

**INDEX TO SPECIFICATONS**

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**PART 1: GENERAL****1.1 SCOPE OF WORK**

- .1 This section to be read in conjunction with Bid Documents. This Section applies to and governs each mechanical and electrical section of this Project Manual.
- .2 All drawings and all sections of the specifications apply to and form an integral part of this section.
- .3 Provide fully operational mechanical and electrical systems in complete accordance with applicable codes and bylaws.
- .4 The drawings for mechanical and electrical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and will not be used as an excuse for deficiencies or omissions.
- .5 Follow Manufacturers' recommendations for installation supplemented by contract documents, unless otherwise specified by the Contract Administrator. Any discrepancies must be brought to the Contract Administrator's attention in writing prior to the close of tenders.
- .6 Connect to equipment specified in other sections and to equipment supplied and installed by other Contractors or by the Contract Administrator.

**1.2 DIVISION OF ELECTRICAL WORK FROM MECHANICAL DIVISION**

- .1 Electrical wiring and connections to motors, equipment, controls, and motor starting switches and alarm devices shall be by Division 16.

**1.3 BID DOCUMENTS**

- .1 Examine contract documents from all disciplines including drawings, specification sections, Instructions to Bidders, and General Conditions for information affecting Division 15.
- .2 Refer to the Specification and Drawing Index to assure that sets are complete at time of Tender and during construction period. Report any discrepancies to Contract Administrator prior to tender closing. No adjustments to contract price will be allowed through non-compliance with the above.
- .3 The Contractor shall obtain a ruling from the Contract Administrator in writing before submitting the tender if there is any discrepancy between the drawings and specifications which may result in the true intent and meaning of the plans to be unclear. If no ruling is requested it will be assumed that the most expensive alternative has been included in the tender price.
- .4 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both.
- .5 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.
- .6 In addition to all of the requirements in the contract documents, include recommended installation details and procedures for equipment as found in Manufacturers' technical data.
- .7 Equipment, materials and work shall comply with the requirements of generally recognized agencies, including but not limited to CSA, ULC, CGA, NBFU, NFPA and the requirements of authorities having jurisdiction.
- .8 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.
- .9 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the

general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while there adequate space is allowed for service, maintenance, repair, or replacement for all equipment.

#### 1.4 ELECTRICAL SPECIFICATIONS

- .1 Refer to the Electrical Drawings for complete electrical specifications.

#### 1.5 SITE EXAMINATION

- .1 Visit the site to determine existing conditions and requirements for protection of adjacent work and accept site and existing work as it exists at time of commencement of work. Verify all dimensions at the site.

#### 1.6 SHOP DRAWINGS AND SUBMITTALS

- .1 After award of contract provide and submit shop drawings at least 15 working days before the reviewed submission will be needed. Clearly identify with references to recognized design standards used, and indicate layouts, quantity, details of equipment, control wiring diagrams, sizes, capacities and roughing in and exact requirements for concrete pits, bases and other supporting members. Until the submission is reviewed the work involving relevant products must not proceed.
- .2 Each shop drawing must be certified by manufacturer and as such shall indicate that all product engineering has been performed to ensure the product will meet the requirements of the intended installation.
- .3 Specified products, and/or products listed as equivalent or alternate will not be accepted by the Contract Administrator unless the shop drawings are accompanied by this list.
- .4 Guarantee of delivery, when required, is not conditional on approval of shop drawings unless they are submitted within one month after Contract award.
- .5 All work and equipment shown on shop drawings is taken as part of mechanical or electrical section unless specifically excluded.
- .6 Secure and verify all field dimensions and where fabrication must proceed before these are available, ensure that field dimensions are followed to suit.
- .7 Each shop drawing shall include name of job, subcontractor, equipment supplier and specification clause under which equipment is specified.
- .8 Checking of shop drawings by the Contract Administrator does not constitute acceptance of responsibility. Such checking constitutes assistance only to the Mechanical or Electrical Division in the proper execution of their work.
- .9 Prior to submittal of shop drawings the Contractor shall check and verify that all details have been included and then indicate so by signing each drawing to this effect.
- .10 Submittal requirements: **One copy only** of each shop drawing shall be submitted to the Contract Administrator by fax, as a pdf document by email attachment, or delivered as a hard copy. This copy shall bear all the required marks of certification and approval by the manufacturer and contractor(s) as indicated above. The Contract Administrator will review and mark up one copy of the shop drawing, and return to the contractor by fax or email attachment. The contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.

**NOTE:** ANY SHOP DRAWINGS SUBMITTED THAT DO NOT MEET THE ABOVE REQUIREMENTS WILL BE RETURNED WITHOUT APPROVAL FOR COMPLIANCE AND SHALL BE RESUBMITTED.

#### 1.7 PERMITS, INSPECTION AND TESTING

- .1 File all necessary notices and approved layouts, obtain and pay for all Local Authority and Fire Underwriters Inspections, approvals and permits applicable to each Section. Make changes required to secure Local Authorities approval, without extra cost. Where conflicting requirements occur, comply with most stringent regulation. Note that requirements shown or specified may exceed minimum standards set by Local Authorities.
- .2 The Contract Administrator may request Mechanical or Electrical Section to operate device or material installed for such time as Contract Administrator may require, as a thorough test, before final acceptance. Such tests shall not be construed as evidence of acceptance, and no claim for cost of such operation for test, or damage due to inadequacy or defect will be recognized.
- .3 Note that site reviews by the Contract Administrator are for the purpose of determining in general if the work is proceeding in accordance with the Contract Documents, and to endeavour to guard the Contract Administrator against defects and deficiencies and not to superintend the execution of the work, which is the Contractor's and their Subcontractors' responsibility.

#### **1.8 DELIVERY AND STORAGE**

- .1 Check and do not deliver finished equipment to job until weatherproof dry storage is available.
- .2 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.
- .3 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Perform any cutting and patching involved in getting assemblies into place.
- .4 Continuously check and expedite the flow of necessary information to and from all parties involved.
- .5 Immediately inform the Contract Administrator of any difficulties in delivery of equipment or if any information is required.

#### **1.9 SPECIAL PROTECTION**

- .1 Protect all finished and unfinished work from soiling or damage, cover floors with tarpaulins or plywood as necessary, and repair any damage resulting from work of Mechanical and Electrical Section.
- .2 Protect finished surfaces to remain exposed, by paper, polyethylene or other satisfactory removable protective covering using paste acceptable to fixture manufacturer to prevent possible damage to finishes, until all reason for construction damage has passed and until acceptance by Contract Administrator, and make good any such damage.
- .3 Cover open ends of pipes, fixtures, ductwork, etc. to prevent entry of building rubbish.

#### **1.10 SPECIAL CLEANING**

- .1 Maintain tidiness within work of Mechanical and Electrical Sections and at completion remove protective paper, labels, etc. and tools and waste materials. Leave clean and in perfect operating condition.
- .2 At the end of construction all systems shall be left ready for operation.
- .3 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.
- .4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances within the scope of work area. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions.
- .5 Clean exposed surfaces of equipment, ductwork, piping, etc., and polish plated work.

- .6 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.
- .7 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.
- .8 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

#### 1.11 MAINTENANCE AND OPERATING INSTRUCTIONS

- .1 Provide operation and maintenance data for incorporation into Operating and Maintenance Manuals. Provide two (2) complete manuals.
- .2 Two weeks prior to substantial performance and training, provide one copy of Operating and Maintenance manuals to Contract Administrator for review. Operating and Maintenance manuals will be reviewed by the Contract Administrator and if re-submission is required, Contractor shall ensure that the manuals have been changed to comply before returning them to the Contract Administrator for review again.
- .3 Obtain from each Subcontractor reviewed shop drawings, approved brochures or literature supplied by manufacturers of each piece of equipment, schematics, single line diagrams, performance curves, parts lists, operating instructions, lubrication schedule, and maintenance instructions for inclusion in Operating and Maintenance Manuals.
- .4 Each manual shall be a 8 ½" x 11" capacity heavy-duty catalogue binder. Insert Title Page sheet on the outside front cover, stating Job Name and Address. Binder to be indexed and shall contain at a minimum the following sections:
  - .1 TABLE OF CONTENTS
    - .1 Job name
    - .2 Job name
    - .3 Mechanical Contractor: name, address and telephone number
    - .4 Electrical Contractor: name, address and telephone number
    - .5 Plumbing Contractor: name, address and telephone number
    - .6 Balancing Agency: name, address and telephone number
  - .2 Tab – SUPPLIER INDEX
    - .1 Contact information for Contractor, Subcontractors and Suppliers, including name address, telephone number and item of Work responsible for.
  - .3 Tab – WARRANTY & CERTIFICATION
    - .1 Contractor Warranty letter
    - .2 Inspection Certificate(s) from Authority Having Jurisdiction
    - .3 Copy of test data, equipment alignment certificates, balancing data for air and water systems, valve tag identification and pipe colour code
    - .4 The Contractor is responsible for supplying all of the above material to the commissioning agency
  - .4 Tab – Maintenance and Lubrication
    - .1 Include all the information from your specification.
- .5 In the following equipment tabs, include shop drawings, brochures, and maintenance bulletins
- .6 Tab – CIRCULATION PUMPS
- .7 Tab – INLINE BASKET STRAINER
- .8 Tab – SAND FILTERS
- .9 Tab – U.V. DISINFECTION SYSTEM
- .10 Tab – FLOW METER
- .11 Tab – VALVES

- .12 Tab – ELECTRICAL
- .13 Tab – THERMOMETER & PRESSURE GAUGES
- .14 Tab – ELECTRICAL
- .15 Tab – AS-BUILTS DRAWINGS (11x17 format)
- .5 The divider tabs shall be laminated mylar plastic.
- .6 On completion of performance test, and debugging, provide updates/corrections for the manuals to the Contract Administrator

#### 1.12 TRAINING

- .1 Instruct Contract Administrator's designated employees in proper care, operation, use and maintenance of all systems and equipment, and provide general explanatory literature required and start up supervision and instructions.
- .2 Training must be arranged with the Contract Administrator, and may not be arranged directly with pool staff.
- .3 Contractor will provide a minimum of 8 hours of training.
- .4 Upon completion of instructions, forward to Contract Administrator with a **copy to the Contract Administrator a letter indicating person instructed and dates that the instruction took place**. If in Contract Administrator's opinion, this is not done satisfactorily, Contract Administrator may direct such instruction, and charge all costs involved to relevant section.

#### 1.13 GUARANTEES

- .1 Provide written guarantee that complete installation including materials, work and operation of all equipment provide under Mechanical and Electrical Sections are first class in every respect, subject only to improper usage by Contract Administrator, and make good forthwith when reported all defects which develop within one year from date of acceptance of building by Contract Administrator at no additional cost to the Contract Administrator.
- .2 In addition, guarantee heating and cooling systems through one complete heating or cooling season, as applicable.
- .3 Deliver to the Contract Administrator all equipment manufacturer's guarantees specified in excess of one year.

#### 1.14 FABRICATION AND WORKMANSHIP

- .1 Employ skilled mechanics in their respective trades, under competent supervision, and where required by Provincial or Local regulations holder of acceptable qualification certificates.

#### 1.15 INSTALLATION AND ERECTION

- .1 Mechanical and electrical drawings do not show all the architectural, structural and electrical features. Check by site measurement.
- .2 Drawings show general location and route to be followed by pipes, ducts, etc. Make necessary changes or additions to runs to accommodate structural conditions as built. Location of pipes and other equipment shall be altered without charge, provided change is made before installation. This does not necessitate a change in quantity of materials.
- .3 Where required pipes and ducts are not shown, or are shown diagrammatically, install to conserve headroom with minimum interference to free use of space through which they pass.
- .4 Assume full responsibility for layout of own work and for any damage caused to property of others through improper location or poor workmanship.
- .5 Before installation of equipment which may interfere with interior treatment and use of building, confer with the Contract Administrator and obtain detail drawings or instructions for each location.
- .6 As work progresses and before installing piping, ductwork, fixtures or equipment interfering with interior treatment and use of building, contact Contract

- Administrator for comment. If the Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, the Contractor to bear all subsequent expense to make good the installation.
- .7 Install piping, generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space.
  - .8 Where space is indicated as reserve for future equipment, leave clear and install piping and other work so that connections can be made to future equipment.
  - .9 Become familiar with work required of other sections, and the progress schedule. Co-operate with others whose work adjoins, to minimize delays and avoid confliction.
  - .10 Secure approval where necessary to cut holes in either finished or unfinished work, employ section whose work is involved, cut openings no larger than necessary and without damage to adjoining work and carefully repair all damage to match adjacent work. Note the Mechanical and Electrical Divisions are responsible for all required cutting and patching relating to this Contract, except as specifically noted otherwise.
  - .11 Provide and set bolts, templates, sleeves and fixing materials for fixing work under this section securely to work provided under other sections, in advance of other work, where required.
  - .12 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. All work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.
  - .13 Spaces reserved for equipment noted as future or allowances made for future extension to buildings, to be left clear so that future connections can be made. Provide adequate clear space for Contract Administrator supplied equipment and connections for such equipment. Provide detailed layouts for checking and approval by Contract Administrator before commencing work.
  - .14 Locate all openings in walls, partitions, beams, etc. required for installation of ducts, pipes and equipment, etc. specified in this section of the specifications and frame all openings as required.

#### 1.16 MATERIALS

- .1 As specified under respective sections.
- .2 Materials of same general type shall be of same manufacturer, i.e., centrifugal fans, in-line fans, condensate pumps, heating coils, etc.
- .3 Submit copies of orders for all materials and equipment as evidence of purchase within 30 days of contract award.

#### 1.17 ELECTRICAL REQUIREMENTS

- .1 Motors and electrical equipment supplied under Mechanical Division shall comply with Electrical Section and electrical characteristics scheduled or shown.
- .2 See "Installation and Wiring Controls" in Electrical Section for equipment supplied under Electrical Section.
- .3 The Electrical section shall provide starters for all motors and wire from starters to motors, unless otherwise indicated.
- .4 The Electrical section shall wire between starters and switching components such as relays, float switches, and pressure switches.
- .5 Supply to Electrical Section within four (4) weeks after contract award, fully detailed diagrams of power and control wiring required for equipment supplied by Division 15.
- .6 Motors shall be squirrel cage induction type 1800 RPM unless otherwise noted. Where dampness occurs, all motors and electrical apparatus such as float

switches, etc. supplied integrally with any piece of apparatus, shall be totally enclosed.

- .7 All motors 1 hp and larger shall be high efficiency as defined in CSA C390.

#### 1.18 AS-BUILT DRAWINGS

- .1 An extra set of clean prints will be issued to each Mechanical and Electrical Section by the Contractor. Mark up as job progresses, and provide to Contract Administrator one full-size set of "As-built" prints as a complete and accurate record "As-Built" of all mechanical and electrical work. Drawings should be signed and dated by the contractor. As-built drawings shall be complete with invert elevations for all new underground services.
- .2 To satisfy Total Performance, Contractor will create and provide one (1) AutoCAD drawing file on CD, and three (3) full-size hard copy prints of the AutoCAD file. Hard copy drawings must be marked "As-Built", and must be signed and dated by Contractor to signify their accuracy.

#### 1.19 SUPPORTS, BASES AND PITS

- .1 Supply and erect all special structural work required for installation of tanks, pumps, motors and other apparatus and supply and install all anchor bolts and fasteners for building in and instruct and direct exact sized and locations for bases required. Each Mechanical Section shall provide and install machinery vibration isolation pads wherever required, whether particularly shown or not. Unless otherwise indicated on drawings, mount all major pieces of equipment such as pumps, fans, etc. on 100 mm (4") high concrete pads, generally in accordance with standard details and to suit.

#### 1.20 TEMPORARY WORK

- .1 Supply office, workshop, tools and materials storage as required for work under Mechanical and Electrical Sections conforming in appearance to Contractor's temporary buildings and be responsible for any loss or damage thereto.

#### 1.21 ALTERATION WORK

- .1 Where work is to be done in existing buildings, accurately survey, provide for avoidance of damage and interference to existing work and rectify any such damage due to work under Mechanical or Electrical Sections. Accept existing work as it exists at time of tendering.
- .2 Carefully dismantle existing mechanical or electrical equipment to be removed or relocated. Temporarily disconnect, remove, and reinstall existing equipment, piping, ductwork, conduit, light fixtures, and similar items, which interfere with the new installation after completion of new work. Store equipment and materials on the premises as directed by the Contract Administrator.
- .3 All usable salvaged equipment and materials shall remain the property of the Contract Administrator unless specifically noted otherwise. Such material shall be removed from the building and be safely and neatly stored on the site for removal by the Contract Administrator. The Contractor shall remove all rejected salvage from the site and legally dispose of it off site.
- .4 Reuse existing equipment in new work after first repairing and reconditioning any defective items where noted. Safely cap and seal disconnected services within finished surfaces.
- .5 The abandonment of existing equipment and material in place is not acceptable. All redundant services are to be removed back to active mains, which shall then be capped at existing point of connection.
- .6 All equipment conflicting with new equipment being installed shall be moved or disconnected, without damage, by Contractor and shall remain property of the Contract Administrator. Remove ducts and piping not required in revised systems



and interfering with new installation. This material shall become property of Contractor.

- .7 Disconnect existing equipment indicated, intended to be reused, rough-in in new position, and after replacement connect up ready for use.
- .8 Removal and relocation of equipment by relevant Sections.

### 1.22 WORK FOR OTHER TRADES

- .1 The Contractor shall rough-in for and/or connect up all equipment requiring mechanical services, as shown on drawings or mentioned elsewhere in the specifications.
- .2 The Electrical Sub-Contractor shall rough-in for and/or connect up all equipment requiring electrical services, as shown on drawings or mentioned elsewhere in the specifications.
- .3 Supply other trades with all necessary details, rough-in drawings, wiring diagrams, etc. as required.

### 1.23 ABBREVIATIONS

A.S.H.R.A.E.	-	American Society of Heating, Refrigerating and Air Conditioning Engineers Inc.
A.S.A.	-	American Standards Association
A.S.M.E.	-	American Society of Mechanical Engineers
A.S.T.M.	-	American Society for Testing Materials
A.W.W.A.	-	American Water Works Association
C.E.M.A.	-	Canadian Electrical Manufacturer's Association
C.F.M.	-	Cubic Feet per Minute
C.F.U.A.	-	Canadian Fire Underwriters Association
C.I.	-	Cast Iron
C.O.	-	Clean Out
C.P.	-	Chromium Plated
C.S.A.	-	Canadian Standards Association
D.B.I.U.	-	Dominion Board of Insurance Underwriters
F.P.M.	-	Feet per Minute
G.P.H.	-	Gallons per Hour
G.P.M.	-	Gallons per Minute
H.P.	-	High Pressure or Horsepower
N.B.F.U.	-	National Board of Fire Underwriters
N.F.P.A.	-	National Fire Prevention Association
O.S. & Y.	-	Outside Screw and Yoke
P.S.I.	-	Pounds per Square Inch
P.S.I.G.	-	Pounds per Square Inch Gauge
R.P.M.	-	Revolutions per Minute
S.P.	-	Static Pressure
U.S.	-	United States (usually combined with other abbreviations)

Other abbreviations will be interpreted as referred to in the American Society of Heating, Refrigerating and Air Conditioning (A.S.H.R.A.E.) Handbook, current edition.

**1.1 RELATED WORK**

- .1 The General Conditions and General Specifications form an integral part of this specification and must be read in conjunction herewith. Read also and be fully cognizant of all Mechanical Sections.

**1.2 SCOPE OF WORK**

- .1 Schedule of Pipe and Fittings
- .2 Installation of Piping
  - .1 Valves
  - .2 Hangers and Supports
  - .3 Strainers, Thermometers and Pressure Gauges

**MATERIALS****2.1 SCHEDULE OF PIPE AND FITTINGS**

- .1 Interior Water Piping (Cold, Hot and Recirculating):
  - .1 CPVC tubing, rated to 180°F and 100psi. Compatible fittings must be used approved by pipe manufacturer.
  - .2 Use only AquaRise cement and primer and install system as per manufacturer.
  - .3 All metal to CPVC thread transitions shall be made using stainless steel reinforced female adaptors.
  - .4 Not permitted for use in vertical shafts
  - .5 **Standard of Acceptance:**
    - .1 IPEX AquaRise.
- .2 Pool Water Distribution Piping
  - .1 Pool water piping up to 50mm (2") Sch 40 pipe Type 1 Grade 1 PVC conforming to A.S.T.M. D1785 and C.S.A. B137.0/B137.3, rated to 60°C (140°F) at working pressure.
  - .2 Pool water piping larger than 50mm (2") Sch 80 pipe Type 1 Grade 1 PVC conforming to A.S.T.M. D1785 and C.S.A. B137.0/B137.3, rated to 60°C (140°F) at working pressure.
  - .3 Fittings shall be PVC of similar materials, schedule and be compatible approved by pipe manufacturer. Fittings shall conform to ASTM D2467.
  - .4 Flanges shall be Sch 80 PCV Vanstone style 150 lb bolt pattern.
  - .5 Fabricated fittings shall have the same pressure rating as that of the C.S.A. certified pipe used in the fabrication and be fibreglass reinforced.
  - .6 Use only cement and primer approved for installation as a system as per manufacturer.
  - .7 All metal to PVC thread transitions shall be made using stainless steel reinforced female adaptors.
  - .8 **Standard of Acceptance:**
    - .1 IPEX Xirtec 140
- .3 Dielectric Couplings
  - .1 Install dielectric couplings in all locations where dissimilar metals are joined. Couplings are to be compatible with and suit the pressure rating of the system.
  - .2 Isolating unions shall be used on pipes 50 mm (2") and smaller.
  - .3 Isolating flanges shall be used on pipes 63 mm (2-1/2") and larger.

**2.2 PIPE AND FITTINGS MATERIAL STANDARDS**

- .1 Pool Water Distribution Pipe
  - .1 PCV piping shall conform to A.S.T.M. D1785.
- .2 Fittings
  - .1 All fittings for PVC piping shall conform to A.S.T.M D2467.

- .3 Flanges and Gaskets
  - .1 Forged carbon steel slip-on welding flanges shall conform to A.S.T.M. Specification A-181, Grade 1.
  - .2 Square headed steel bolts and hexagon nuts for flanges shall conform to A.S.T.M. Specification A-107.
  - .3 Flange facings shall have a serrated finish with raised face.
  - .4 All companion flanges on valves and equipment shall have flat or raised faces, to match the flange on the valve or equipment.
  - .5 All forged steel flanges shall be of Crane manufacture.
  - .6 All PVC flanges shall be Van Stone style 150 lb.
  - .7 All flange gaskets shall be pre-formed non-asbestos type.
  - .8 Site and shop cut gaskets will not be permitted.

### 2.3 VALVES

- .1 The Mechanical Division shall supply and install all valves called for elsewhere in the specification or shown on the drawings in accordance with the following general specifications. Any valves not specifically covered herein shall be of comparable quality to those specified.
- .2 All valves shall be as far as possible the products of a single manufacturer. After the Contract is awarded, the Mechanical Division shall submit a brochure of the valves he proposes to install showing make, number and use. Globe valve discs must be of a type recommended for the services.
- .3 Where possible, valves shall be installed with the valve bonnet in an upright position to prevent deterioration or corrosion of the bonnet and packing.
- .4 Valve body materials shall be compatible with piping system materials. Valves shall meet all pressure, temperature, and fluid handling requirements of the system.
- .5 A valve drain shall be provided at the base of each riser and at the low points of the system. Manual air vents shall be provided at the top of each riser and at the high points of the system.
- .6 Ball valves and butterfly valves shall be used in place of gate valves providing they meet the pressure, temperature, and fluid handling requirements of the system.
- .7 Isolation shutoff valves shall be installed at each piece of equipment and each branch takeoff to facilitate shutdown for repair.
- .8 Drain valves up to and including 19 mm (3/4") shall be compression stops or hose bibbs, rough brass, with garden hose thread outlet.
- .9 Valve Schedule
  - .1 Pool Water Distribution Valves:
    - .1 Up to 50mm (2"): Ball valves body, stem, ball and unions shall be made of PVC compound which meets or exceeds the requirements of cell classification 12454 according to A.S.T.M. D1784. Seats shall be PTFE which shall comply with NSF-61. Working pressure of 1.6 MPa (232 psi) at 23°C (73°F). Valve to be equal to IPEX VXE ball valve.
    - .2 63mm to 100mm (2½" to 4"): Ball valves body, stem, ball and unions shall be made of PVC compound which meets or exceeds the requirements of cell classification 12454 according to A.S.T.M. D1784. Seats shall be PTFE which shall comply with NSF-61. Working pressure of 1.6 MPa (232 psi) at 23°C (73°F). Shall be provided with locking lever handle. Valve to be equal to IPEX VKD ball valve.
    - .3 100mm to 350mm (4" to 14"): Flanged PVC butterfly valves wafer style with gear operators. Valve body shall be glass reinforced polypropylene (GRPP). Valve disk shall be made of polypropylene. Disk liner and O-ring seals shall be EPDM. Valve shaft to be Stainless Steel. Valve to be equal to IPEX FK Series.

- .4 Isolation/Shut-off valves 63mm (2½") and over: Shall be as per the above Flanged PVC valve with a locking lever handle in-place of a mounted gear. Refer to drawings for locations of lever-handle or wheel-handle valves.
- .5 Check valves: Valve body, cover, hinge arm, and disc shall be made of stainless steel, Type 316 meeting ASTM A351 CF8M. Gaskets and seals to be made of PTFE. Valve must be minimum Class 150. Valves to be equal to Crane Figure 377.

#### 2.4 HANGERS AND SUPPORTS

- .1 Provide adjustable Clevis type equal to Grinnell Fig. 65 for pipe sizes up to and including 50mm (2"). For pipe sizes 62mm (2½") and over, provide adjustable Clevis type equal to Grinnell Fig. 260 size to suit O.D. of insulation.
- .2 Plastic and Other Types of Piping: Support devices as recommended by Manufacturer. Spacing 1200 mm (4') or according to manufacturer.
- .3 All pipe hangers and trapeze hangers shall be supported by mild steel rod of the correct diameter to suit the hanger, as recommended by the manufacturer.
- .4 The load on any hanger rod shall not exceed the capacity indicated in the following table:
 

2.1	Rod Diameter	Max. Safe Load
2.2	10 mm (3/8")	610 lbs.
2.3	13 mm (1/2")	1130 lbs.
2.4	16 mm (5/8")	1810 lbs.
2.5	19 mm (3/4")	2710 lbs.
- .5 Provide fabricated steel supports as required to adequately support piping and equipment. Details to be approved by Contract Administrator.
- .6 Above indicates general requirements. Provide hangers and supports of equal quality to suit job requirements where not covered by the above.
- .7 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.
- .8 Hangers to be adjustable after pipe is in place. Parts must be of adequate strength for weight to be supported with safety factor of 5 to 1.

#### 2.5 THERMOMETERS

- .1 Thermometers to be bi-metal dial thermometers, having stainless steel cases and rings with stainless steel stems, brass separable thermowells. Scale range to be as follows:
  - .1 10°C (50°F) to 150°C (300°F).
- .2 Thermometers to have 125 mm (5") diameter dials. Use back or bottom inlet stems, whichever is best suited for ease of reading.
- .3 Separable wells to have insulation extensions, where mounted on insulated piping or equipment, to ensure dials are clear. Stem and wells to be immersed in liquid flow, minimum length of stems to be 150 mm (6").
- .4 Where a separable well is mounted in pipe 38 mm (1½") diameter or less enlarge pipe to 50 mm (2") diameter, for well length plus 75 mm (3").
- .5 **Standard of Acceptance:**
  - .1 Winter's
  - .2 Terice

#### 2.6 PRESSURE GAUGES

- .1 Pressure gauges on suction and discharges of pumps and where noted shall be 1% full scale quality gauges having bronze geared movements, bronze bourbon tube, friction glass cover and precision type pointer. Where noted or shown at 1/2% full scale is required.

- .2 Gauges to be liquid filled.
- .3 Use 150 mm (6") dial. Gauges chosen with indicating needle at 12 o'clock position for normal operating pressure.
- .4 Gauges to have A10 brass tee handle cock. Install MSB4 adjustable snubbers on pump gauges. When a gauge is to be used for steam install type AO31 iron (schedule 40) siphon.
- .5 Gauges, subject to vibration, shall have copper tube extension and shall be located away from source of vibration; preferably on an adjacent wall or other stable mounting surface.
- .6 Casing to be stainless steel.
- .7 For pump discharge: Dual scale ranges: 0-30psi / 0-200 kPa,.
- .8 For pump suction: Dual scale ranges: -30 in Hg to 30 psi / -100 kPa to 200 kPa,.
- .9 **Standard of Acceptance:**
  - .1 Winter's
  - .2 Terrice

## 2.7 SUPPORTS, BASES, PADS, AND PITS

- .1 Provide all special structural work required for installation of tanks, piping, pumps, fans, motors and other apparatus.
- .2 Concrete pads, concrete for floating bases, curbs and pits to be supplied under Division 15.
- .3 Supply all anchor bolts, fasteners and foundation drawings.
- .4 Unless noted otherwise, provide housekeeping pads (equipment bases) at least 100mm (4") high under all floor-mounted equipment and as shown on the drawings. Each pad shall extend 150mm (6") beyond the outside dimensions of the supported equipment. Housekeeping pad shall be reinforced with 10M @ 16" on-centre each-way top. Provide 10M hooked dowels at 16" on-centre around perimeter drilled in and epoxy-grouted min. 4" into existing floor. Concrete shall be Class N, 25 MPa, 20mm aggregate.
- .5 Where not detailed elsewhere, mount equipment suspended above floor level on platform bracketed from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

## EXECUTION PROCEDURES

### 3.1 GENERAL INSTALLATION OF PIPING

- .1 All pipe shall be cut accurately to measurements taken at the site and shall be installed without springing or forcing. All changes in direction shall be made with fittings.
- .2 All PVC and CPVC pipe socket connections are to be with manufacturer-approved cement and primer.
- .3 Install check valves on the discharge piping as noted on the drawings and shut-off valves on the suction and discharge piping at each pump.
- .4 Run piping parallel to walls and in such a manner as to be as unobtrusive as possible when viewed from inside or outside of building. Install drain cocks on each pump and at other locations in mechanical rooms where shown on the drawings and pipe to nearest floor drain.
- .5 The inside of all pipe, fittings, valves and all other equipment shall be smooth, clean and free from blisters, loose mill scale, sand and dirt when erected.
- .6 Install shut off valves directly upstream of unions or flanges at each item of equipment.

### 3.2 POOL WATER DISTRIBUTION SERVICES

- .1 All PVC and CPVC piping to be assembled as per manufacturer's recommendations.

- .2 All reductions in pipe size shall be made by using eccentric reducers or eccentric reducing couplings.

### 3.3 VALVES

- .1 All valves must be installed with stems upright or horizontal; not inverted. Valve operators for each valve shall be located to facilitate ease of use by the Owner. Confirm orientation with drawings or obtain clarification prior to installation.

### 3.4 HANGERS AND SUPPORTS

- .1 All piping and equipment shall be securely supported from the building structure. Perforated strap or wire hangers will not be permitted.
- .2 Hangers in new concrete structural floor systems shall be supported by inserts placed prior to pouring of concrete. Inserts shall be Grinnell cast iron or wrought steel adjustable type.
- .3 Where hangers must be installed in existing concrete slabs, approved expansion type inserts shall be used, or if heavy weights must be supported, a hole shall be drilled through the slab and a 50 mm x 50 mm (2" x 2") washer and nut installed above rough slab before the floor finish is poured.
- .4 Where desired, several individual hanger rods may be supported from a trapeze.
- .5 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use 2 nuts on each rod, one above the clevis or angle iron and one below.
- .6 Where pipes or equipment are supported from floors or walls, structural steel supports shall be fabricated, using welded joints except where provision is made for adjustment. Where details of construction are not indicated, drawings shall be submitted to Contract Administrator for approval before fabrication.
- .7 Clamps should be located immediately below a coupling if possible. Risers up to 50 mm (2") size shall be braced at intervals not over 2100 mm (7').
- .8 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc.

### 3.5 TESTING

- .1 All tests shall be carried out fully in accordance with the following time pressure requirements and also in accordance with any regulations and requirements of authorities having jurisdiction.
- .2 Pressure test the PVC piping systems according to manufacturer's recommendations.
- .3 All tests shall be made with compressed air. If the contractor wishes to use water for any system test, the Engineer must be contacted for approval and requirements on methods and procedures.
- .4 All piping on the various services, which has to be concealed prior to the completion of the service as a whole, shall be tested in sections to the pressures and for the periods specified, prior to the piping being concealed. All tests shall be witnessed by the Contract Administrator's representative. Two (2) working days prior, notice shall be given to the Contract Administrator of when such tests shall take place. All test pressures specified shall be the pressure as registered at the highest point of the system. When sections of systems are being tested, the additional pressure developed by the static head of the remainder of the system, above the section being tested, shall be added to the specified test pressure.
- .5 Make good any leaks, replace defective parts, and retest until system is satisfactory and adjust until system functions correctly.

**1.1 RELATED WORK**

- .1 The General Conditions and General Specifications form an integral part of this specification and must be read in conjunction herewith. Read also and be fully cognizant of all Mechanical Sections.

**1.2 EQUIPMENT IDENTIFICATION**

- .1 Manufacturer's Nameplate
  - .1 Provide metal nameplate on each piece of equipment, mechanically fastened with raised or recessed letters.
  - .2 Provide Underwriters Laboratories and/or CSA registration plates, as required by respective agency.
  - .3 Manufacturer's nameplate to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
  - .4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.
- .2 System Nameplates
  - .1 Provide laminated plastic plates with black face and white centre of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment.
  - .2 Fasten nameplates securely in conspicuous place. Where nameplates can not be mounted on cool surface, provide stand-offs.
  - .3 Identify equipment type and number (e.g. Pump No. 2) and service or areas or zone of building served (e.g. Pool Water Primary).
  - .4 Submit list of nameplates for review prior to engraving.

**1.3 PIPING**

- .1 Identify medium in piping with markers showing directional flow arrows in accordance with CGSB 24-GP03A.
- .2 Apply primary colours and secondary colour bands on finished piping surfaces, in exposed areas only to indicate type and degree of hazard.
- .3 Manufactured Pipe Markers and Colour Bands:
  - .1 Plastic coated cloth material with protective over coating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 150°C and intermittent temperature of 200°C. Apply to prepared surfaces.
  - .2 50 mm wide tape single wrap around pipe or pipe covering with ends overlapping one pipe diameter but not less than 25 mm for colour bands.
  - .3 All new pipes to have directional arrows. Direction arrows 150 mm long by 50 mm wide for piping of 75 mm nominal or larger o.d. including insulation and 100 mm long by 20 mm wide for smaller diameters. Use double-headed arrows where direction of flow is reversible.
  - .4 Waterproof and heat resistant plastic marker tags for pipes and tubing 20 mm nominal and smaller.
  - .5 Black pipe marker letters and direction arrows.
  - .6 Where colours differ submit legends with colour classifications to Contract Administrator for approval before ordering
  - .7 Location
    - .1 Locate markers and classify colours on piping systems so they can be seen from floor or platform.
    - .2 Piping runs at least once in each room.
    - .3 Maximum 50 ft (15 m) between identifications in open areas.
    - .4 Both sides where piping passes through walls, partitions and floors.

- .5 At point of entry and leaving, where piping is concealed in pipe chase or other confined space, at each access opening.
- .6 At major manual and automatic valves immediately upstream of valves.
- .7 Identify branch, equipment or building served after valve.
- .8 Table: Pipe Identification:

Pipe Marker Legend	Primary Color	Secondary Color
Pool Water Supply	Light Blue	Red
Pool Water Return	Light Blue	Black
Boiler Water Supply	Dark Blue	Light Blue
Boiler Water Return	Dark Blue	Red

**1.4 VALVES AND CONTROLLERS**

- .1 Provide brass tags with 12 mm stamped code lettering and numbers filled with black point, secure with non-ferrous chains or "S" hooks for valves and operating controllers.
- .2 Provide Contract Administrator with identification flow diagrams for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.
- .3 Install in main mechanical room or where otherwise directed one copy of the flow diagram and one Valve Schedule mounted in a glazed frame. Provide one copy in each operating maintenance instruction manual.
- .4 Consecutively number valves in system.



**GENERAL****1.1 GENERAL REQUIREMENTS**

- .1 The General Conditions and General Specifications form an integral part of this specification and must be read in conjunction herewith. Read also and be fully cognizant of all Mechanical Sections.

**1.2 SCOPE OF WORK**

- .1 This section shall provide all labour, material, equipment and services necessary for and reasonable incidental to the supply and installation of the pool pumping and filtering system as shown on the drawings and hereinafter specified. Generally this shall include the following:
  - .1 The demolition of existing pump, pad and various section of piping.
  - .2 The demolition of existing soda ash system.
  - .3 The supply and installation of new pool pumps and piping distribution.
  - .4 The supply and installation of new sand filters.
  - .5 The supply and installation of flow meter.
  - .6 The supply and installation of an Ultraviolet Treatment System.

**1.3 GENERAL REQUIREMENTS AND PROCEDURE**

- .1 Refer to Section 15010 and 15050 for general requirements and installation procedure.

**1.4 SOUND CONTROL AND ISOLATION**

- .1 This section shall supply to Section 15050 approved drawings of all equipment to be isolated.
- .2 All bases shall be shimmed level so that all piping connections can be made to a rigid system, at the operating level, before isolator adjustment is made.
- .3 Pump bases shall be grouted to the concrete clean-up pads. Grout completely within pump frame to the top elevation of the frame.
- .4 The Contractor shall supply all necessary structural steel wherever equipment is not sufficiently rigid for isolator point loading.

**MATERIALS****2.1 CIRCULATING PUMPS - GENERAL**

- .1 Supply and install circulating pumps where shown on the drawings, of the size and type and capacity as indicated in the Pump Schedule.
- .2 The complete pumping unit shall be suitable for the service shown in the Pump Schedule and the pump manufacturer shall conduct running tests to verify the conditions of head capacity specified.
- .3 Renewable bronze wearing rings shall be provided on both the impeller and the wheel to prevent wear.
- .4 The pump manufacturer shall include checking and aligning all pumps prior to start up.
- .5 All piping adjacent to each pump shall be adequately supported from the structure so that no weight is carried on the pump casings. In addition, long sweep elbows shall be used on each pump section and discharge.
- .6 See clause "Sound Control" for vibration isolators.
- .7 The standby pump shall be cross-connected with the other pumps as detailed.

**2.2 BASE-MOUNTED END-SUCTION PUMPS**

- .1 Furnish and install pumps with performance characteristics as shown on plans. The pumps shall be long coupled, base mounted, single stage, end suction, vertical split case design, in cast iron bronze fitted construction specifically

- designed for quiet operation. Suitable standard operations at 225° F and 175 PSIG working pressure or optional operations at up to 250° F and 250 PSIG working pressures. Working pressures shall not be de-rated at temperatures up to 250F. The pump internals shall be capable of being serviced without disturbing piping connections, electrical motor connections or pump to motor alignment.
- .2 The pumps shall be composed of three separable components a motor, bearing assembly, and pump end (wet end). The motor shaft shall be connected to the pump shaft via a replaceable flexible coupler.
- .3 All wetted components are to be epoxy coated for use with chlorinated pool water.
- .4 A bearing assembly shall support the shaft via two heavy-duty regreaseable ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreaseable without removal of the bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.
- .5 The bearing assembly shall have a solid SAE1144 steel shaft. A non-ferrous shaft sleeve shall be employed to completely cover the wetted area under the seal.
- .6 Pump shall be equipped with an internally flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have a brass housing, Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.
- .7 Bearing assembly shaft shall connect to a bronze impeller. Impeller shall be both hydraulically and dynamically balanced to ANSI/HI grade G6.3 and keyed to the shaft and secured by a stainless steel locking capscrew or nut.
- .8 Pump should be designed to allow for true back pull-out allowing access to the pump's working components, without disturbing motor or piping, for ease of maintenance.
- .9 A centre drop-out type EPDM coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor.
- .10 An ANSI and OSHA rated coupler guard shall shield the coupler during operation. Coupler guard shall be dual rated ANSI and OSHA compliant coupling guard and contain viewing windows for inspection of the coupling. No more than .25 inches of either rotating assembly shall be visible beyond the coupling guard.
- .11 Pump volute shall be of a cast bronze design with integrally cast pedestal volute support, rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges. Volute shall include gauge ports at nozzles, and vent and drain ports.
- .12 Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to the standards outlined in EPACK 92.
- .13 Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI for Horizontal Baseplate Design standards.
- .14 Pump shall be of a maintainable design and for ease of maintenance should use machine fit parts and not press fit components.
- .15 The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI for recommended acceptable unfiltered field vibration limits for pumps with rolling contact bearings.

- .16 Pump shall conform to ANSI/HI standard for Preferred Operating Region (POR) unless otherwise approved by the engineer. The pump NPSH shall conform to the ANSI/HI standards for Centrifugal and Vertical Pumps for NPSH Margin.
- .17 Pump manufacturer shall be ISO-9001 certified.
- .18 Pump impeller shall be factory-supplied to match the performance specifications in the schedule.
- .19 Impeller trimming is to be by factory certified personnel and shall be completed such that the work does not void any warranty.
- .20 The contractor and/or pump supplier shall be responsible for covering any costs associated with the impeller trim in order to meet the balance requirements.
- .21 See clause "Sound Control" for vibration isolators.
- .22 Each pump shall be factory tested and name-plated before shipment.
- .23 **Standard of Acceptance:**
  - .1 Bell & Gossett Model 1510
  - .2 Armstrong 4030

### 2.3 ELECTROMAGNETIC FLOW METER

- .1 Meter shall be capable of operation in pool environment.
- .2 ANSI 150 10" stainless-steel (316L SS) flange connections.
- .3 Stainless-steel connection box.
- .4 Stainless-steel (316L SS) electrodes (replaceable).
- .5 IFC100 wall-mount converter display panel.
- .6 Controls and wiring for remote read-out panel.
- .7 Nominal pipe diameter of piping serving meter to be nominal size of meter.
- .8 The elements shall be located and installed in accordance with the manufacturer's recommendations and shall be installed in the horizontal position. Note straight pipe requirements before and after meter.
- .9 Digital flow measurement display to be provided with measuring element. Display is to be wired by Division 15.
- .10 **Standard of Acceptance:**
  - .1 Krohne Enviromag 2000 VB15 (10" diameter).
  - .2 Krohne IFC100 display panel.

### 2.4 ULTRA VIOLET (UV) TREATMENT SYSTEM

- .1 Supply and install UV treatment system of size and capacity as noted in the contract documents.
- .2 The UV treatment system shall be of a two medium pressure lamp design, flow through configuration, designed for pool applications. System shall come complete with treatment chamber and control system.
- .3 Lamp power shall be 3.0 kW each.
- .4 Treatment chamber shall be constructed of 316L stainless steel and rated for 150 psi at operating temperature. Chamber shall come complete with temperature probes, UV monitor probes, and automatic quartz wipers, integral strainer.
- .5 The unit shall be supplied complete with an integral 600V-480V transformer.
- .6 Control system shall:
  - .1 Provide control and protection of the UV system.
  - .2 Controller shall be complete with contacts for pump control.
  - .3 Come complete in a NEMA 12 rated cabinet
- .7 Electrical connections by Division 16.
- .8 **Standard of Acceptance:**
  - .1 ECOFLO II ECF-230-10
  - .2 Control Panel ECF-A-30

**2.5 SAND FILTERS**

- .1 Assembly: pressure sand-and-gravel type consisting of filter tanks, face piping with butterfly valves, and gauge panel.
- .2 The filter system specified under this section shall be of a pressurized design and shall consist of "Non-Corrosive" Horizontal Hi-Rate Permanent Media Filter(s).
- .3 The filter system shall be of the horizontal type requiring one grade of filter media and shall have a maximum flow of 20 U.S. gallons/minute (13.6 liters/second) per square foot (square meter) of filter area. The filter tank shall be able to serve as the bottom tank in a stacked tank-on-tank filter system.
- .4 The filter tank system shall consist of a 34" (863 mm) horizontal filter tank(s), internal overhead distribution system, internal lower collection system, gauge panel with 2-60 PSIG (400 kPa) gauges, internal automatic air relief, external air relief with a manually adjusted shut off valve, integrally molded 12" x 16" (303 mm x 406 mm) manhole, integrally molded drain/dump port, 2-FRP bottom saddle supports and 2- FRP top saddle supports. The filter system shall be fabricated in a fully assembled state by the original equipment manufacturer, then disassembled for shipping to prevent damage to internal parts or face piping.
- .5 The horizontal filter tank(s) shall be 34" (863 mm) in diameter with a total length of 91.5" (2324 mm) without face piping.
- .6 A 12" x 16" (303 mm x 406 mm) integrally molded manhole complete with FRP/ acrylic cover, o-ring, bolt and yoke, shall be located at a 40 degree angle in the body of the filter tank(s). All o-ring contact points on the manhole port of the body and manhole cover shall have a smooth finish to provide a continuous watertight seal.
- .7 An integrally molded 2" (50 mm) combination media dump port and drain complete with an ABS media retainer shall be located in the filter tank(s) body.
- .8 The filter shall have 4" (100 mm) influent and effluent connections that are integrally molded. A continuous, watertight exterior seal at the influent and effluent ports of the filter tank(s) shall be provided with the use of integrally molded flange connections. Support brackets shall be provided for the upper distribution and lower collection headers on the interior of the dished head opposite to the influent and effluent flanged connections. The filter tank(s) shall be mounted on two FRP saddle supports and shall have two additional saddle supports attached to the top of the tank. The top saddle supports shall provide self-alignment of the top tank to the bottom tank in a stacked tank configuration while preventing lateral movement of the top tank.
- .9 Internal filter tank equipment shall include an upper distribution system and lower collection system, hydraulically balanced to prevent turbulence and/or displacement of the filter media during service operation or backwash. Standard pipe arrangement or an internal valving system will not be acceptable.
- .10 The upper distribution system shall include hydraulic distribution lenses; injection molded ABS plastic, located in multiple sets of two over the filter bed. They shall be joined to the influent flange connection by means of an o-ring seal to a 4" (100 mm) Sch 80 header, 1 1/4" (32 mm) PVC nipples and elbows.
- .11 The lower collection system shall include 2" (50 mm) laterals; injection molded ABS plastic, designed to retain multiple types of granular filter media or a single grade of #20 silica sand. The laterals shall be strategically placed to produce minimum head loss while providing full filter bed coverage. The laterals shall be self-cleaning through the use of a molded V slot configuration, which promotes thorough filter media cleansing through balanced fluidization during backwash. They shall be joined to the effluent flange connection by means of an o-ring seal to a 4" (100 mm) Sch 80 header.

- .12 Filter media shall consist of uniformly graded silica with a minimum combined mean percent of silica by weight of 90%, which shall be free of limestone or clay. The media shall be angularly shaped particles of #20 grade silica with an effective size range .45-.55 mm, roundness value between 0.0 and 0.15 and a uniformity coefficient of 1.5 maximum.
- .13 Round or Sub-rounded particle shapes are not acceptable as suitable media. The specific gravity of the media shall not be less than 2.5 with a minimum hardness of 7 mhos. The filter(s) will require a filter bed depth, which shall extend to an approximate level of 8.7" (219 mm) below the top of the hydraulic distribution lenses.
- .14 The filter system shall be certified by NSF International to ANSI / NSF Standard 50 for use with zeolite filter media as well. The zeolite media shall be uniformly graded with an effective size of .55mm, roundness value of 0.68 and a uniformity coefficient of 1.64 maximum. The specific gravity of the media shall not be less than 1.73 with an ASTM-131 abrasion resistance number of 20, grading C, 500 revolutions. The filter(s) will require a filter bed depth, which shall extend to an approximate level of 9.81" (250 mm) below the top of the hydraulic distribution lenses.
- .15
- .16 The pressure gauge panel shall consist of two 2½" (63 mm) diameter gauges scaled from 0-60 PSIG (0 to 400 kPa). The pressure gauges shall be mounted in a molded FRP panel with a printed system nameplate. The pressure gauges shall be connected to influent and effluent pressure points with air relief cocks, compression fittings and semi-rigid PVC tubing.
- .17 The filter system shall be certified by NSF International to ANSI/ NSF Standard 50 for pool/ spa and salt water applications.
- .18 Performance:
  - .1 Flow rate: 292 gpm.
  - .2 Filter rate 5-20: 97 gpm; 386 gpm.
  - .3 Backwash rate: 292 gpm.
  - .4 Total effective area: 19.3 sq ft.
  - .5 Filtering capacity: 20 gpm per sq ft of filter area.
- .19 **Standard of Acceptance:**
  - .1 Nemato NFS-34-50B-193S

## 2.6 FILTER TANK FRP FACE-PIPING SYSTEM

- .1 The horizontal Hi-Rate sand filter shall be provided with 4" (100 mm) molded FRP face piping, including 4" (100 mm) PVC-EPDM butterfly valves, Uni-lever stainless steel valve linkage and PVC vanstone mating flanges, which shall be pre-assembled by the original equipment manufacturer.
- .2 The 4" (100 mm) face piping shall be manufactured with a patented one-step process comprised of multiple core one piece molding of the respective front and rear sections of the face piping. The material used in manufacturing the face piping shall be food grade Isophthalic resin and E glass that provides a minimum laminate flexural modulus of 1.82E+06 psi and flexural strength of 36.4 ksi.
- .3 The face piping shall be designed for a maximum working pressure of 50 PSIG (345 kPa) with a Hydrostatic test pressure of 75 PSIG (518 kPa). A high quality professional finish shall be achieved through the application of a smooth, gel coated, UV protected outside surface.
- .4
- .5 The influent/effluent ports of the face piping shall be aligned with the influent/effluent ports of the filter tank to provide for minimal head loss during operation and shall be configured to conform to the profile of the head for attachment to the filter tank. The influent, effluent and backwash connections for mating to field connected piping shall be PVC vanstone flanges. The operation valves, influent, effluent, backwash by-pass and backwash ports shall all be

marked with identification labeling. The face piping shall come complete with an adjustable support foot to provide stress free installation to the filter tank influent/effluent ports.

- .6 The face piping kit shall come complete with four vertically aligned 4" (100 mm) PVC butterfly valves to reduce floor space. The butterfly valves shall be installed with "o"-ring seals between the front and back sections of the face piping kit. The butterfly valves shall be designed for 150 PSIG (1035 kPa) operating pressure and shall come complete with dynamic dual lip EPDM/Vinton seat for bubble tight shut-off operation. The butterfly valves shall be provided with stainless steel linkage connecting the valves with stainless steel linkage connecting the valves with operator arms, connecting arms, shear pins, couplings and jam nuts. The valves shall be set to move concurrently with one pair opening while the other pair is closing to avoid water hammer while simplifying operation. Smooth operation shall be insured through the use of shoulder bolts and Teflon bushings at every moving joint of the stainless steel linkage. The uni-lever shall have a locking pin to secure the valves in the filter position and act as a locator for the backwash position.
- .7 The lever operator shall be provided for the face piping kit serving the lower filter in each set of 2 stacked filters. The face piping kit serving the upper filter in each set shall be operated with a chain-wheel and gearbox operator. The chain shall be sized so that it can be easily operated from the floor elevation with no need for a ladder.
- .8 **Standard of Acceptance:**
  - .1 Nemato NFS-34-SFUP-0400

## 2.7 BASKET STRAINERS

- .1 Inline FRP basket strainer.
- .1 Strainers are designed for working pressures up to 30 P.S.I.G. and a vacuums service up to 20" of mercury.
- .2 Strainers are constructed of food grade Fiberglass Reinforced Isophthalic or Vinylester Resin (F.R.P.), PVC and stainless steel material. The strainers are totally non-corrosive and have a high gloss gel-coat finish with UV protection.
- .4 Interlocking design between the strainer body and lid as well as a food grade EPDM square ring provides manual opening as well as hand tightened sealing of the lid to the body at 45 P.S.I.G.
- .5 Strainer to come with integrally molded influent/ effluent vanstone flange connections, F.R.P. cover with clear acrylic viewing window, stainless steel j-bolt fastening hardware and drain/ vent plugs.
- .6 Strainer basket to produce 0-P.S.I.G. head loss when operating at designed flow rates. The strainer basket consists of food grade FRP end caps, 16- gauge stainless steel straining element with 1/8" perforated holes and stainless steel connecting rods. All strainer baskets have a minimum of a 4 to 1 open area ratio of the strainer basket to influent flange connection. The vertically pleated strainer element shall act as a flow baffle providing for full use of the open area in the strainer basket.
- .7 Strainers to be certified to ANSI/ NSF Standard 50 for both pool and spa applications.
- .8 **Standard of Acceptance:**
  - .1 Nemato NSS-16-030-1008R

**EXECUTION PROCEDURES****3.1 PUMP CONNECTIONS**

- .1 All piping adjacent to each pump shall be adequately supported from the structure so that no weight is carried on the pump casings. In addition long sweep elbows shall be used on each pump suction and discharge.
- .2 Provide a minimum of 5x suction diameter of pipe on pump suction of pipe size shown on drawings.
- .3 Clean and flush filter tanks after installation. Seal until pipe connections are made.
- .4 Provide the necessary access space around components to allow for servicing, repair, replacement as well as for the TAB technician to take proper readings.
- .5 Deliver equipment and store in area as designated by the Contract Administrator. Set equipment on temporary bases to avoid contact with the ground. Protect equipment from damage.
- .6 Locate equipment as shown on the drawings to provide best possible connection arrangement and accessibility for servicing. Provide clearances on all sides of equipment as required by Authorities having jurisdiction or Manufacturer, whichever is greater.

**3.2 WATER BALANCING**

- .1 Provide flow measurement ports as shown on drawings, on piping schematics, and in locations as directed by the water balancing specialist.
- .2 Provide any pump impeller modifications as recommended by Division 15850.

**GENERAL****1.1 GENERAL CONDITIONS AND SPECIFICATIONS**

- .1 The General Conditions and General Specifications form an integral part of this specification and must be read in conjunction herewith. Read also and be fully cognizant of all Mechanical Sections.
- .2 Testing and Balancing shall be performed by an independent test and balance agency that specializes in that its business is limited to testing and balancing of H.V.A.C. systems and shall be fully certified by AABC.
- .3 Testing and Balancing agency as part of its contract shall act as authorized inspection agency, responsible to list all items that are installed incorrectly, require correction or have not been installed in accordance with contract drawings and/or specifications, pertaining to the air distribution, cooling and heating systems. The Mechanical Contractor shall make good these items.
- .4 Final payment on the building will not be issued until the final balance report has been submitted to the Contract Administrator and has been approved by the Contract Administrator.
- .5 The Mechanical Contractors involved shall co-operate with the selected Testing and Balancing agency in the following manner:
  - .1 Provide sufficient time before final completion date so that tests and balancing can be accomplished.
  - .2 Provide immediately labour and tools to make corrections when required without undue delay.
  - .3 Put all equipment into full operation and continue the operation of same during each working day of testing and balancing.
  - .4 Testing and Balancing agency shall be kept informed of any major changes made to system during construction and shall be provided with a complete set of as built drawings.

**1.2 SCOPE OF WORK**

- .1 Testing and balancing of the new pool pumps as indicated on the drawings.
- .2 Testing and balancing of the 3" pool boiler loop and main 8" branches as indicated on the drawings.
- .3 Testing and balancing of the 3" pool boiler loop as indicated on the drawings.
- .4 The balance of the system shall be for the flow rate +/- 10%, with a clean sand filter operation. The pumping head may vary from the design pressure noted on the drawings. Provide Contractor with design flow rates and respective head pressures.
- .5 Upon completion of any changes by the Contractor, the system is to be rebalanced to ensure proper flow is maintained.

**1.3 EXECUTION PROCEDURES**

- .1 Pool Pumps
  - .1 Prior to final inspection, adjust all water systems to provide the design flows required in accordance with flow diagrams.
  - .2 Where calibrated venturi tubes, orifices, or other metered fittings and pressure gauges are installed in piping system, use with flow meter to determine system flow rates.
- .2 Pool Boiler Loop.
  - .1 Balance the pool boiler loop (3" supply and return) by using the butterfly valve on the 8" main, and with the 3" ball valves on the branch lines if necessary. Confirm flow rate requirements with the consultant prior to balancing.
  - .2 Balance such that there is equal flow ( $1750 \text{ gpm} / 2 = 875 \text{ gpm}$ ) to each side of the pool through the existing 8" mains.