventer and/or reduced pressure zone, and pressure reducing valve to ensure the incoming line pressure does not exceed 50 P.S.I.


5. DFWLS-T, Transducer style water level sensor, min. type 316 stainless steel housing with isolated diaphragm sensors. The transducer is certified intrinsically safe, 4 to 20 mA outputs. The transducer is shipped complete with polyurethane jacketed shielded cable with polyethylene vent tube and Kevlar tension members, 200 lbs pull strength for use in a 5' depth tank. Conductors are 22 AWG. The length of the cable shall be no less than 150' and shall be verified by contractor if more is required to make home run to PLC without a junction.

6. DFDS-14SS-PJ/SH, Custom fabricated type 304 stainless steel and fiberglass constructed discharge sump with stainless steel grate, 27W/12VAC RGB LED ring light with nozzle insert (showerhead and smooth bore),12VAC Pop-jet nozzle with quick connect fitting and valve, junction box, potting compound and cord seals.

7. DFPJN-100F, Animated pop jet nozzle with machined stainless steel nozzle (nozzle insert in ring light fixture), stainless steel support and high density synthetic construction, capable of producing programmed effects at a high switching speed of up
to 10 times per second via a 12 VAC switching mechanism. The
nozzle is to be housed in a stainless steel sump with light and
grate, pre-plumbed with Cam-Lock type quick disconnect fittings
attached to rib reinforced Tigerflex tubing that will not kink.
8. DFUL-27W, (27W) selectable 12VAC RGB LED UL Listed,
  wet/dry fountain ring light fixture with oversized face ring,
  certified marine grade 316SS housing with minimum 1/8" thick
  shell (stamped or spun fixture housing will not be accepted),
  silicone gasket, tempered glass lens, 10-15 degree beam angle,
  3M UL listed SOW cable (3,5 or 7 wire). Static or Auto
  preprogrammed color change with connection to power supply,
  supplied with internal DMX-512 and driver on board. Replaceable
  LEDs, removable base disc and yoke for wet or dry installation
  and standard “sparkle matt” face ring with optional mirror
  polish SS.
9. DFJB-4, 4-Tap underwater junction box, cast bronze constructed
   with silicone gasket and (1) 3/4” bottom tap and (4)
10. DFGDF-400, 4” N.P.T. Gravity drain fitting, sch. 40 type 304
    stainless steel constructed with integral water-stop flange.
11. DFGDF-600, 6” N.P.T. Gravity drain fitting, sch. 40 type 304
    stainless steel constructed with integral water-stop flange.
12. DFGC-50, 1/2” Machined brass cord seals with neoprene grommet,
    for water sensor cord.
13. DFGC-2125C, two-part re-enterable potting compound for
    application in the junction boxes to provide watertight
    environment for electrical connections.
14. DFCFU-300, 30” X 30” Chemical feed vault with aluminum tile set
    hatch, fiberglass constructed with all fittings glassed to the
    tank wall for watertight integrity. Includes 20 gal.
    polypropylene tank for acid and 60 gal. tank for chlorine
    storage.
15. DFST-11200, 8” x 14” x 6’ subterranean equipment vault, heavy
    duty fiberglass constructed with minimum (13) layers of
    fiberglass or a minimum of 1” thick, one-piece molded
    construction on bottom shell and lid. Fabricating the bottom
    shell from fiberglass sheets and caulking the joints will not be
    acceptable. The vault access hatch shall be 42” x 42” Aluminum
    tile set hatch bolted to the fiberglass with stainless steel
    lockable hardware. 6” vents with fiberglass vent caps. All pipe
    connection fittings to be glassed and sealed to the tank wall
    for watertight integrity. The use of bulkhead type fittings will
    not be accepted. A leveling skid fabricated from steel tubing
    shall be glassed to the vault bottom allowing for clearance of
    the sump and for ease of leveling and handling of the vault on
    site. The vault is to house the feature/filter pump, filtration
    equipment, UL listed control panel, automatic sump pump, exhaust
    fan, utility light and access ladder. The vault is pre-plumbed
    and pre-wired ready for installation and dome lid. As shown on
    the drawings.
16. DFOPR/PH-PM200, 120VAC 5A single phase combination ORP/pH
    chemical controller. Fully interactive Ethernet TCP/IP graphical
    interface with security access codes. 2 line, 16 character LCD
    display, 5 buttons. 2 LEDs: Steady Blue = "OK", Flashing Blue =
    flow switch is in "Recovery Delay" after a flow interruption,
    Flashing Red = "Alarm". Control - On/Off, P/PI/PID, Time
    Modulated, Event Timer, Flow Restored delay (adjustable).
Communication - HTML server on board, standard, USB port, Standard Ethernet, Wireless EVDO Cellular, Optional WiFi for use with Smartphone / iPad, HTML Micro Web Server with user definable IP address Non-metallic NEMA 4x enclosure with lithium battery for rain stored values.

17. DFCT-3600, 6, x 6”, x 6’ Collector tank, heavy-duty fiberglass constructed with minimum (13) layers of fiberglass or a minimum of 3/4” thick, one-piece molded construction on bottom shell and lid. Fabricating the bottom shell from fiberglass sheets and caulking the joints will not be acceptable. The vault access hatch shall be 42” x 42” Aluminum tile set hatch and bolted to the fiberglass with stainless steel lockable hardware. All pipe connection fittings to be glassed and sealed to the tank wall for watertight integrity. The use of bulkhead type fittings will not be accepted. A leveling skid fabricated from steel tubing shall be glassed to the vault bottom allowing for clearance of the sump and for ease of leveling and handling of the tank on site. The tank will house the sump pump, overflow, junction box, water level sensor, and filter discharge manifold. The tank is pre-plumbed and ready for installation.

18. DFUV-30. Ultraviolet light sanitizer, 208V, 1 phase, 114 GPM maximum flow to produce a UV dosage rate of 40mJ/sec/cm² at the end of the bulb life. The unit shall have an average bulb life expectancy under normal conditions equal to 8,000 - 12,000 hours. The UV chamber unit is manufactured of 316L stainless steel, with 3” flanged ANSI 150 RF fittings and produces wave lengths that operate within a 200 nanometer to 315 nanometer range or UV-C spectrum and remain unaffected by water temperature variance. The unit comes equipped with temperature probes, UV monitor probes, power control, and automatic wiper system. The medium pressure system shall produce an energy band in the bacterial region and shall emit multiple wave lengths suitable for chlorine destruction and have high power outputs (1.3kw - 7.3kw). The UV units shall be validated via 3rd party testing to meet the requirements of the health department codes. An external signal supplied from a flow switch/meter shall be tied into the control cabinet for water flow detection through the chamber to not allow the lamp to operate in a no flow condition. The chambers shall include temperature sensors and UV output monitors wired to the control unit. The control system for the UV unit shall be located in a NEMA 12 (IP54) rated panel. The control unit shall incorporate simple touchpad control buttons for ease of operation and shall be capable of incorporating many user configurable features for system integration and the microprocessor shall be able to be set up and monitored from a remote computer. The unit shall have a polychromatic light for improved chloramines destruction and shall also be designed to improve performance by treating 100% of the filtration flow. The unit shall be NSF/ANSI 50 certified, manufactured in the US, have MET/UL/CSA approval, and ISO9001 quality systems compliancy. The unit shall incorporate advanced wiper technology that is DC electrically powered. The wiper shall be able to park away from the lamp reducing wiper ring degradation. The location of the wiper shall incorporate an optical readout and have no proximity switches, magnets, or timers and shall incorporate multiple seal arrangements for long
life. The UV control unit shall include many interface options such as process interlock for local pressure switch pump interference, low power overnight operation, automatic restart on power supply interruption, and shall have profibus interface capabilities. The lamp technology shall incorporate chokes. Units supplied with ballasts are not acceptable. The control panel unit incorporates multiple levels of operation and shall include stop/reset buttons. The unit shall also include LED two line text display indicating UV dosage, lamp current, UV intensity, flow, temperature, operational hours, lamp fault, low UV and temperature alarm, pre-temperature alarm, power supply over-temp alarm, ground fault trip, and wiper fault. The unit shall incorporate interface controls of local remote operation, process interruption, valve control with limit switch feedback, UV shutdown, and flow meter input. The unit shall have built in data-logging which include parameters logged of UV intensity required, UV intensity measured, lamp current, temperature, flow, time and date, and all alarms generated.

19. DFVG-100, Vacuum Switch and gauge panel assembly equipped with (1) weathertight nema 4 enclosed, single pole/double throw switching element, combination vacuum switch with viton o-rings that are suitable for temperatures of 32° - 400° F. Panel also includes (1) ¾” N.P.T., glycerin liquid filled, 304 stainless steel case vacuum pressure gauge with 2.25” dia. face, and (1) ¼” N.P.T., glycerin liquid filled, 304 stainless steel case vacuum gauge with 2.25” dia. face. Mounted on P.V.C. backboard.

20. DFDPG-100, Differential Pressure Switch and gauge panel assembly equipped with (1) weathertight nema 4 enclosed, single pole/double throw switching element, pressure differential switch with viton o-rings that are suitable for temperatures of 32° - 400° F. Panel is also equipped with influent and effluent ¾” N.P.T. glycerin liquid filled, 304 stainless steel case pressure gauges with 2.25” dia. face. Mounted on P.V.C. backboard.

21. DFPP-050, ½ Hp, Self-priming, NSF approved full-rated filter pump and fitted 2” FPT connections. The pump shall operate at a minimum of 40 GPM at 40’ TDH. Pump is one piece case constructed with oversized basket strainer, double ring lock design lid for tool free access to removable basket strainer and pump internals. The pump shall have a floating eye seal between the closed impeller and diffuser for maximum efficiency. The motor shall be 208V, 3 phase, 3450 R.P.M and have a rust-proof stainless steel shaft, and permanently lubricated, sealed bearings. Filter pump is pre-plumbed and pre-wired in the equipment vault including all necessary check valves, isolation/flow control valves, true union type, as shown on the drawings.

22. DFSF-3.14, 24 1/2” Diameter Sand filter with automatic back washing valve, 3.14 square feet of filter surface area and stainless steel linkage valve system with pressure differential switch for backwash activation, pre-plumbed on tank. The sand filter tank is heavy duty one piece re-enforced fiberglass constructed with UV resistant outer coating surface finish. Sand filter includes easy access, heavy duty closure with integral pressure gauge with air-relief valve, swing away diffuser for easy access to sand and internal parts, all internal parts are
threaded for ease of service, maximum operating pressure - 50 p.s.i. The automatic backwash linkage system shall consist of one 3-port bronze body ball valve with electronic actuator, one cast bronze 3-port ball valve and sch. 80 P.V.C. Piping with flanged, clear acrylic sight glass. The valves are connected by type 304 stainless steel single lever linkage with double operator arms and stainless steel jam nuts and couplings to facilitate manual adjustment of the linkage assembly. The electronic actuator shall be powered by 120V relay outputs from either the P.L.C. (if provided) or relays in the control panel. The backwash initiation shall be configurable for either a set time for backwashing or by use of a pressure differential switch measuring pressure differential from the influent and effluent sensors located on the face piping manifold of the filter. A visual alarm light or dedicated screen on the H.M.I. will be incorporated in the main control panel to alert when the system is in the backwash cycle. Controls for the automatic backwash will switch the position of the 3-port valve when the pressure transmitters read the set pressure differential level. Once the 3-port valve state is switched, the controls will run through a timer controlled backwash cycle. Once the time set of the cycle is complete, the controls will switch the 3-port valve back returning to normal filtration cycle. Sand filter is pre-plumbed in equipment vault. Filter media is to be provided by contractor.

23. DFPAV-200, 120VAC NEMA 4X aluminum alloy powder coated electric actuator, designed for load requirements of up to 445 in/lbs and be used in either a horizontal or upright position. Outdoor or humid environments actuators must be continuously powered up and the heater is functioning. Actuator has two auxiliary switches, (shared common, rated at 3A 250V Max.), an internal low power heater and mechanical connections that are ISO5211 compliant. The Actuator shall come with the optional internal proportional control card that accepts a wide range of control signal and generates multiple feedback signals and built-in manual override capabilities. Duty cycle on all actuators shall be a minimum of 75% with an ambient temperature operating range of -30°C to +65°C (-22°F to +150°F). The actuator shall have a minimum of (2) selectable and programmable 2-10vdc, 1-5vdc, 4-20mA control signal inputs and also come with a minimum of (2) 2-10vdc or 4-20mA feedback signal outputs.

24. DFCFP-33, 110V, 1-phase Fractional Horse Power Chemical Feed pumps. NSF approved with output of 0.18gph capacity with discharge pressure of 145psi. Polypropylene constructed with EPDM seals, PVDF wetted ends eliminate compatibility concerns, integral bleed valve prevents loss of prime, and external control via dry contact pulse.

B. Electrical Components: The major components to be included in the control panel and to be incorporated into a fully functional operating fountain system are specified and listed below:

1. The fountain control system shall be designed for 208 Volts, 3 phase, 4 wire service and shall operate (3) 4 Hp feature pumps, (1) 1/2 Hp filter pump, (25) 27W/12VAC led lights, (1) Anemometer for wind speed compensation control of the display pump, and
appurtenances of the fountain. A transducer type low water cut off system shall be provided to de-energize the control system during a low water level condition. The water level sensor shall also provide a separate water level control system to increase the water level before the low water cut off alarms in both operating and static environments.

2. NEMA 3R enclosure of galvanized steel construction, primed and phosphatized, finished with ANSI 49 gray baked on enamel, manufactured by Hoffman, equal to HCR series shall be provided. The enclosure shall have collar studs for sub-panel mounting, hasp and staple for padlocking, butterfly type stainless steel draw latches and hinged cover. All Hardware shall be stainless steel.

3. All components shall be mounted to a removable sub-panel. The sub-panel shall be fabricated from 14-gauge steel and shall be finished with baked on white enamel.

4. Service entrance lugs shall be provided, sized for 600 volts, 300-amp minimum. The power distribution block shall have a flammability rating of UL 94V-0, shall be based on NEC table using 75 degrees C wire and shall be equivalent to Square D class 9080.

5. A 600V lightning arrester shall be provided and connected to the service entrance lugs for 3 phase power and 250V lighting arrester for single phase power.

6. Motor starters for feature pump shall be IEC rated full voltage, non-reversing with thermal overload relay. Auxiliary contacts shall be provided as required for the specific control functions. Motor starters shall be as manufactured by Square D, Allen Bradley or pre-approved equal.

7. All 120 volt equipment shall be protected individually by thermal magnetic circuit breakers with an interrupting rating of 10KAIC @ 240 volt minimum. All circuit breakers shall be calibrated and sealed at the factory and shall be equivalent to Square D, type QOU.

8. The lighting and filter pump contactors shall be 30 amps rated and shall be equivalent to Omron type g72 or equal.

9. The fountain feature / filter pump, and lights shall be controlled by individual 24-hour time clock settings. The time clocks shall be electronic with 24-hour capabilities or shall be integral to the memory module or PLC.

10. The motor and lights shall be controlled by touch screen, designated “Hand - Off - Auto”. In the “Hand” mode, the appropriate motor or set of lights shall be energized until the selection is placed in the “Off” mode. In the “Auto” mode, the appropriate motor shall be controlled by the appropriate time clock.

11. All power wiring shall be color coded using MTW #12 AWG minimum. Control wiring shall be MTW #14 AWG minimum and be numbered/lettered at each end. Wire numbers/letters shall be equivalent to Pass and Seymour “LeGrande”.

12. All wiring shall be routed through a wiring duct system to provide wire protection and an organized appearance.

13. Terminals shall be provided for interface with field-installed equipment. The terminal blocks shall be mounted on a 30-degree angle for ease of field connection. Terminals shall be equivalent to Siemens, Allen Bradley, or Square D.

14. All components shall be labeled using a laser-screened Mylar nameplate. The nameplate shall be a laminated two-part system
using black letters on a white background on the door and yellow background on the back panel providing protection against fading, pealing, or warping. The labeling system shall be computer controlled to provide logos, post- script type or custom design. The use of engraved plastic type tags is not acceptable.

15. The control system shall have complete drawings/schematics using AutoCAD. The drawing shall have a complete Bill of Materials, front panel view with component locations and electrical schematic. References to the Bill of Materials shall be located for each component.

16. The control system shall be designed and manufactured to meet all state and local codes, Underwriters Laboratories and the National Electric Code (particular attention to article 430 and 680)

17. The entire control system shall bear a UL 508 serialized label "Enclosed Industrial Control Panel". The use of the UL label "industrial control panel enclosure" without the UL 508 serialized label is not acceptable. Additionally the control panel shall bear a UL label for "Industrial Control Panel for Permanently Attached Fountains".

18. The low water cutout system shall provide intrinsically safe voltage to the transducer style sensor. The sensor shall provide an input to the PLC to de-energize the pumps and motors. An adjustable time delay shall be provided to prevent nuisance tripping. The HMI shall indicate this alarm as well as provide time delay values for alarm and reset.

19. The water make up system shall provide intrinsically safe voltage to the transducer style sensor. The sensor shall provide an input to the PLC to energize the water make up solenoid. An adjustable time delay shall be provided to prevent nuisance tripping. The HMI shall indicate this alarm as well as provide time delay values for alarm and reset. The water make-up shall operate on 2 set points for operating and static fill functions.

20. The variable frequency drive shall be a special purpose drive with application-specific features that add significant "more-for-less" benefits. The VFD shall be a select model for remote access, Siemens G-120, or pre-approved equal.

   a. ASIDs: Application Specific Integrated Circuitry increases reliability.

   b. Dual-bridge, 12-pulse rectification. By using a phase shift input transformer with dual secondary, input current harmonic distortion factor can be reduced over 90%.

   c. Energy savings control with Automatic output voltage adjustment in response to actual motor loading. Real-time energy savings based on motor algorithms. Increases motor efficiency by several %.

   d. Simplified operator keypad with 16 function LEDs provides the perfect execution of old-fashioned simplicity of discrete indicator lights and the modern sophistication of keypad programming and control.

   e. Built-in PID control that eliminates cost of external device.

   f. Built-in power consumption monitoring with built-in kW display eliminates the need for external signal conditioner.

   g. Performance features:

1) Ratings: 4 HP at 208 VAC
2) Overload capacity: 120% for 60 sec (180% peak)
3) Starting torque: 150%
4) DC injection braking: ramp or coast to stop, adjustable, current limited
5) Electronic reversing
6) Adjustable accel/decel: 0.1 to 3600 sec (2 each)
7) Controlled speed range: 40:1
8) Critical frequency rejection: 2 selectable, adjustable bands
9) Torque limiting circuit: 30 to 180%
10) Drive efficiency: 96 to 98%
11) Energy saving control: improves motor efficiency
12) Displacement power factor: 0.98
13) Output frequency: 0.1 to 400 Hz
14) Frequency resolution: 0.01 Hz with digital reference, 0.06 Hz with analog reference
15) Frequency regulation: 0.01% digital (-10°C to 40°C), 0.1% analog (15°C to 35°C)
17) Torque boost: full range, auto
18) Jog forward and reverse
19) Power loss ride-thru: 2 sec
20) Inertia ride-thru
21) Selectable auto restart after momentary power loss
22) Programmable auto restart (0 to 10 attempts) after re-settable fault
23) DC bus reactor: 30 to 125 HP at 230 VAC, 30 to 250 HP at 460 VAC

h. Design Features

1) 32-bit microprocessor logic
2) Surface mount devices
3) Carrier frequency: selectable to 15 kHz
4) Keypad operator controls
5) LED display: four digit
6) 24 VDC control logic
7) Programmable contacts, one form C and one NO
8) Timer function: contact-initiated
9) RS-232 communications port
10) Volts/hertz ratio: 15 preset and one infinitely-adjustable pattern
11) 5 Multi-speed settings
12) Remote speed reference: 0 to 10 VDC or 4 to 20 mA
13) Set-point (PID) control
14) Signal follower: bias and gain
15) Analog monitor output: 0 to 10 VDC
16) Fully EMC compliant when optional RFI filter connected
17) NEMA 1 enclosed or protected chassis
18) UL listed; IEC: 146A
19) MTBF: exceeds 28 years
20) Embedded web page for remote access and monitoring

i. Protective Features

1) DC bus CHARGE indicator
2) Optically-Isolated controls
   a) Phase-to-phase / phase-to-neutral short circuit protection
   b) Ground fault protection
   c) Electronic motor overload (UL)
   d) Current and torque limit
   e) Fault circuit: over-current, over-voltage, and over-temperature Service Conditions

3) Ambient service temperature: -10°C to 40°C (104°F) NEMA 1, to 45°C (113°F) protected chassis
4) Humidity: non-condensing to 95%
5) Altitude: to 3300 ft; higher by derating
6) Input voltage: +10%/-15%, 200 to 230 VAC, 380 to 460 VAC
7) Input frequency: 50/60 Hz ± 5%
8) 3-phase, 3-wire, phase sequence insensitive

21. A programmable logic controller shall control the fountain pumps. The PLC shall be an Allen Bradley Micrologix series, Siemens 571200 series, or pre-approved equivalent.

a. Mechanical features
   1) Rugged, compact plastic housing;
   2) Easily accessible connection elements and controls
   3) Assembly on standard horizontal or vertical;
   4) Terminal block as permanent wiring assembly.

b. Design features
   1) Data integrity; the user program is the most important
   2) Parameter settings are stored in the internal EEPROM.
   3) Built-in DC 24V sensor/load power supply for the
   4) Direct connection of sensors and actuators;
   5) On-board digital input/outputs (CPU with 12 inputs and 12 outputs)
   6) Interrupt points;
   7) High-speed counters;
   8) Easy expandability;
   9) 2 high-frequency pulse outputs;
   10) EEPROM 16K memory sub-module with real time clock.
   11) Battery module for long-term back up.
   12) Embedded web page for remote access and monitoring.

c. Functions
   1) Fast instruction execution; Instruction execution times of ms or 0.8
   2) Extensive instruction set; A large variety of basic operations such as binary logic, result assignment, save, count, time generation, load, transfer, compare, shift, rotate, complement generation, call subroutines, integrated communications instructions and other user-friendly functions such as pulse duration modulation, pulse train function, arithmetic functions, floating-point arithmetic, PID closed-loop control, jump
functions, loop functions and code conversions serve to simplify programming.
3) Counting;
4) Interrupt handling;
5) Edge-controlled interrupts
6) Time-driven interrupts
7) Counter interrupts
8) Communications interrupts.
9) Direct interrogation and driving of inputs and outputs;
10) Password protection;
11) Full access
12) Read only
13) Complete protection.
14) Debugging and diagnostic functions.
15) "Forcing" of inputs and outputs in debugging and diagnostic mode

d. Communications: The built-in PPI (point-to-point interface) provides a range of communications features.
1. If the control panel drawings include remote communication, the avenue of connection through Ethernet through cat5 cable will be installed by contractor. The communications capabilities can range from PLC upload/download, to full HMI, VFD, and PLC monitoring and control.

22. Programming: The PLC shall be supplied with a fully functional program that shall perform basic operations including time clock settings and water level control functions.
1. HMI - Simatic HMI TP700 comfort, comfort panel, touch operation, 7" widescreen-TFT-display, 16 mil. colors, 800 x 480 pixels, profinet interface, MPI/Profibus DP interface, 12 mb user memory, Windows CE 6.0, configurable from wincc comfort v11. It shall come with a SMART SERVICE Licenses to allow for connection to a LAN that can be accessed remotely over private VPN tunnel. Siemens Model #6AV2124-0GC01-0AX0 or pre-approved equivalent.

WIFI Module
a. The eWON Flexy 200 Router allows OEMs and system integrators to link remote devices in an environment where communication technologies are constantly changing. The Flexy 200 is a data collection gateway without any routing functions between LAN, WAN and serial sides. The main applications with the Flexy 100 are data monitoring and data collection from remote field equipment components. Allows for connection to the device end regardless of the industrial protocol used: serial, MPI, Profibus, Ethernet, proprietary protocols. Installation Components
b. WiFi client for WAN access to Internet
c. WiFi Flexy extension card with WLAN access points that allow internet connectivity while avoiding connection on the factory/corporate LAN network. The eWON Flexy extension card provides a powerful backup internet access for industrial MM applications. WLAN technology offers free access, high band width, easy deployment (no cabling) and facilitates security network management
2. Syncronorm DMX512 programmable show Controller or pre-approved equivalent. With 2x16 segment LCD display, 6 keys, anemometer control, with all necessary switches and/or DMX to analog decoders.

a. Performance Features:
   1) Incoming Power: 15 to 24VDC
   2) Power Consumption: 8W
   3) Protocols: DMX512
   4) Ethernet: RJ45 connection
   5) Operating Temperatures: 0°C to 40°C
   6) Up to 4 Universes of DMX512
   7) Programmed: Degence software
   8) Removable SD Card memory card data storage

b. Interface Features
   1) 2 DMX512-RDM channels
   2) 1024 music DMX-RDM channels
   3) 3 isolated digit inputs
   4) RJ45 socket for 10/100Base-TX Ethernet
   5) IEEE 802.3af PoE powered device
   6) 5-pin DIN socket for MIDI In
   7) 5-pin DIN socket for MIDI Out

3. Acclaim RDS 600 DMX512 signal splitter for RGB lights or pre-approved equivalent.

a. Performance Features:
   1) Operating Voltage 100-240VAC
   2) Operating Frequency: 50/60 Hz
   3) Power Consumption: .12A, 14.4W at 120VAC
   4) Number of DMX Inputs: 1
   5) Number of DMX Outputs: 6
   6) Number of DMX Thru Links: 1
   7) Protocols: RDM & DMX-512
   8) Operating Temperatures: -10°C to 50°C
   9) Fixture Connectors: 3 pin terminal blocks for RDM / DMX,
      Bare wire 3 conductor for AC input
   10) Warranty: 3 Year

2.2 INSTALLATION COMPONENTS

A. Piping Materials:

1. Unless architects specifications indicate otherwise, the suggested minimum piping and fitting standard recommended for this installation is Type 1.
2. All interconnecting piping and associated fittings, supplied by installing Contractor, shall be a minimum of Schedule 80 PVC, NSF-FW rated.
3. All welded PVC fittings above 6" diameter shall be fiberglass reinforced and used only on non-pressurized lines.
4. Use only clear PVC cleaner meeting NSF, UPC, and ASTM standards for cleaning and repairing PVC pipe and fitting surfaces for solvent cementing (IPS Corporation “Weld-On” Type C-65 or equivalent). Follow all directions and instructions appearing on product label.
5. Use only purple PVC primer meeting NSF, UPC, and ASTM #F-656 standards for softening and preparing field pipe and fitting surfaces for solvent cementing (IPS Corporation “Weld-On Type P-70 or equivalent). Follow all directions and instructions appearing on product label.
6. Use only clear or white, heavy bodied, medium setting PVC cement meeting NSF, UPC, and ASTM #D-2564 standards for solvent cementing PVC plastic pipe and fittings (IPS Corporation “Weld-On” Type 711 or equivalent). Follow all directions and instructions on product label.
7. Provide Link Seal for all penetrations in equipment room. All penetrations through outside walls to below grade shall be sealed per building specifications. Using “easy-link seals” is recommended.
8. All piping penetrations through structure walls into open areas below pool structure must have the necessary allowances made for settlement.
9. Pipe hangers and supports per national plumbing code. All piping in open areas below the pool shall be installed free hanging from the ceiling in the level below with pipe hangers/per specifications and code.
10. Reference requirements of other Project Manual Specifications for materials and items not specified herein.
11. Thrust Block for Piping Turns

B. Electrical Materials:

1. Rigid conduit shall be corrosion resistant and either galvanized steel or rigid PVC as specified in Part 3 Article “Basic Electrical Methods” herein. Submit Product Data and related specifications on materials to be used. All electrical conduit and conduit fittings between submersible light fixture niches, junction boxes and control panels will be U.L. listed rigid, nonmetallic, PVC NEMA, TC-2 max. 90°C, sunlight resistant for above and below ground use. All conduits shall be protected at all times from possible water ingress. Use only approved primer and PVC glue suitable for joining all PVC conduits and fittings per manufacturer’s instructions.
2. All conductors shall be copper with insulation suitable for the particular wiring location as specified in Part 3.4 Article “Basic Electrical Methods” herein. Submit Product Data and related specifications on materials to be used underwater.
3. Reference requirements of other Project Manual Specifications for materials and items not specified herein.
4. All PVC conduit connections underground shall be SCH40 pressure fittings ((FE) male adaptors and couplings). Use color coded primer, pressure fitting PVC glue, and Teflon paste. The use of normal electrical PVC fittings is prohibited.
5. All connections in the pool/fountain shall be made with the assistance of a plumber, using Teflon paste or Teflon tape to eliminate all leaks. Use only tapered (NPT) stainless steel fittings and nipples. The use of galvanized, black, brass or steel piping is prohibited.

6. All conduit connections between dissimilar metals must be made with dielectric fittings, and sealed with dielectric thread compound to prevent galvanic degradation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing elevations: Verify all joining elevations prior to laying pipe or setting pipe. Notify Fountain equipment manufacturer, Architect, and or Engineer of all discrepancies before proceeding with the construction of the fountain.

B. Verification of Dimensions: Before proceeding with any work, the contractor shall check and verify all dimensions, sizes, and the like, and shall assume full responsibility for the fitting-in of all materials and equipment to the conditions on site if the Fountain equipment manufacturer, Architect, and or Engineer is not notified in writing and a resolution is not agreed upon.

C. All conflicts relating to any penetration size, dimension, elevation, equipment location, or equipment size or dimension, shall be addressed and resolved with the manufacturer, Architect, and or Engineer of record before the contractor can proceed with the construction of any part of the fountain that may be or become affected by the confliction.

D. Verify Utilities: Contractor shall verify with local authorities where the proper tie into sanitary or storm sewer for overflow and drain.

E. Contractor shall verify matching voltage and phase of main power feed provided to serve the fountain equipment control panel and report all discrepancies in writing to the Fountain Manufacturer, Architect, and Engineer.

3.2 INSTALLATION

A. All equipment furnished under this Section shall be installed in full conformity with the Contract Documents, engineering data, instructions, and recommendations of the manufacturer.

B. Contractor shall obtain all necessary installation permits and inspections

C. Installation of fountain equipment appurtenances shall confirm with provisions of Reference Standards and suit existing conditions on site as approved by Architect.
D. Contractor shall insure that installation complies with all applicable national and local codes and project specifications.

E. The incoming water supply line pressure must not exceed 50 PSI and is part of the building contract, not the fountain.

F. Install horizontal piping 1’ below freeze line.

G. Excavation, Backfill, and Compaction:
   1. Excavating, trenching, and backfilling shall be as specified in the Contract Documents and as noted on the drawings and compaction done in a maximum of 6” lifts.

H. All pools/splash pads shall be waterproofed by specified approved means.

I. Prior to any finishing materials (I.E. lights, jets, coverplates) being installed, all pools shall be tested for leaks for a minimum of 72 hours and all waterproofing and tile work shall be completed.

J. Refer to mechanical and electrical notes on drawing for further information.

K. Contractor shall field verify all dimensions.

L. Consult architectural, structural, mechanical, and electrical drawings for additional details not shown on these drawings.

M. When applicable, all weirs shall be installed with an accuracy of “+” or “-”1/16” over the entire weir length. Unless otherwise noted, refer to the architectural drawings for weir details.

N. Contractor shall provide all concrete work as required by all mechanical and electrical fountain equipment requirements including, but not limited to, housekeeping pads, lock-down slabs, and thrust blocks where indicated.

O. Contractor shall provide all utilities such as power supplies, water supplies, and sewer connections under the building contract up to the fountain controls, equipment and/or pool fittings where indicated.

P. Contractor shall provide and is responsible for all elevation and X-Y coordinates relating to all fountain equipment including vaults, pool floors, and pumps.

3.3 BASIC PIPING METHODS

A. The Contractor shall verify and confirm all piping layouts, locations, and dimensions shown in these drawings, and insure that the specified locations do not interfere with other equipment, architecture, or construction before installation. All piping shall be installed as shown and as otherwise specified to make a complete, workable, and neat system.
All piping shall be cut accurately from dimensions established at the Project site and allowances shall be made for clearance of other devices.

B. All intraconnecting piping and associated fittings, supplied by system manufacturer, shall be a minimum of Schedule 80 PVC, NSF-FM rated. Interconnecting-intraconnecting interface points shall be slip fit, threaded or flanged.

C. All interconnecting piping and associated fittings, supports, and seals shall be per section 2.2 A.

D. The Contractor shall not deviate from the pipe sizes shown herein unless prior written approval is obtained from the manufacturer and Architect. When a size is not indicated, the Contractor shall request the pipe size from the fountain manufacturer. In the event that interference with other equipment or architecture requires relocation of pipes or a layout different from that shown herein, the Contractor shall notify the fountain manufacturer immediately for reexamination of hydraulic parameters of the affected sections.

E. Pipe and accessories shall be handled in such a manner to not cause damage. All cutting shall be done in a good workmanlike manner. Before installation, all piping and fittings shall be visually inspected for damage or defects. The interior of the pipe shall be clean during the laying operation. Pipe shall not be laid in water or in the trench when weather conditions are unsuitable for the work. Water shall be kept out of the trench until the pipe is installed. While work is in progress, open ends of the pipe and fittings shall be securely closed so that no trench water, earth, or other foreign matter will enter the piping system or fittings.

F. Perform adequate trenching and backfill operations when installing PVC piping below grade. Trench width should be minimum of “pipe O.D. plus 12 inches” and deep enough to allow piping to be buried a minimum of 12” below the maximum expected frost penetration line to avoid freeze damage. Lay piping in horizontal, parallel, or perpendicular manner. Avoid vertical stacking of pipes. Space minimum of 3” apart on all parallel runs.

G. Use only clean, free-flowing, non-expansive backfill material (naturally rounded 4” pea gravel, 57 stone, or sand) and backfill in 6” lifts with adequate and complete compaction between lifts to 90% of maximum density per ASTM 1557-70. Compaction to excessive loads shall not be permitted. A second pressure test on the piping system must be made at this time to insure that piping has not been damaged during backfill operations.

H. Concrete “thrust” blocking is recommended at all directional changes (tee’s, elbows, etc.), reducer fittings and line terminations (bushings, end caps, plugs, etc.) in fountain display discharge piping 6” and larger.

I. The bearing surface for the concrete thrust blocks, where possible, should be placed against undisturbed soil. Where it is not possible, the fill between bearing surface and undisturbed soil must be compacted to at least 90% standard proctor density. Thrust block shall be a concrete mix
not leaner than one part cement, two and one-half sand, and five parts stone. Contractor shall coordinate the location of the thrust block with other work and existing conditions. Work shall be performed in accordance with all applicable codes. For additional information, refer to NFPA 24.

J. The sump pump in the equipment vault shall be connected as immediately as possible after secure placement and shall have a continuous power supply for the duration of the fountain system installation process.

K. Pressure test all piping as specified in Part 3 Article "Field Quality Control" herein.

L. Avoid laying suction piping in a manner that could result in a suction loop before, during, or after backfilling and compaction. Always pitch pipe in a downward direction to avoid a suction loop that will cause air to be permanently trapped, causing loss in performance of the piping system due to increased friction and work load demand.

M. Piping in areas subject to freezing shall be installed at elevation of minimum 1 foot below frost line.

N. Do not install any water lines above the control panel.

O. Any and all costs associated with above are responsibility of installer.

3.4 BASIC ELECTRICAL METHODS

A. The information supplied in the drawings specifies the general requirements of a complete functioning electrical power distribution and control system. The electrical subcontractor shall coordinate all electrical installation activities with the Construction Manager, Contractor, Architect, and (with respect to work Phase) other separate contractors performing work related to fountain installation.

B. All electrical work shall comply with the latest edition of the National Electric Code (NEC), Section 680, published by the National Fire Protection Association; Quincy, Massachusetts. In the event of conflicting requirements between Contract Documents and any local electric code or other governing organizations for this location, the most stringent shall govern and take precedence. In this event, the Architect shall be notified immediately in writing of such conflict.

C. The installation of electrical equipment and wiring in water can produce extreme hazards. It is the responsibility of the installing electrical contractor to consult and comply with all electrical codes and safety regulations prior to installation of electrical equipment. Local codes take precedence over the general notes where discrepancies of conflicts exist.

D. All wiring and conduit shall be sized by the electrical sub-contractor in accordance with the latest edition of the NEC and all electrical codes and regulations. Where wiring and conduit sizes are specified herein, they shall be interpreted as minimum allowable sizes. All conductors
shall be copper with insulation suitable for the particular wiring location. Minimum acceptable insulation is type THW or better, suitable for both dry and wet locations. Conductor insulation shall be moisture resistant, flame-retardant thermoplastic as approved by the NEC. Conductor sizing shall be based on an ambient temperature of 30°C and a conductor temperature rating of 75°C maximum per Article 310 of NEC. All underwater electrical cable shall either be encased in waterproof, sealed PVC conduit or shall be rated for continuous operation in underwater, marine environments.

E. Contractor shall obtain all necessary installation permits and inspections.

F. It is the responsibility of the installing electrical contractor to insure that all electrical equipment is installed and wired by a qualified, licensed electrician, experienced in fountain system wiring. Delta Fountains assumes no responsibility for liability whatsoever for installations not carried out by a qualified, licensed, electrician in accordance with our shop drawings, and all provisions of the latest edition of NEC in general, Article 680 specifically, and local safety regulations. All Delta Fountains electrical control panels include GFCI’s when and where required, when furnished.

G. It is the responsibility of the installing electrical contractor to verify all field dimensions critical to fountain equipment installation and performance and report any discrepancies to Delta Fountains and the engineer upon immediate notice.

H. All conductors shall be run in rigid conduit sized for the number of wires contained within per NEC requirements. Rigid conduit shall be corrosion resistant and either galvanized steel or rigid PVC. When conduit is submerged or in other wet locations, rigid PVC shall be required. Conductor sizing shall be corrected for the number of wires to be run in a single conduit or raceway in accordance with NEC. All conduit locations and routing shall be approved by the Architect before installation.

I. The work includes such necessary material and devices of a minor nature that may not be indicated on the drawings or mentioned in the specifications, but which are necessary for the compliance with codes and for the successful operation of the entire control system. The contractor shall be allowed no extra compensation because of this requirement.

J. All GFCI protected circuits must have a separate neutral. All GFCI breakers have pigtails wired to a neutral bar. A Class ‘A’ ground fault circuit interrupter (GFCI) must be installed in each branch circuit supplying submersible or underwater fountain equipment. Equipment operating at 15 volts or less must be protected by suitable transformer U.L. Listed and marked for the application.

K. Conduits are drawn for clarity and do not necessarily show exact routing. Contractor shall install conduits with as few changes in direction as jobsite conditions will allow.
L. All electrical equipment must be properly bonded and grounded for safety, per the latest NEC and local code requirements. All bonding lugs shall be provided by installing electrical contractor. Installing contractor shall verify all necessary requirements of local inspector before installing, and notify Delta Fountains of any required deviations from specifications or plans or notes, and resolve all conflicts before installing equipment. Contractor to ensure that all bonding codes are complied with for each metal pool equipment component.

M. Submersible/underwater lighting fixtures must be installed for operation at 150 volts or less between conductors. Submersible pumps most operate at 300 volts or less between conductors.

N. Submersible lighting fixtures must be installed with the top of the fixture lens a minimum of 2” below the normal operation water level and must have the lens adequately guarded to prevent contact by any person.

O. All electrical equipment which depends on submersion for safe operation must be protected against overheating by an independent low water cutoff device if the water level drops below normal operating levels, or contain an internal Thermal Bimetallic Ambient compensating overload.

P. Maximum length of exposed submersible cord in the fountain is limited to 9 feet. Cords extending beyond fountain perimeter must be enclosed in approved wiring enclosures.

Q. All submersible lights and pumps must have sufficient cord length to allow removal from the water for re-lamping and normal maintenance. Fixtures can not be permanently embedded in the fountain structure so that the water level must be reduced or the fountain drained for re-lamping, maintenance, or inspection.

R. Submersible equipment must be inherently stable or be securely fastened in place with non-corrosive fasteners suitable for the purpose.

S. Underwater junction boxes must be filled with an approved re-enterable electrical potting compound (wax or paraffin is not acceptable) prior to filling pool and after all circuits have been checked to prevent the entry of moisture and must be firmly attached to supports or directly to the fountain surface and bonded as required. All conduit stubbed up through pool floor must be stainless steel. PVC, Red Brass, and Everdur are not acceptable as a conduit support stub for submersible junction boxes. All conduit entries must be completely sealed prior to potting to prevent compound from entering conduit system. After testing, junction boxes shall be sealed with scotch 3M re-enterable compound or other approved filling compound.

T. All underwater junction boxes must be equipped with threaded conduit entries and compression type cord connectors for cord entry. Strain relief connectors serving niche-Mounted underwater lights shall be capable of sealing both the fixture cord and an AWG #8 insulated bonding wire which may be required by some local codes.
U. Pull correct quantity and size conductors, wired with separate ground, through conduit into junction box. Make all splices and connections tight and well insulated. Connect ground wire to ground lug in junction box, or other suitable grounding location.

V. Insert each submersible cord through the brass cord seals provided on the junction box and tighten completely.

W. Do not operate submersible lights or pumps more than ten seconds unless completely submerged or damage will result and warranty will be voided.

X. The installing electrical contractor will verify that all electrical equipment grounds will have the same reference potential and will give evidence of such to Delta Fountains before any equipment is initially energized.

Y. The installing contractor shall size all feed-wires leading to fountain control panel for no more than 2% voltage drop, and shall notify Delta Fountains before fabricating electrical control panel if wire is upsized such that extra large wire lugs are required. It is the responsibility of electrical contractor to provide any disconnect required by local code requirements.

Z. The fountain control panel shall be adequately protected from debris and stored properly during construction and prior to initial operation and shall be vacuumed clean and all screws for terminal connections tightened.

AA. The electrical contractor shall ensure that supply voltage is within 5% of design voltage when all equipment is in operation and shall re-tap transformer, up size wire, or supply a buck and boost transformer to get supply voltage to necessary level, if necessary.

BB. Wires for water level sensors must be run in a separate conduit to the fountain control panel.

CC. All conduit penetrations through structure walls into trade areas below the pool structure must have the necessary allowances made for settlement.

DD. Floor mounted motor control centers and transformers for fountain related equipment shall be installed on a 4" concrete housekeeping pad in equipment room.

EE. Contractor installing fountain manufacturer supplied deck boxes in concrete for fountain lighting is to ensure that all open conduit ports are plugged watertight prior to slab pour around deck boxes.

FF. All penetrations through outside walls to below grade shall be sealed per building specifications. Using “easy-link-seals” is recommended.

GG. Any and all costs associated with the above are the responsibility of installing contractor.
3.5 FIELD QUALITY CONTROL

A. Inspection and Testing, General: Labor, materials, instruments, and power for testing shall be furnished by the Contractor. All tests shall be performed to the satisfaction of the Owner, Architect, and such other parties that may have legal jurisdiction. Item or system to be tested shall not be closed up, buried, or covered until testing is completed and owner confirms approval. Prepare reports of testing activities and submit as specified.

1. Reference Division 1 Section 01400 “Quality Requirements” for related and additional provisions.

B. Piping Test:

1. Conduct piping tests before joints are covered and after thrust blocks have been hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Flush out all pipes with clean water prior to performing leak tests.
2. Do not include equipment in tests which could be damaged by high pressure.
3. Automatic water make-up systems shall be thoroughly tested and operative at the time of final observation.
4. Pressure testing requires that a prescribed period of curing / drying time be allowed in order to allow the PVC cement to properly cure and take a permanent set. The following table sets forth the minimum curing period before the required pressure tests. Note that the table applies only to weather temperatures ranging from 50° F. to 90°F. For drying times during temperatures that differ from this, consult the fountain manufacturer.

<table>
<thead>
<tr>
<th>Piping Size</th>
<th>Curing Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5” - 2.5”</td>
<td>8 hours</td>
</tr>
<tr>
<td>3” - 4”</td>
<td>18 hours</td>
</tr>
<tr>
<td>6” - 8”</td>
<td>24 hours</td>
</tr>
<tr>
<td>10” &amp; higher</td>
<td>36 hours</td>
</tr>
</tbody>
</table>

5. A 24-hour static pressure test of 10 ft. above highest vacuum, drainage, or gravity pipe invert elevation shall be performed on all vacuum and or gravity pipe lines using water as the medium. All vacuum and gravity drain piping shall be tested with no loss of water, pressure, or noticeable leaks. All pressure testing shall include a visual check of each joint by the Contractor in the presence of Construction Manager, owner, authorized representative, and/or Architect.

6. The Contractor shall provide all pumps, pressure plugs, gauges, and other instruments and devices necessary to perform the hydrostatic pressure tests specified herein. Each complete discharge piping system shall be hydrostatically tested to a pressure of 150% of the system working pressure. For purposes of this test, system-working pressure shall be defined at 50 PSIG and the hydrostatic test shall be performed at 75 PSIG. Pressure test for at least 8 hours, at which time pressure shall
remain constant, without additional pumping, pressure loss, or noticeable leaks. PSI is required on all pressure piping to include return inlets piping using water as the medium.

7. Pressure test all water piping prior to commencing backfill operations. Hydrostatic (water) testing shall be the only approved method. DO NOT PRESSURE TEST WITH COMPRESSED AIR as severe pipe damage and bodily injury can occur. Do not exceed the rated operational pressure of the piping and/or fittings carrying the lowest pressure rating. Locate and repair any leaks and retest prior to completion of backfill operations.

8. After the system has operated for one week, contractor and owner’s representative shall inspect water make-up rates and agree that water usage is appropriate for a system of this type, are within local ordinances or codes, and that such rates are not indicative of excessive leakage from system. A water meter shall be placed on the fill line for this purpose, if necessary to document precise water usage.

C. Manufacturer’s Field Services:

1. The fountain manufacturer shall be present for a minimum of 4 site coordination meetings, which includes the review of the plans and shop drawings with the mechanical, electrical, and structural disciplines. The fountain manufacturer must be available at the jobsite within a one week notice. The representative shall be a factory employee, not a local representative.

3.6 START UP AND ADJUSTMENTS

A. Manufacturer shall be present for the initial start up of the fountain system.

B. Contractor shall adjust fountain water system for volume and water flow characteristics to reflect design intent as approved by Architect.

C. Contractor shall have the following conditions satisfied prior to departure of personnel from factory.

1. All electrical connections shall be made and tested.
2. All underwater lighting shall be lamped, installed and tested.
3. Thoroughly test all fixtures, services, and all circuits for proper operating conditions and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions.
4. All underwater junction boxes shall be wired and sealed with potting compound.
5. Pump and filter motors shall be power tested to insure proper impeller rotation at specified voltage.
6. Electronic water level control and/or low water cut-off control shall be installed and wired for operation.
7. All hydraulic lines and fittings shall be pressure tested for leaks, repaired as necessary, and flushed clean. Basket strainers shall be checked and cleaned as required.
8. All nozzles, jets, manifolds, headers, and spray apparatus shall be installed properly and flushed of debris as required. Final nozzle adjustment for position and throttling to achieved specified performance for all display discharge points to be performed by installing contractor.

9. Pump vaults, when supplied by manufacturer shall be thoroughly cleaned of debris, tested for electrical integrity and pressure tested for leaks.

10. Chemical feed system, when supplied, shall be filled to proper level with required dosage of chemicals. (Manufacturer does not supply chemicals unless specifically listed in proposal).

11. The fountain basin shall be thoroughly cleaned and filled to proper water level with clean, fresh water.

12. Contractor shall make available to factory personnel a plumber and electrician who have first hand knowledge of the fountain installation, at contractors own expense.

13. Contractor will perform any manual labor or provide any tools for adjustment and start-up.

D. Contractor acknowledges the above requirements and understands that, should above requirements not be completed, factory personnel may immediately cancel visit and return to factory. In such case, Contractor shall be responsible for all costs and expenses incurred by manufacturer.

3.7 DEMONSTRATION

A. Furnish complete on-site instructions and demonstration to owner in the operation, adjustment and maintenance of fountain system.