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Part 1 General

1.1 GENERAL

.1 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

1.2 SCOPE OF WORK

.1 Work to include all labour, Material and equipment required for installing, testing and placing in initial operation the following systems as detailed in Specifications of each section and as shown on Drawings.

- .1 Section 15051 Acceptable Materials & Equipment
- .2 Section 15400 Plumbing
- .3 Section 15500 Fire Protection
- .4 Section 15800 Air Distribution
- .5 Section 15990 Testing, Adjusting and Balancing

.2 All Mechanical Work to be bid as a single complete Subcontract even though Work of various mechanical trades has been further sub-divided into each Section noted above.

1.3 EXISTING CONDITIONS

.1 Examine Site, existing adjacent buildings and local conditions affecting Work under this Contract. Examine Architectural, Mechanical and Electrical and all other Contract Drawings to ensure Work can be performed without changes to the building as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention, in writing, in accordance with B4.

1.4 REGULATIONS

.1 Comply with, most stringent requirements of Manitoba Building Code, National Building Code and local regulations and by-laws, with specified standards and codes and this Specification. Before any Work is proceeded with, approved layouts to be filed with and approved by proper authorities.

.2 Provide necessary notices, obtain permits and pay all fees, in order that Work specified may be carried out. Charges and alterations required by authorized inspector of any authority having jurisdiction, to be carried out without charge or expense to The City. Pay all charges for service connections to municipal mains.

.3 Furnish certificates confirming Work installed conforms to requirements of authorities having jurisdiction.

1.5 LIABILITY

.1 Install Work in advance of concrete pouring or similar Work. Provide and set pipe sleeves as required.

.2 Install concealed pipes and ducts neatly, close to building structure so furring is minimum size. Pipes, ducts and equipment installed improperly, to be removed and replaced without cost to the City.

.3 Protect and maintain Work until building has been completed and accepted. Protect Work against damage during installation. Cover with tarpaulins if necessary. Repair all damage to floor and wall surfaces resulting from carrying out of Work, without expense to the City.

.4 During welding or soldering ensure structure is protected against fire, shield with fire-rated sheets and galvanized iron sheets. Mount portable fire extinguishers in welding or soldering areas.

.5 During welding or soldering ensure structure is protected against fire by shielding, using fire-rated sheets and galvanized iron sheets. Contractor shall provide trained persons armed with suitable type extinguishers, with no other duties than to watch for and extinguish sparks, etc.

.6 Co-ordinate Work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all Contract Drawings.

.7 On completion of Work, remove tools, surplus and waste Material and leave Work in clean, perfect condition.

1.6 GUARANTEE

.1 Guarantee satisfactory operation of all Work and apparatus installed under this Contract. Replace, at no expense to The City, all items which fail or prove defective within a period of one year after final acceptance of complete Contract by The City, always provided such failure is not due to improper usage by The City. Make good all damage to building incurred as a result of failure or repair of mechanical Work.

.2 No certification given, payment made, partial or entire use of equipment by The City, shall be construed as acceptance of defective Work or acceptance of improper Materials. Make good at once, without cost to the City all such defective Work or Materials and consequence resulting therefrom, within one year of final acceptance date.

.3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

1.7 ENGINEERING OBSERVATIONS

.1 The term "Contract Administrator" in all mechanical sections of Specification shall mean:

SMS Engineering Ltd.
770 Bradford Street
Winnipeg, Manitoba
R3H 0N3

.2 Contractor's Work will be observed periodically by The City, and/or Contract Administrator or their representatives, solely for purpose of determining general quality of Work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and Specifications to assist him to carry out Work. Observations and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install Work in all its parts in a safe and Workmanlike manner, and in accordance with plans and Specifications, nor impose upon The City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any Work.

1.8 WELDING REGULATIONS

.1 Do not weld when temp. of base metal is lower than -17 deg. C except with consent of Contract Administrator. At temp. below 0 deg. C, surface of all areas within 75mm (3") of point where weld is to be started to be heated to temp. at least warm to hand before welding is commenced. At all temperatures below +4 deg. C, operator and Work to be protected against direct effect of wind and snow.

.2 Welding shall be performed by welder holding current welder's certificate from Provincial Department of Labour.

.3 Comply with CSA W117.2 "Safety in Welding, Cutting, and Allied Processes".

1.9 MECHANICAL SHOP DRAWINGS

.1 Submit for review a minimum of six sets of detailed Shop Drawings. Refer to Section 15051 "Acceptable Materials & Equipment" for Shop Drawings requirements.

.2 Check Shop Drawings for conformity to plans and Specifications before submission.

.3 Each Drawing to bear a signed stamp including project name and Contractor's Firm name verifying Drawings have been checked prior to submission to Contract Administrator. Signature of stamp shall signify the Contractor has checked and found all dimensions to be compatible with the Contract Drawings and all capacities, quantities, sizes and other data contained in the Contract documents have been listed by the supplier on the Drawings and have been checked by the undersigned and found correct.

.4 Clearly show division of responsibility. No item, equipment or description of Work shall be indicated to be supplied or Work to be done "By Other's or By Purchaser". Any item, equipment or description of Work shown on Shop Drawings shall form part of Contract, unless specifically noted to contrary.

.5 Take full responsibility for securing and verifying field dimensions. In case where fabrication must proceed prior to field dimensions being available, check all Shop Drawings and approve for dimensions only. In this case guarantee that dimensions will be Worked to and ensure that other Subcontractors are aware of these dimensions and shall comply to them.

.6 Review by Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with Work are noticed, attention of Contractor will be called to such errors of interferences, but Contract Administrator's review of Drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such Work, and Materials as may be required for completion of Work as called for in Contract documents.

1.10 MECHANICAL SUBCONTRACTORS

.1 State in Bid Opportunity, names of all Subcontractors to be used in sublet Work. Also, state extent of any Work so sublet. Request and receive Contract Administrator's approval in writing, of all Subcontractors for such Work before placing Subcontractor Contract.

.2 Contractor to have minimum five years experience in field of mechanical Contracting and to have successfully performed Work of similar nature and approximate size to that indicated in Specifications and on Drawings. Subcontractors shall employ, on this project, foremen or supervisory personnel who have had similar experience to that required of Contractor.

1.11 SCHEDULING OF WORK

.1 Complete building to be occupied during term of this Contract. Schedule new work so normal functions within building are not unduly interrupted. In general, Work on the new areas to be performed during normal hours. Work in remainder of building to be scheduled so as to provide minimum of inconvenience to The City. i.e. Perform Work either where areas are vacated during night period or at periods when it is permissible to Work in the existing areas to be approved by The City. Suitable periods for shutting off mechanical services to be arranged with The City's appointed representative. Perform Work requiring shutdown of air systems during night period or on weekends.

.2 Existing buildings to be in use during construction of the addition. Arrange Work so that interruption of services is kept to minimum. Obtain permission from Contract Administrator, prior to cutting into mechanical services. Where deemed necessary by Contract Administrator, temporary piping to be installed, and/or Work to be carried out at night and on weekends.

1.12 DRAWINGS

.1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken from at building. Make, without additional expense to The City, all necessary changes or additions to runs to accomodate structural conditions. Locations of pipes, ducts and other equipment to be altered without charge to The City, provided change is made before installation and does not necessitate additional Materials and that all such changes are ratified by Contract Administrator, recorded on Record Set of Drawings.

.2 Drawings and Specifications to be considered as an integral part of Contract Documents. Neither Drawings nor Specifications to be used alone. Misinterpretation of requirements of plans or Specifications shall not relieve Contractor of responsibility of properly completing Work to approval of Contract Administrator.

.3 As Work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult Contract Administrator for comments. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.

.4 Drawings indicate general location and route to be followed by pipes and ducts. Where required pipes and/or ducts are not shown on plans or only shown diagrammatically, install in such a way as to conserve head room and interfere as little as possible with free use or space through which they pass.

1.13 MATERIALS

.1 Materials and equipment specified and acceptable manufacturers are named in this Specification for the purpose of establishing the standard of Materials and Workmanship to which Contractor shall adhere. Bid Opportunity price shall be based on the use of Materials and equipment as specified.

.2

.1 Materials of same general type to be of same manufacture (e.g. all air supply units shall be of same manufacturer). Contractor to ensure that all Subcontractors provide products of same manufacturer.

.1 Follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs of individual equipment installed.

.2 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems and without interference with building structure or other equipment.

.3 Provide accessible lubricating means for bearings, including permanent lubricated 'Lifetime' bearings.

.3 Contractor may propose alternate for any specified item which Contractor considers equal to that specified. Substitutes or alternates must be submitted in accordance with B6. All alternate items submitted for consideration must not exceed available space limitations. All additional costs for mechanical, electrical, structural and/or Contract Administrator revisions required to incorporate Materials substituted by Contractor shall be responsibility of Contractor.

.4 Equipment listed as 'equal' in Specifications or submitted as alternate by Contractor must be submitted in accordance with B6 and meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations.

.5 Equipment and Materials shown on Drawings and not specified herein, or specified herein and not shown on Drawings, shall be included in this Contract as though both shown and specified.

1.14 REMOVAL AND DISCONNECTION OF THE CITY'S EXISTING EQUIPMENT

.1 All mechanical equipment conflicting with new equipment being installed to be removed or disconnected by Contractor shall remain property of The City. Remove ducts and piping not required in revised systems and interfering with new installation which shall become property of Contractor.

.2 Mechanical Drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to The City.

1.15 ELECTRIC MOTORS, STARTERS AND WIRING

.1 Provide electric motors for all equipment supplied in this Division. Motors to operate at 29 r/S (1800 rpm), unless noted otherwise. Motor design shall comply with Canadian Electrical Code requirements. All electric motors supplied shall be capable of being serviced locally.

.2 All three phase motors shall have a service factor of 1.15 times nominal rated horsepower of the motor.

.3 Operating voltages: to CAN3-C235-83, motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Motors 0.75 kW (1 hp) and larger shall be high efficiency motors as defined in CSA C390 or IEEE 112B Nominal Standards. Minimum efficiency (%) shall be per the following table.

	Minimum efficiency (%)			
kW	3600 RPM	1800 RPM	1200 RPM	900 RPM
.75	79.0	82.4	81.1	74.4
1.11	81.0	82.8	83.8	76.8
1.50	81.7	83.8	84.4	83.8
2.24	84.6	86.1	86.4	83.6
3.73	86.4	86.9	87.2	85.4
5.60	87.4	88.4	88.2	86.2
7.46	88.4	89.4	88.6	88.6
11.19	89.3	90.1	89.0	88.0
14.92	89.7	90.9	89.8	89.8
18.65	90.0	91.1	90.9	89.6
22.38	90.6	91.5	91.1	90.3
29.84	91.0	92.0	91.6	90.1

List information on Shop Drawing submittals

.5 Determine from electrical Drawings and Specifications, voltage characteristics applying to each individual motor. Where motor voltages are mentioned in this Specification, confirmation to be made by reference to electrical Drawings and Specifications ordering motors.

.6 Division 16 - Electrical to provide starters for all motors, except as otherwise noted. Division 16 - Electrical shall wire from starters to motors.

.7 Wiring required between starters and switching apparatus such as wiring from starters to float switches, pressure switches and all control wiring to be by Division 16 - Electrical except as noted otherwise on Drawings and in Specifications. Provide proper terminal connections and lead wires at motors and other apparatus ready for connection by Division 16 - Electrical. Provide Division 16 - Electrical with accurate locations of electrical connection points and all necessary schematic and other Drawings to facilitate electric Work.

.8

.1 Division 15 shall provide wiring diagrams indicating all power and control wiring requirements.

.9 Division 15 shall provide wiring diagrams indicating all power and control wiring requirements for equipment supplied by Division 15.

1.16 IDENTIFICATION OF VALVES

.1 Provide engraved lamacoid color coded tags secured to items with non-ferrous chains or "S" hooks. Use for valves and operating controllers of all systems. Consecutively number valves in each piping system i.e. domestic water, steam, etc.

.2 For each building, provide tag schedule, designating number, service, function, colour code, and location of each tagged item.

.3 Provide one plastic laminated copy and secure to mechanical room wall where instructed. Place one copy in each maintenance instruction manual.

.4 Identify controls and gauges by labels of 3mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 62mm x 25mm (2-1/2" x 1") high.

1.17 HANGERS AND SUPPORTS

.1 General
- .1 Piping, ductwork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.
- .2 Support components shall conform to Manufacturers Standardization Society Specification SP-38.

.2 Installation - Horizontal
- .1 Hangers shall adequately support piping system. Locate hangers near or at changes in piping direction and concentrated loads. Provide vertical adjustment to maintain pitch required for proper drainage. Allow for piping expansion and Contraction. Piping weight and stresses shall be supported independently of any equipment.
- .2 Maximum spacing between pipe supports:
  - .1 Steel Pipe:
    - .1 Up to 50mm (2") diam. - 2.4m (8 ft.)
    - .2 62mm (2-1/2") and larger - 3.6m (12 ft.)
  - .2 Copper Tubing (Hard):
    - .1 Up to 25mm (1") diam. - 1.8m (6 ft.)
    - .2 32mm and larger - 2.4m (8 ft.)
  - .3 Cast Iron Pipe
    - .1 Maximum spacing - in accordance with Plumbing Code. Locate hangers adjacent to hubs or joints.
    - .2 Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator's approval. At multiple fittings or short lengths provide sufficient hangers to support all joints to Contract Administrator's satisfaction.
  - .4 Plastic Pipe As recommended by manufacturer.

.3 Installation - Vertical Piping
- .1 Support vertical pipes at each floor by Anvil Fig. 261 riser clamps. Locate clamps immediately below coupling if possible. Support soil pipe at hub. Brace risers up to 50mm (2") size at intervals not over 2.13m (7'). Support base in approved manner.

.4 Structural Attachments
- .1 To Concrete:

.1 Place inserts in structural floors for support of piping and equipment prior to pouring of concrete. Inserts in concrete slabs shall be Anvil Fig. 285 Light Weight Concrete Insert for loads up to 182 Kg (400#) or Anvil Fig. 281 Wedge type concrete insert for loads up to 544 Kg (1200#).

.2 Support hangers in corrugated steel deck by 50mm (2") piece of 3mm (1/8") thick steel plate placed across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.

.3 Where inserts must be placed in existing concrete use Hilti H.D.I. steel anchors as recommended by manufacturer, or if heavy weights must be supported, drill hole through slab and provide 50mm x 50mm (2" x 2") washer and nut above rough slab before floor finish is poured.

.2 To Steel Beams:

.1 Where pipe size is 50mm (2") or less, use Anvil Fig. 87 Malleable Iron C-Clamp and Retaining Clip, or equal.

.2 Where pipe size is over 50mm (2"), use Anvil Fig. 229 Malleable Beam Clamp or Fig. 228 Forged Steel Beam Clamp.

.3 To Wooden Ceilings and Beams:

.1 Use Anvil Fig. 153 Pipe Hanger Flange or Fig. 156 or equal.

.4 Miscellaneous:

.1 Provide suitable attachments equal in quality to above where required.

.5 Hangers and Supports

.1 Steel Pipe: Up to 50mm (2") - Anvil Fig. 65 light clevis - size to suit O.D. of pipe. 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation.

.2 Copper Tubing (Hard):

.1 Up to 50mm (2") - Anvil CT65 copper plated clevis - size to suit O.D. of pipe. Fig. 65 may be used if isolation is provided - see below.

.2 62mm (2-1/2") and larger - Fig. 260 clevis - size to suit O.D. of insulation - on uninsulated pipe provide isolation as specified below.

.3 Plastic and Other Types of Piping: Support as recommended by manufacturer.

.4 Provide fabricated steel supports as detailed on Drawings or as required to adequately support piping and equipment. Details to be approved by Contract Administrator. Supports shall be of welded construction except where adjustment is required.

.5 For vertical piping support, use Anvil Fig. 261 clamp. For vertical copper piping, use Fig. CT-121-C.

.6 Above indicates general requirements. Provide hangers and supports of equal quality to suit job requirements where not covered by the above.

.7 Support groups of horizontal pipes by angle iron trapeze hangers.

.8 Rollers and chairs shall not be installed on trapeze hangers.

.9 Several individual hanger rods may be supported from a trapeze or individual inserts in concrete slab.

.10 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.

.11 Hanger Rod:

.1 Support hangers with mild steel rod. Load on hanger not to exceed capacity indicated in following table:

.2 Rod Diam. Max. Safe Load

.1 9.5mm(3/8") 277 Kg(610 lbs.)

.2 13mm(1/2") 514 Kg(1130 lbs.)

.3 16mm(5/8") 822 Kg(1818 lbs.)

.4 19mm(3/4") 1232 Kg(2710 lbs.)

.3 Rods to have sufficient threaded length to allow for vertical adjustment after pipe is in place. Use two nuts in each rod, one above clevis or angle iron, and one below.

.6 Isolation

.1 Copper piping shall be isolated from steel supports by copper plated hangers, plastic coated hangers, tinning pipe at supports, or provision of suitable lead or copper isolators. Where no pipe movement or abrasion is expected, suitable plastic electricians tape may be wrapped around pipe at hangers.

1.18 SUPPORTS, BASES, PITS

.1 Supply and erect all special structural Work required for installation of tanks, pumps, fans, motors and other apparatus.

.2 Supply all anchor bolts, fasteners and foundation Drawings. Unless noted otherwise, all major pieces of equipment such as pumps, compressors, etc. to be mounted on 150mm (6") concrete pad. Refer to standard details for method of forming pump bases, etc.

.3 Mount equipment suspended above floor level but not detailed on platform bracketted from wall. Where wall thickness is inadequate to permit such brackets, carry supports to either ceiling or floor, or both as required.

1.19 IDENTIFICATION OF EQUIPMENT

.1 Provide manufacturer's nameplate on each piece of equipment.

.2 In addition Mechanical Contractor shall provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3-1/2" x 1-1/2" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.

.3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).

.4 Provide manufacturers' registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.

1.20 FLOOR PLATES AND SLEEVES

.1 Set sleeves in concrete forms for all pipes and ducts passing through concrete walls, beams and slabs.

.2 Pipe sleeves to extend above floor line as follows:

.1 Unfinished areas - 25mm (1")
.2 Finished areas (copper sleeves) - 6mm (1/4")
.3 Mechanical rooms, kitchens and washrooms - 100mm (4")
.4 Caulk sleeves to provide watertight installation.

.3 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated pressed floor plates.

.4 Install galv. oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.

.5 Sleeves and holes for cold water, chilled water and ice water lines to be large enough to accommodate pipe insulation. Insulation on hot water lines may stop at walls or floors.

.6 Prior to installing sleeves in concrete beams, receive final jobsite approval by the Structural Contract Administrator.

1.21 SCREWS, BOLTS AND FASTENERS

.1 Use standard commercial sizes and patterns with Material and finish suitable for service.

.2 Use heavy hex heads, semi-finished unless otherwise specified. Use non-ferrous Material throughout for plumbing services. Use type 304 stainless steel for exterior areas.

.3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.

.4 Bolts shall not project more than one diameter beyond nuts.

.5 Washers

.1 Use plain-type washers on equipment, sheet metal and soft gaskets, lock-type washers where vibration occurs, and resilient washers with stainless steel.

1.22 PUMPS-GENERAL

.1 Provide coupling guards on all pumps.

.2 Submit certified pump curves with Shop Drawings. Pumps shall be selected such that head at design conditions does not exceed 85% of maximum possible head at design flow rate.

.3 Manufacturer to include for checking and aligning pumps prior to start-up. Following completion of piping all base mounted pumps shall be aligned by a qualified millwright using a dial gauge. Alignment using a straightedge is not acceptable as it does not provide sufficient accuracy. The millwright shall provide a report indicating the degree of misalignment prior to carrying out the Work and the final readings when the alignment Work has been completed. Final payment will not be made until a satisfactory report has been submitted.

.4 Piping adjacent to pump to be supported from structure so no weight is carried on pump casings. Use long sweep elbows at pump.

.5 All pumps to have motor size large enough to not overload at runout condition. If this requires larger motor than specified, pay for larger motor starter, wiring and the like.

.6 Mount on cast iron or heavy steel base, having drip lips and tapped drainage holes. Provide air cock on each pump.

.7 Pump bases to have neoprene-steel-neoprene vibration isolators of sizes recommended by manufacturer unless alternate type base specified elsewhere in Specification. Refer to standard details for installation and forming of pump bases.

.8 Provide mechanical seals on all pumps.

1.23 OPENINGS IN FIRE SEPARATIONS

.1 Provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.

.2 Firestopping
- .1 Firestopping to be Dow-Corning Fire Stop System.
- .2 Material shall be Dow-Corning silicone elastomer Fire Stop penetration Seal and/or Dow-Corning liquid silicone elastomer Fire Stop Foam of density, width and depth to maintain assembly fire resistive rating.
- .3 Components shall be ULC listed.

.3 Installation
- .1 Prepare all surfaces so they are clean, dry, and frost free, as per manufacturer's published recommendations.
- .2 Use Sealant around single pipes and/or ducts.
- .3 Use Foam for multiple pipe installation.
- .4 Follow manufacturer's published installation instructions precisely including field quality control after installation.
- .5 Submit to Contract Administrator, suitable document signed by manufacturer's local representative, stating:
  - .1 Div. 15 Sub-Contractor received sufficient installation instruction from manufacturer's representative.
  - .2 Manufacturer's representative witnessed installation procedures on Site.
- .6 Remove firestopping assembly for random inspection by Contract Administrator and replace at no extra cost to The City.
- .7 Issue report to General Contractor, The City and Contract Administrator stating that all mechanical openings have been fire stopped in accordance with fire stop mfg. methods to maintain integrity of fire separation being penetrated.

1.24 TRIAL USAGE

.1 The City reserves right to use any piece of mechanical equipment, device or Material installed under this Contract, for such reasonable lengths of time and at such times as Contract Administrator may require, to make complete and thorough test of same, before final completion and acceptance of any part of Contract. It is agreed and understood, that no claim for damage will be made for any injury or breakage to any part or parts of the above due to aforementioned tests, whether caused by weakness or inaccuracy of parts, or by defective Materials or Workmanship of any kind whatsoever. Supply all labour and equipment for such tests.

1.25 SAFETY DEVICE TESTING

.1 Make complete inspection of all safety devices to ensure:
- .1 That safety devices are complete and in accordance with Specifications and manufacturer's recommendations.
- .2 That the safety devices are connected and operating according to all local regulations.

.2 Safety devices to be inspected shall include, but not be limited to:
- .1 Pressure relief valves
- .2 Low-water cut-offs
- .3 High or low water alarms

.4 Sprinkler alarm valves
.5 Fire extinguishers
.6 Fire dampers

.3 On completion of inspections, supply to Contract Administrator letters and/or certificates for their record, confirming that inspections have been completed.

1.26 TEMPORARY USE OF EQUIPMENT

.1 Permanent systems and/or equipment not to be used during construction period, without Contract Administrator's written permission.

.2 Equipment used during construction period to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to entire satisfaction of Contract Administrator and The City.

.3 Provide proper care, attention and maintenance for equipment while it is being used. If, in opinion of Contract Administrator, sufficient care and maintenance is not being given to equipment and systems, Contract Administrator reserves right to forbid further use of said equipment and systems.

.4 Temporary use of equipment shall in no way relieve Contractor of providing twelve month guarantee on all equipment so used this guarantee period to commence as of date of final acceptance of building by The City as interpreted by Contract Administrator.

1.27 RECORD DRAWINGS

.1 Provide one set of Contract prints to form Record Drawings, marked clearly with all changes and deviations from piping and ductwork, including all Contract Changes.

.2 Use different colour ink for each service.

.3 Update Record Drawings on a regular basis to ensure they are accurate, and have available for reference and inspection at all times.

.4 This information will be used by others to create Record Drawings on CAD.

1.28 INSTRUCTIONS TO THE CITY'S PERSONNEL

.1 In addition to start-up supervision and instruction of The City's personnel required of individual equipment manufacturers and systems as noted, Contractor's construction supervisor to instruct The City's personnel in operation and maintenance of all equipment and systems to satisfaction of Contract Administrator.

.2

.1 All instructions to The City's personnel shall be video taped by the Contractor.
.2 This video will remain property of the The City and will be used for the sole purpose of training and orientation of The City's maintenance staff.
.3 Instruction shall include visual Materials such as Drawings, diagrams, and printed handouts.
.4 Instructor(s) shall provide the necessary audio-visual equipment and other aids necessary to convey thorough understanding of system and/or equipment operation and maintenance.
.5 Provide The City with one copy of video taped session in VHS or DVD format. The City to decide, and confirm format.

.3 Provide The City with four copies of manuals incorporating following:
- .1 Service instructions - including lists of spare and replacement parts and names and addresses of suppliers.
- .2 Maintenance & Operating instructions.
- .3 Revised Shop Drawings.

.4 Forward manuals to Contract Administrator for review. Final payment will not be made until all required manuals have been received.

.5 Review instructions with The City's representative to ensure The City's representative has a thorough understanding of equipment and its operation.

.6 Contractor shall submit to Contract Administrator, suitable document signed by The City's representative, stating:
- .1 The City has received satisfactory instruction in operation and maintenance of all equipment and systems.
- .2 Operation and maintenance manuals have been reviewed with The City.
- .3 Specified spare parts. keys, removable handles and the like, have been turned over to The City.

1.29 PAINTING

.1 Finish painting of mechanical equipment, piping, ductwork and the like shall be performed by a competent painting Subcontractor of Division 15 - Mechanical.

.2 Following areas shall have equipment and Materials painted:
- .1 Mechanical Room.

.3 Thoroughly clean off rust and oil, all exposed iron and steel Work of every description, including hangers, pipes, ducts, etc. paint with a coat of chrome oxide phenolic base primer and a coat of 100% Alkyd base enamel of approved colour. Paint exposed galv. metal surfaces in above areas with a coat of zinc dust galvanize primer and a coat of 100% Alkyd base enamel of approved colour.

.4 Paint exposed covering in above room and areas with two coats of 100% Alkyd base enamel of approved colour.

.5 After piping, etc. has been painted, paint neatly stencilled letters, about 25mm (1") high, designating pipe service and arrows showing direction of flow. Wording to be as later directed by Contract Administrator. Stencilling to occur at not more than fifty foot intervals. "Mystik" tape arrows and identification letters may be substituted, at discretion of Contract Administrator. Stencil all pipes at access doors also.

.6 All colours shall be approved by Contract Administrator.

1.30 IDENTIFICATION OF PIPING

.1 Scope: Comply to standard detail plate "Identification of Piping Systems" number 15010-1.
- .1 Identify fluids in piping with Mystic markers showing name and service, including temperature and pressure where relevant, and with Mystic arrows to indicate flow direction.
- .2 Apply primary colours in exposed areas only on finished piping surfaces, including secondary colour bands, to indicate type and degree of hazard.

.3 For building additions and alterations, use existing coding system. For new buildings, use CGSB 24-GP-3a and CSA and B53 colour codings and identification systems, using CGSB 1-GP-12c colour coding system schedule.

Primary Classification	Secondary Classification	Legend and Direction Arrows
Yellow 505-101	Orange 508-102	Black 512-101
Green 503-107	Purple 511-101	White 513-101
Blue 202-101	Black 512-101	
Red 505-102	Yellow 505-101	
White 513-101		

.2 Paint: For primary colour paint conform to CGSB 1-GP-60C.

.3 Pipe Markers and Colour Bands

.1 Plastic coated cloth Material with protective overcoating on outside and waterproof contact adhesive on underside, suitable for continuous operating temperature of 149 deg. C (300 deg. F) and intermittent temperature of 204 deg. C (400 deg. F).

.2 For colour bands apply 50mm (2") wide tape single wrap around pipe or pipe covering with ends overlapping 25mm (1") minimum.

.3 Use block capital letters 50mm (2") high for pipes of 75mm (3") and larger od (including insulation) and not less than 18mm (3/4") high for smaller diameters.

.4 Use direction arrows 150mm (6") long by 50mm (2") wide for piping of 75mm (3") or larger od including insulation and 100mm (4") long by 18mm (3/4") wide for smaller diameters. Use double head arrows where direction of flow is reversible.

.5 Use waterproof and heat resistant plastic marker tags for pipes and tubing of 18mm (3/4") and smaller od.

.6 Use black pipe marker letters and direction arrows except use white on red background for fire protection piping.

.4 Standard of Acceptance: WH Brady identification tapes, bands, markers.

.5 Location of Identification

.1 Locate markers and classifying colours of piping systems, so that they can be seen from floor or platform.

.2 Identify piping runs at least once in each room.

.3 Do not exceed 15m (50 feet) between identification in open areas.

.4 Identify on both sides where piping passes through walls, partitions and floors.

.5 Location schedules:

.1 Where piping is concealed in pipe chase or other confined space, identify at point of entry and leaving, and at each access opening.

.2 Identify piping at starting and ending points or runs and at each piece of equipment.

.3 Identify piping at major manual and automatic valves immediately upstream of valves. Where this is not possible, place identification as close to valve as possible.

.6 Identify branch, equipment, or building served after each valve.

.7 Legends and colour classifications: Submit to Contract Administrator for approval, where differing from following table, at least two weeks before ordering Material.

.8 Table: Pipe and valve identification. Note: Information in brackets under Pipe Marker Legend column is explanatory and need not be included as part of legend test.

PIPE MARKER LEGEND	VALVE TAG LEGEND	PRIMARY COLOUR	SECONDARY COLOUR
Fire Protection water	F.P.W.	Red	White
Sprinkler water	S.W.	Red	White

1.31 CUTTING AND PATCHING

.1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by Div. 15 - Mechanical in Bid Opportunity price. Division 15 - Mechanical to employ and pay appropriate Subcontractor whose Work is involved, for carrying out Work described above.

1.32 SALVAGE

.1 All usable salvaged equipment and Materials shall remain the property of the The City unless specifically noted otherwise. Such Material shall be neatly stored on Site for removal by the The City. Contractor shall remove all rejected salvage from the Site and legally dispose of it.

.2 Mechanical Drawings indicate most mechanical equipment to be removed and/or disconnected. Mechanical equipment not indicated on Drawings as being removed or disconnected, but which has to be removed due to removal of walls of existing building, to be removed and pipes capped off by Contractor at no additional cost to The City.

1.33 CLEANING AND FLUSHING OF PIPING SYSTEMS

.1 On completion, each piping system shall be flushed out before installation of equipment, etc. in order to remove any foreign Material in piping.

.2 Flush with water, unless noted otherwise in individual mechanical sections of Specifications.

.3 All equipment shall be thoroughly cleaned and left in first class operating condition.

1.34 LIST OF ACCEPTABLE MANUFACTURERS

.1 Refer to Section 01630

1.35 ASBESTOS CONTROL PROCEDURES

.1 This building contains asbestos in the ceiling spaces and/or on structural members.

.2 This building may contain asbestos in the existing piping and equipment insulation.

.3 For further information regarding procedures contact: Workplace Safety and Health, Department of Labour, Province of Manitoba.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Following Appendix of Manufacturers lists manufacturers of equipment and Materials acceptable to Contract Administrator, subject to individual clauses under the various sub-sections of Mechanical Work Specifications. See item 'Materials' under this section of Specification.

.2 Product noted in individual Specification clauses is an item that meets Specification in all respects regarding performance, quality of Material and workmanship, and is acceptable to Contract Administrator without qualification. Equipment proposed from other manufacturers listed as 'Approved Manufacturers' and alternates shall meet same standards.

.3 Contractor to submit within forty-eight hours of notification from Contract Administrator, one (1) copy of fully and properly completed Appendix of Manufacturers listing thereon names of manufacturers of products which shall be used to execute Work of Contract. If list is not submitted within 48 hours, Contractor must use product named in each individual clause.

.4 Submit Shop Drawings for all items marked with asterisk(*).

.5 Request for equals in Accordance with B6, must be received in Contract Administrator's office no later than seven (7) working days prior to close of Bid Opportunity.

1.2 EQUIPMENT OR MATERIAL & APPROVED MANUFACTURERS

.1 ELECTRIC MOTORS

.1	G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba	

.2 PLUMBING

.1	Drainage specialties* (floor drains, cleanouts, etc.)	Watts; Zurn; J.R. Smith; Mifab

.3 FIRE PROTECTION

.1	Automatic sprinkler equipment*	Reliable; Viking; Victaulic; Tyco Fire Products
.2	Gate valves*	Kennedy; McAvity; Mueller; Watts; Nibco; Crane
.3	Ball Valves*	Milwaukee; Global; Victaulic; Crane
.4	Check valves*	Crane; Check-Rite; Val-matic; Victaulic; Gruvlok
.5	Butterfly valves*	Crane; Victaulic; Mueller; Watts; Gruvlok; Global; Nibco
.6	Pressure gauges*	Dresser; Morrison; Marshalltown; H.O.; Ashcroft; Trerice; Ametek; Kunkle; Winters; Tyco
.7	Fire hose cabinets*	Larsen; Wilson & Cousins
.8	Fire extinguishers*	Pyrene; Diamond; Flag; Badger; Kidd; Ansul
.9	Fire pumps*	Peerless; Aurora; Armstrong; ITT; Darling
.10	Jockey pumps*	Burks

	.11	Mechanical joints*	Victaulic; Gruvlok
	.12	Pre-action control valves*	Reliable; Griswold; Claval; Tyco Fire Products (Gem, Star, Central); Victaulic
	.13	Backflow preventers*	Watts; Conbraco; Ames; Wilkins
	.14	Valve monitor & flow switches*	Potter; Canswiss
.4	AIR DISTRIBUTION		
	.1	Ducturns, damper hardware, fan connections*	Duro-Dyne
	.2	Duct Sealer	Duro-Dyne; 3M; Flexa-Duct; United; Bakelite
	.3	Fire Damper*	Controlled Air; Penn; Air Balance; C.A.A.; Hart & Cooley; Ruskin; Nailor; Cesco
	.4	Belt driven in-line fans*	Greenheck; Loren Cook
	.5	Diffusers, registers & grilles*	E.H. Price; Hart & Cooley; Titus; Carnes; Nailor
	.6	Backdraft damper*	Penn; Greenheck; Ventex
.5	CONTROLS/INSTRUMENTATION		
	.1	Temperature control system*	Johnson
.6	H.V.A.C. BALANCE AND TESTING		
	.1	H.V.A.C. Balance & Testing Agency	Airdronics Inc.; DFC; AHS; Air Movement

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

.1 Provide labour, Material, equipment and services necessary for and incidental to the supply and installation of the systems shown on the Drawings and hereinafter specified.

.2 Generally this shall include:
- .1 Sanitary Drainage System
- .2 Equipment

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 15010 Mechanical General Provisions

.2 Section 15051 Acceptable Materials & Equipment

Part 2 Products

2.1 PIPE AND FITTINGS

.1 General
- .1 Pipe and fittings shall conform to the standards listed in the applicable Building Code (latest revision).
  - .1 Where alternate piping Materials or jointing are specified a uniform type of pipe and fittings shall be used throughout each system.
- .2 Drains and vents - sanitary
  - .1 Drains and vent pipes shall be in accordance with local or provincial regulations with the following exceptions, unless otherwise specified.
  - .2 All cast iron soil pipe shall be class 4000.
  - .3 Cast iron soil pipe may be hub and spigot or mechanical joint. Mechanical joint couplings shall have a corrugated stainless steel sleeve over the joint with stainless steel worm drive securing bands tack welded to the sleeve. Titan or approved equal.
  - .4 PVC Ipex system 15 and system XFR.

2.2 CLEANOUT ACCESS COVERS

.1 Finished and unfinished areas:
- .1 Zurn ZANB-1460-13 175mm (7") diam. polished nickel bronze frame and cover.

2.3 PLUMBING EQUIPMENT

.1 Fixtures

.2 Equipment
- .1 Floor Drains

.1 FFD #1:
.1 Zurn Z-415-F cast iron floor drain, 3" x 9" (75mm x 225mm) polished nickel bronze strainer with one piece oval funnel with full port opening.

2.4 BACKFILL MATERIAL

.1 Bedding and backfill Material to 300mm (12") above the pipe shall conform to standard WCA 3 for granular fill.
.1 Passing 3/4" 100%
.2 No. 4 80-90%
.3 No. 50 5-30%
.4 No. 200 0-5%

.2 Granular backfill Material other than as described in .1 above shall conform to standard WCA 2.
.1 Passing 3" 100%
.2 No. 4 40-80%
.3 No. 200 5-20%

Part 3 Execution

3.1 GENERAL INSTALLATION

.1 All pipe shall be cut accurately to measurements taken at Site, installed without springing or forcing. All changes in direction made with fittings.

.2 Co-operate with all Subcontractors to properly locate all equipment connections.

3.2 DRAINAGE SYSTEMS

.1 Sanitary Drains
.1 Provide complete systems of sanitary drainage and venting to serve drains from equipment in Contract such as pump bases, etc.
.2 Cleanouts:
.1 Install cleanouts at all changes of direction, at intervals of not over 15m (50') in horizontal runs, at all points where obstructions might be formed and at points required by plumbing regulations or shown on Drawings.

3.3 EXCAVATION AND BACKFILL

.1 General:
.1 Perform all excavating and backfilling required in connection with this Subcontract.
.2 Place bracing, sheet piling, barricades, warning light, ladders, etc. as required by municipal ordinances and the Workplace Health & Safety.
.3 Examine Drawings and existing conditions to determine where excavations interfere with concrete floors, etc. Where this does occur, backfill with sand and employ the particular Contractor and pay all costs to match all surfaces damaged by new Work.
.4 All damage to pipe shall be repaired.

.2 Piping Support

.1 No portion of pipe shall bear directly against rock or other hard surface. Shape bottom to fit pipes and sockets. Form to support minimum 1/3 of outside circumference of pipe. Bed pipe on 4" layer of sand.

.3 Backfill

.1 Backfill below pipe crown shall be sand and gravel, to height of 300mm (12") above pipe. It shall be hand placed and hand tamped and compacted. Remaining backfill shall be as follows:

.1 Inside building - All backfilling shall be with sand and gravel 19mm (3/4") dia. max. No earth backfill will be accepted.

.2 Settlement of Backfill

.1 Make good any settlement of fill and pay costs involved in making good all other surfaces damaged by such settlement and subsequent restoration.

.3 Excess Excavation Material

.1 Excavation Materials shall be piled, stored and/or disposed of as directed by Contract Administrator.

3.4 JOINTING

.1 All joints shall be made in accordance with manufacturer's recommendations.

3.5 CLEANING AND FLUSHING

.1 On completion, flush out piping systems in order to remove any foreign material in piping.

.2 Clean equipment and leave in first class operating condition.

3.6 TESTING

.1 All piping systems shall be pressure tested as follows:

.1 Plumbing and drainage systems - in accordance with local regulations.

.2 General

.1 Contract Administrator's representative shall witness tests. Give 48 hours notice in advance of all tests.

END OF SECTION

Part 1 General Conditions

1.1 GENERAL

.1 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section

1.2 WORK INCLUDED

.1 Labour, Material, plant, tools, equipment and services necessary and reasonably incidental to completion of fire protection Work including:

.2 Double-Interlock preaction automatic sprinkler system.

.3 Fire extinguishers, cabinets and mounting.

.4 Modification to existing standpipe and hose system.

.5 Fire and Jockey Pump.

.6 Preparation of Shop Drawings, approvals of same by authorities having jurisdiction, inspecting, testing and approval as specified herein and as required by authorities having jurisdiction.

.7 Removal of existing Halon System.

1.3 RELATED WORK SPECIFIED ELSEWHERE.

.1 Section 15010 – Mechanical general provisions

.2 Section 15051 – Acceptable Materials and equipment

.3 Section 15400 – Plumbing

.4 Section 15800 – Air distribution

.5 Section 16010 – Electrical general provisions

1.4 WORK BY OTHER TRADES

.1 Floor drains and hub drains shall be by section 15400.

.2 Compressed air supplies by section 15500.

.3 Concrete bases, pits, housekeeping pads, etc. by section 15400.

.4 Electrical wiring shall be by Division 16 - Electrical.

Part 2 Products

2.1 MATERIALS

.1 General

.1 Materials shall be defined for the purposes of this section as, “All piping and equipment constituting or used in the installation of the fire protection system(s) and all appurtenances attached during or after installation of the fire protection system(s).”.

.2 All Materials shall be in accordance with the requirements of the applicable NFPA fire codes including NFPA 13 – Installation of Sprinkler Systems, NFPA 14 – Standpipe and Hose Systems, NFPA 20 – Centrifugal Fire Pumps.

.3 All Materials shall conform to the appropriate standards listed in the most current published National Building Code of Canada (NBC), National Fire Code of Canada (NFC), and the requirements and standards required by the authority having jurisdiction.

.4 All Materials shall be listed, labelled and approved for intended use by Underwriters Laboratories of Canada (ULC), Underwriters Laboratories (UL), or Factory Mutual (FM) and shall meet with approval of the authority having jurisdiction.

.5 All Materials shall be new, unused products of a current design produced by a manufacturer regularly engaged in the production of products intended for use in fire protection systems.

.2 Pipe

.1 Steel pipe shall meet the requirements of NFPA 13 – Installation of Sprinkler Systems and shall meet the requirements of ASTM A53 – Welded and Seamless Pipe.

.2 Steel pipe shall meet the requirements of NFPA 14 – Standpipe and Hose Systems and shall meet the requirements of ASTM A53 – Welded and Seamless Pipe.

.3 All piping in sprinkler systems shall be schedule 40, black or galvanized steel.

.4 All piping in standpipe and hose systems shall be schedule 40, black or galvanized steel.

.5 Stainless steel pipe shall meet the requirements of NFPA 13 – Installation of Sprinkler Systems and shall meet the requirements of ASTM B446 – Alloy Materials and/or ASTM A-312. Stainless steel piping shall be of a schedule no less than schedule 10, type 316L.

.6 Stainless steel pipe shall meet the requirements of NFPA 14 – Installation of Sprinkler Systems and shall meet the requirements of ASTM B446 – Alloy Materials and/or ASTM A-312. Stainless steel piping shall be of a schedule no less than schedule 10, type 316L.

.7 Pipe 50mm (2”) and smaller shall be joined by threaded connections or by welding and shall meet the threaded joining requirements and methods in NFPA 13 – Installation of Sprinkler Systems.

.8 Pipe 64mm (2½”) and larger shall be joined by roll groove joints and mechanical groove couplings or by welding and shall meet the grooved or welded joining requirements and methods in NFPA 13 – Installation of Sprinkler Systems.

.9 Copper tubing shall be joined by UL, ULC, or FM approved methods for sprinkler systems and shall meet the joining requirements and methods in NFPA 13 – Installation of Sprinkler Systems.

.10 Schedule 10, 316 L stainless steel piping shall be joined by roll groove connections only and shall be of 38mm (1½”) or larger nominal diameter.

.11 Schedule 40, 316 L stainless steel piping shall be joined by threaded connections, roll groove connections or welding as follows:

.1 38mm (1½”) and larger piping shall be roll grooved or welded.

.2 32mm (1¼”) and smaller piping shall be threaded.

.12 All welded pipes shall be shop welded and shall meet the requirements, standards, and procedures of NFPA 13 – Installation of Sprinkler Systems, NFPA 14 – Standpipe and Hose Systems and the NBC. Submit documentation

confirming that shop welding methods and procedures comply with AWS B2.1 – Specification for Qualification of Welding Procedures and Welders for Piping and Tubing. Sprinkler Contractor shall provide during Shop Drawing submittal to Contract Administrator their written quality assurance procedure ensuring compliance with above-mentioned standards. Welded joints found leaking during testing stages shall be replaced with a new shop welded section of piping.

.3 Fittings

.1 Weld fittings up to and including 38mm shall be 13,790 kPa socket weld, 50mm and larger shall be butt weld.

.2 Pipe flanges shall be class 150 forged steel except for welded pipe connections, flanges for pipe 64mm and larger shall have a grooved extension for connection to pipe using mechanical groove coupling, flanges for pipe 50mm and smaller shall be threaded. Slip on or welding neck flanges may be used on shop fabricated components. Valve companion flanges shall be flat or raised face to suit valve flange. Provide suitable red rubber ring or full-face gasket, machine bolts and hex nuts unless otherwise recommended by manufacturer of connecting valve or equipment.

.3 Threaded fittings shall be class 125/150, as suitable for system operating pressure and shall meet the requirements of NFPA 13 – Installation of Sprinkler Systems and NFPA 14 – Standpipe and Hose Systems.

.4 Thread fittings shall be cast iron, ductile iron, malleable iron or brass.

.5 Close thread nipples are not permitted.

.6 Grooved fittings shall be Victaulic Groove End or Victaulic Firelock fittings as appropriate for supplied couplings. Drain elbows shall be Victaulic No. 10-DR, Drain Elbow.

.7 Mechanical grooved couplings shall be Victaulic style 005 Firelock rigid coupling.

.8 Mechanical grooved reducing couplings are not permitted.

.9 Grooved flange adapters shall be Victaulic Style 744 Firelock Flange Adapter or Victaulic Style 741 Flange Adapter. See clause 2.1.4 – “Gaskets. Nuts, Bolts and Hardware”.

.10 Mechanical tees may be used where approved by the Contract Administrator. Mechanical tees shall be Victaulic Style 920/920N Mechanical-T Bolted Branch Outlet or Victaulic Style 922 Firelock Outlet-T.

.11 Grooved reducers shall be Victaulic No. 50 or No. 51. Where reduction to threads is necessary Victaulic No. 52 Reducer Small End shall be used.

.12 Thread to groove adapters shall be Victaulic No. 80 Female Thread Adapter or Victaulic No. 40 Groove to Thread Nipple.

.13 Groove to flange adapters shall be Victaulic No. 45 Flange Adapter Nipple or Victaulic No. 41 Flange Adapter Nipple.

.14 All grooved fittings and couplings shall be coated with either a rust inhibiting alkyd enamel paint, hot dip galvanizing to ASTM A-153 or zinc electroplating to ASTM B-633.

.15 Victaulic Style 073 Firelock Outlet Couplings are not permitted.

.16 Victaulic No. 66 Vic-End/ No. 67 Vic-End II end of run sprinkler fittings are not permitted.

.17 Victaulic Style 925 Snap-Let fittings are not permitted.

.18 Victaulic Style 923 Vic-Let fittings are not permitted.

.19 Victaulic PressFit, FIT, and Plain End systems and products are not permitted.

.20 Victaulic grooved end copper system and products may be used where approved by Contract Administrator. Submit to Contract Administrator for review and approval Shop Drawings and product data sheets for approval of all Materials, products, and equipment when using this system.

.21 Victaulic stainless steel grooved piping system and products may be used where approved by Contract Administrator. Fittings shall be schedule 10S, 316 L stainless steel conforming to ASTM A-403. Submit to Contract Administrator for review and approval Shop Drawings and product data sheets for approval of all Materials, products, and equipment when using this system.

.22 Restricted orifice unions for use with inspectors test stations shall be a 25mm brass union fitting with an integral 13mm, machined orifice, LynCar Products Model No. 80534.

.4 Gaskets, Nuts, Bolts and Hardware

.1 Mechanical groove couplings shall have an EPDM gasket installed, suitable for use in fire protection systems; Victaulic Grade E, Type A or Victaulic Grade E standard gasket. All dry pipe systems shall have a flush seal gasket, Victaulic Grade E, FlushSeal.

.2 Flange gaskets shall be 1.6mm, full faced red rubber gaskets. Grooved flange gaskets shall be as supplied by flange manufacturer.

.1 Where grooved flange adapters mate to raised, serrated, rubber faced or AWWA cast flanges a suitable red rubber gasket and a flat 316L stainless steel, brass or phenolic flange washer (spacer ring) size identical to gasket shall be used as follows:

.1 Flange washers shall be metal unless used on grooved copper flange adapters, in such cases a type F phenolic flange washer shall be used. Victaulic Flange Washer, Type F Phenolic or Metal.

.2 When a grooved flange adapter mates to a raised face or serrated flange or system components; a flange gasket shall be installed adjacent to the serrated flange, the flange washer is installed between the flange gasket and grooved flange adapter.

.3 When a grooved flange adapter mates to a wafer valve where valves are rubber lined and partially rubber faced (smooth or not), the flange washer shall be placed between the valve and the grooved flange adapter.

.4 When a grooved flange adapter mates to a rubber faced flange the flange washer shall be placed between the grooved flange adapter and the rubber faced flange.

.5 When mating AWWA cast flanges to IPS grooved flanges the flange washer or transition ring shall be placed between two grooved flange adapters with the hinge points oriented 90-degrees to each other. Where one flange is not a grooved flange adapter a flange gasket shall be installed adjacent to the non-grooved flange and the flange washer inserted between the flange gasket and grooved flange adapter. Transition rings shall only be used in piping 350mm and larger.

.2 Where threaded or welded flanges mate a flange gasket shall be installed in conformance with the following requirements:

.1 Flange washers shall be metal unless used on copper or brass flange adapters, in such cases a phenolic flange washer shall be used.

.2 When flange mates to a raised face or serrated flange two flange gaskets with a flange washer between gaskets shall be installed between flanges.

.3 When flange mates to a wafer valve where valves are rubber lined and partially rubber faced (smooth or not) or when flange mates to a rubber faced flange no flange gasket or washer shall be installed.

.4 When two rubber faced flanges mate a flange washer shall be installed between flanges.

.3 Provide dielectric fittings, dielectric unions, flange isolation kits and other dielectric and isolations products where shown on Drawings and whenever transitions are made between dissimilar metals. Submit cut sheets for all dielectric and isolation products:

.1 Thread to groove, thread to thread, groove to groove and groove to groove dielectric fittings, Victaulic Style 47-GT/TT/GG Dielectric Waterway.

.2 UL/ULC listed dielectric flanges and dielectric unions.

.3 Dielectric flange isolation kits 65mm and larger, Minton composition, one-piece integral sleeves and washers kit as manufactured by Advance Products & Systems, Inc. or equal.

.4 Hex head bolts and heavy hex nuts meeting ASTM A-183 and zinc electroplated in conformance with ASTM B-663 shall be used on all grooved products.

.5 Hex head bolts, heavy hex nuts and washers used on flanges and for general use shall meet the requirements of ASTM A-183 and be zinc electroplated in conformance with ASTM B-663.

.6 All thread, continuous or intermittent thread rod shall have a nickel-cadmium or zinc electroplating. All thread, continuous or intermittent thread rod shall meet the requirements of NFPA 13 – Installation of Sprinkler Systems and NFPA 14 – Standpipe and Hose Systems.

.5 Pressure Gauges, Miscellaneous Equipment and Supplies

.1 Provide pressure gauges where indicated on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Gauges shall be ABS bodied, bronze-geared movement, friction poly-carbonate window and precision type pointer. Gauges shall be 90mm diameter with range selected so that pointer is approximately vertical at normal system operating pressure and shall have dual scale (psi/kPa) with ‘psi’ on outer scale. Connection to system shall be by 6mm (¼-inch NPT) male pipe threads and shall be installed with Neo #563 three-way test valve. Installation shall have sufficient clearance at test port to permit connection of 100mm-diameter test pressure gauge. Valve test port shall be plugged during normal system operation.

.6 Valves

.1 Provide valves of types indicated on Drawings or where not indicated of suitable type listed in this section. Valves shall be located where shown on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction.

.2 Valves shall be UL, ULC, and/or FM approved for use in fire protection systems. Valves shall be permanently marked with the manufacturers name or trademark, UL and ULC trademark, FM identification figure number and pressure ratings.

.3 Valves shall be of an indicating type with easy identification of open or closed position. Globe valves and OS&Y gate valves shall be of a rising stem design. Post or wall indictors shall visibly indicate open or closed position. Ball valves shall be designed so the handle points inline of the piping to which it is attached and the direction of water flow in the open position. Butterfly and supervisory type ball valves shall have a flag type indicator that visibly shows, open or closed position.

.4 Where valves control the flow of water into, between, through, or within fire protection systems they shall be considered supervisory valves. Supervisory valves shall be equipped with a UL, ULC, and FM approved supervisory switch. Wiring shall be by division 16.

.5 Gate valves 50mm and smaller shall be bronze, OS&Y pattern with threaded connections, rated for 1,210 kPa service, Crane Figure 459.

.6 Gate valves 64mm and larger shall be iron body, tapered solid wedge disc, renewable bronze seat rings, flanged ends, and rated for 1,210 kPa service, Crane Figure 467.

.7 Ball valves, non-supervisory 50mm and smaller shall be full port, threaded ends, chrome plated brass ball, rated for 4,140 kPa service, Crane Figure 9203-B.

.8 Bleeder, lever type ball valves used for testing pressure devices on shall be bronze body, zinc plated steel handle, rated for 1,210 kPa service, 3mm exhaust port and 13mm threaded connections, LynCar Products Model No. 4075.

.9 Globe valves, non-supervisory, 50mm and smaller shall be Class 150, bronze body, rising stem, renewable PTFE disc, with threaded ends, Crane Figure 7TF. Globe type 6mm three way valve for connection of pressure gauges shall be Neo #563.

.10 Angle valves, non-supervisory, 50mm and smaller shall be class 150, bronze body, rising stem, renewable PTFE disc, with threaded ends, Crane Figure 17TF.

.11 Ball valves 50mm and smaller shall be brass body, standard port, brass gearbox, brass stem, chrome plated brass ball, TFE seats, rated for 2,410 kPa service, threaded ends, c/w two single pole double throw pre-wired switches for supervision, Victaulic Series 728 Firelock Ball Valve.

.12 Butterfly valves 64mm and larger shall be grooved end, heat fused polyphenylene sulfide coated ductile iron body, EPDM coated disc, gear operated valve position indicator, two single pole double throw pre-wired switches for supervision, Victaulic Series 705W Firelock Butterfly Valve complete with weatherproof actuator. Butterfly valves 64mm and larger where flanged connections are required shall be iron body, lug style, with aluminium-bronze disc and replaceable EPDM seat, manual gear operator with valve position indicator, rated for 1,379 kPa service, Tyco mode BFU-N lug style butterfly valve complete with supervisory switches.

.13 Alarm test modules 50mm and smaller shall be bronze body, dual poly-carbonate sight glasses, test and drain ports, threaded ends, rated for 2,068 kPa service, Victaulic Style 720 Testmaster II Alarm Test Module, AGF Model 1000 TestAnDrain.

.14 Check valves 50mm and smaller shall be bronze body, class 150, y-pattern, PTFE renewable disc, with threaded ends, Crane Figure 141TF. Check valves 64mm and larger shall be a ductile iron body, PPS coated welded nickel seat,

EPDM coated disc, upstream and downstream drain ports, rated for 2,065 kPa service, with grooved ends, Victaulic Series 717 Firelock Check Valve.

.15 Backflow preventers in AWWA class 1, 2, 3 installations shall be as follows:

.1 50mm and smaller double check assembly, bronze body, captured springs, top mounted access panels, replaceable seats and seat discs, with threaded ends, Watts Series 007 Double Check Backflow Assembly.

.2 64mm and 75mm double check assembly, epoxy coated cast iron body, captured springs, top mounted access panels, replaceable seats and seat discs, with flanged ends, Watts Series 007 Double Check Backflow Assembly.

.3 100mm and larger double check assembly, epoxy coated body, captured spring check, replaceable seats and seat discs, with flanged ends, Watts 709 OSYRW Double Check Assembly.

.4 All valves on backflow preventers shall be supervised.

.16 Fire hose valves 64mm shall be cast brass, 2068 kPa working pressure, fire line angle valve, complete with cap and chain and red hand wheel. Threads to suit local fire department requirements, National Fire equipment Mode A561 Model A156.

.17 Provide forged brass 64mm female by 38mm male fire hose valve reducing adapter c/w 38mm forged brass cap and chain in lieu of 64mm cap on all 64mm fire hose valves, National Fire Equipment Model A-75.

.18 Ball drip valves shall be brass, 13mm or 19mm male to male threads and shall be available with a 13mm spring-loaded option, National Fire Equipment Model A-75.

.19 Ball drip valves shall be piped locally over floor drains or directly into drain riser or line as indicated on Drawings.

.20 Preaction Alarm Valves

.1 Actuated system valves (Deluge and Preaction), shall be rated for working pressures of up to 2065 kPa. Ductile iron bodied conforming to ASTM A-536, aluminium bronze clapper, aluminium bronze latch and piston, 17-4 series stainless steel shafts, nitrile rubber seat O-rings and 300 series stainless steel springs, Victaulic Firelock NXT Series 769. Valve to be c/w double interlock electric/pneumatic release trim, alarm pressure switch, and air supervisory pressure switch.

.7 Electronic Supervision and Tamper Devices

.1 Vane type waterflow alarm switches shall be rated for service up to 3102 kPa, rated for surges of up to 5.4 M/s and alarm activation at 0.63 l/s. Switch configuration shall consist of two sets of single pole double throw (S.P.D.T.) Form C synchronized contacts rated at 15A, 125 VAC and 2A, 24 VDC, Switch enclosure shall meet NEMA 4 rating, be equipped with a 0-90 second range adjustable retard. Enclosure cover shall be held captive by tamper resistant screws or supervised for removal by a cover tamper switch. Flow switch saddles shall have a factory installed non-corrosive insert. Waterflow alarm vane switch shall be provided and installed at each sprinkler system connection to the wet pipe main where indicated on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction, Potter Model VSR-F.

.2 Pressure type waterflow switches shall be rated for service up to 1206 kPA, and operate an increasing pressure of 27 to 55 kPA. Switch configuration shall consist of two SPDT form C contacts rated 10A, 125 VAC and 2A, 30 VDC. Potter Model PS10-2.

.3 Pressure type air supervisory switches shall be rated for service up to 1206 kPA and operate on a pressure increase or decrease of 69 kPA. Switch configuration shall consist of two SPDT Form C Contacts rated 10A, 125 VAC and 2A, 30VDC. Potter Model PS40-2.

.4 Valve supervisory switches shall contain two sets of single pole double throw (S.P.D.T.) Form C contacts rated at 15A, 125/250 VAC and 2.5A, 0-30 VDC resistive. Switch enclosure shall have a die cast zinc base with two 13mm electrical conduit knockout connections, a die cast zinc cover with factory installed gasket and tamper resistant stainless steel screws. All components shall have a corrosion resistant finish. Units shall be mounted using a clamp bar and carriage bolt or by means of a detachable threaded 13mm nipple. Valves installed in line with pressure type alarm devices shall be supervised for their full open position via an integral valve position switch. Enclosure shall meet NEMA 6P requirements, totally submersible where required. Trip rod shall be fully adjustable in length, made of stainless steel and be held captive by a set screw. Provide and install valve supervisory switches for each sprinkler system control valve, which can be used to shut off the flow of the fire protection water supply to any zone or portion of. Valve supervisory switches shall be installed where indicated on the Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Switches used on outside stem and yolk valves shall be Potter OSYSU-2. Switches for post indicating or butterfly valves shall be Potter PCVS-2. Switches in line with pressure type alarm devices shall be Potter Model BVS-1/2", 3/4" or 1".

.5 Valve supervisory switches for use on ball valves with lever or tee handles on listed backflow preventors not containing integral tamper switches shall contain two sets of single pole double throw (S.P.D.T.) Form C contacts rated at 10A, 125/250 VAC and 2A, 30 VDC resistive. Switch enclosure and cover shall be a non-corrosive composite Material with one 13mm electrical conduit knockout connection, factory installed gasket and cover supervised for removal with integral tamper switch. All components shall have a corrosion resistant finish. Units shall be mounted using a mounting bracket, clamp bar and carriage bolt assembly. Valves shall be supervised for their full open position by valve position switch. Enclosure shall meet NEMA 6P requirements, totally submersible where required. Provide and install valve supervisory switches for each sprinkler system control valve, which can be used to shut off the flow of the fire protection water supply to any zone or portion of. Valve supervisory switches shall be installed where indicated on the Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction, Potter Model RBVS-T.

.8 Sprinkler Heads, Cabinets and Wrenches

.1 Provide chrome plated recessed automatic sprinklers with white escutcheon finish in areas with finished ceilings, as indicated on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Sprinkler heads shall be factory tested to 3447 kPa and suitable for a working pressure of 1206 or 1723 kPa. Connection to system shall be by 15mm (½-inch NPT) pipe thread. Sprinkler heads shall have a 13mm nominal orifice size with a K-factor of 8,1 S.I. (5.6 Imp.). Sprinkler heads shall be a glycerine solution frangible-bulb type, with quick (3mm-bulb) response, shall have a beryllium-nickel spring and die cast brass frame. Victaulic Frame V27, K5.6, Models V2708.

.2 Provide brass upright automatic sprinklers in unfinished areas where sprinkler piping cannot be concealed, as indicated on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Sprinkler heads shall be factory tested to 3447 kPa and suitable for a working pressure of 1206 or 1723 kPa. Connection to system shall be by 15mm (½-inch NPT) pipe thread. Sprinkler heads shall have a 13mm nominal orifice size with a K-factor of 8,1 S.I. (5.6 Imp.). Sprinkler heads shall be a glycerine solution frangible-bulb type, with quick (3mm-bulb) response, shall have a beryllium-nickel spring and die cast brass frame. Victaulic Frame V27, K5.6, Models V2703 and V2704.

.3 Provide brass standard horizontal sidewall automatic sprinklers and chrome plated recessed horizontal sidewall automatic sprinklers with white escutcheon finish where shown on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Sprinkler heads shall be factory tested to 3447 kPa and suitable for a working pressure of 1206 or 1723 kPa. Connection to system shall be by 15mm (½-inch NPT) pipe thread. Sprinkler heads shall have a 13mm nominal orifice size with a K-factor of 8,1 S.I. (5.6 Imp.). Sprinkler heads shall be a glycerine solution frangible-bulb type, with quick (3mm-bulb) response, shall have a beryllium-nickel spring and die cast brass frame. Victaulic Frame V27, K5.6, Models V2710.

.4 Provide adjustable concealed automatic sprinklers with white escutcheon plate where indicated on Drawings and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Sprinkler heads shall be factory tested to 3447 kPa and suitable for a working pressure of 1206 or 1723 kPa. Connection to system shall be by 15mm (½-inch NPT) pipe thread. Sprinkler heads shall have a 13mm nominal orifice size with a K-factor of 8,1 S.I. (5.6 Imp.). Sprinkler heads shall be a glycerine solution frangible-bulb type, with quick (3mm-bulb) response, shall have a beryllium-nickel spring, die cast brass frame, zinc chrome plated cold rolled steel cup and fusible solder cover plate. Victaulic Frame V38, K5.6, Models V3802. In clean room applications provide a white nitrile rubber sealing gasket, Victaulic part number S380P00020.

.5 Provide sprinkler head storage cabinet(s) to store stock of spare sprinkler heads as required by and as required by NBC, NFC, NFPA standards and the authority having jurisdiction. Cabinet(s) shall have room to facilitate storage of and shall contain for each type of sprinkler head stored in storage cabinet one sprinkler head installation wrench. Victaulic part numbers SA1-000-0000, SA2-000-0000, SA3-000-0000 and SA4-000-0000.

.9 Floor Plates and Sleeves

.1 Where piping passes through masonry walls provide steel pipe sleeves full thickness of wall.

.2 Where riser piping passes through floor or ceiling penetrations watertight floor sleeves shall be provided.

.3 Provide split or solid round escutcheon plates on all exposed piping passing through walls, floors or ceilings.

.4 Piping or equipment passing through fire or smoke separations shall be firestopped to the equivalent wall rating. Firestopping shall be UL and ULC listed and FMRC approved.

2.2 HANGERS, SUPPORTS AND BRACING

.1 All piping, system components and appurtenances constituting the sprinkler and/or standpipe system shall be supported in accordance with NFPA standards, NBC, NFC, the requirements of the authority having jurisdiction, the requirements of the Contract Administrator.

.2 Pipe rings shall be zinc coated Anvil figure 69 or approved equal.

.3 Hanger rods shall be electro-galvanized or cadmium plated of minimum 9.5mm diameter, rod size shall be in accordance with NFPA 13 – Installation of Sprinkler Systems.

.4 All hangers shall be in conformance with the appropriate NFPA standards, the NBC, NFC, local building codes, the authority having jurisdiction and the requirements of this sub-section. Bracing shall be designed and installed in accordance with good Engineering practices.

.5 In no case shall the sprinkler system piping and fittings be improperly braced so as to cause damage to other building systems or the building itself and its appurtenances.

.6 Section 15500 shall submit all design documents and reports detailing the anchoring system and bracing with Shop Drawings prior to construction as part of Bid Submission of sprinkler Shop Drawings.

.7 Contractor to include for testing concrete inserts for pipe hangers, pull test to be carried out at the discretion of the Site inspector to approximately 10% of hangers installed. All test results are to be logged by Contractor and submitted to Contract Administrator.

2.3 FIRE HOSE AND STANDPIPE SYSTEMS

.1 Conventional wet fire hose and standpipe systems shall be designed and installed in accordance with NFPA 14 – Standpipe and Hose Systems, NBC, NFC, local building codes, the authority having jurisdiction's requirements and the requirements of the Contract Administrator.

- .1 Wet standpipe and fire hose systems shall only be installed in areas not subject to freezing conditions.
- .2 Wet standpipe and hose systems shall be equipped with a vane type, water flow alarm switch at the incoming water source. Where Drawings indicate flow switches on individual standpipe risers equip each with vane type, water flow alarm switch. Flow switches shall detect water flow alarm condition and send appropriate signal to fire alarm panel. Wiring by division 16.
- .3 Wet standpipe and hose systems connected to potable and non-potable water supplies shall be equipped with backflow prevention devices as shown on Drawings and as required by NFPA, NBC, NFC, local building codes and the authority having jurisdiction.
- .4 Provide pressure gauge complete with three-way test valve at top of all risers.
- .5 Provide test header at the most remote standpipe's highest elevation. Test header shall be equipped with two (2) 64mm hose valve connections at roof level, automatic ball drip valve piped to drain and indicating type butterfly valve complete with tamper switch for isolation. Wiring by division 16.
- .6 Provide and install all fittings, piping, appurtenances, etc. necessary and as required by NFPA standards, by this sub-section and as intended by the Contract Drawings and this Specification to properly install a complete wet standpipe system.

2.4 AUTOMATIC SPRINKLER SYSTEMS

.1 Double-interlock preaction, automatic sprinkler systems shall be designed and installed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems, NBC, NFC, local building codes, the authority having jurisdiction's requirements and the requirements of the Contract Administrator.

.1 Individual preaction systems shall not exceed a maximum system capacity of 2,839 litres, where system design allows water to reach the test connection in under 60 seconds systems may contain up to a maximum of 5,678 litres. Where larger systems are required additional actuated system preaction alarm valves shall be installed.

.2 Preaction systems connected to potable and non-potable water supplies shall be equipped with backflow prevention devices as shown on Drawings and as required by NFPA, NBC, NFC, local building codes and the authority having jurisdiction.

.3 Provide pressure gauge complete with three-way test valve at top of all risers.

.4 Actuated system preaction alarm valves shall be of low air pressure (89 kPa) design.

.5 Provide inspectors test station where shown on Drawings and/or where required by NFPA standards. Inspectors test stations shall be complete with external splash pad. Where piping and fittings protrude through wall fittings and piping shall be galvanized.

.6 Provide all piping, fittings, appurtenances, etc. necessary to connect the actuated system preaction alarm valve to the system piping.

.7 Provide and install an alarm pressure switch, supervisory air pressure switch, solenoid release valve and butterfly valve c/w supervisory tamper switch. Wiring by division 16.

.8 Actuated systems preaction alarm valve shall be complete with factory supplied trimming kit:

.1 Alarm pressure/flow switch and supervisory low pressure switch. Wiring by division 16.

.2 Water supply and system pressure gauges.

.3 Piston charge line ball valve (normally open), strainer, check valve, 1.8mm restrictor, pressure gauge and gauge valve.

.4 Alarm line ball valve (normally open), alarm test line (normally closed) ball valve, alarm drain line ball valve (normally closed), alarm line 1.6mm drain restrictor and drip check valve.

.5 Main system drain valve and flow test valve.

.6 Drip cup and drip cup check valve.

.7 Auto drain, check valves, ball check and dry actuator.

.8 Air line strainer and 1.6mm air line restrictor and Victaulic Series 757 Air Maintenance Device.

.9 Electric release solenoid valve.

.10 Manual pull station.

.11 Main control valve, complete with tamper switch. Wiring by division 16.

.9 Provide air compressor sized in accordance with the manufacturer data sheet of actuated system preaction valve. Air compressor shall be factory assembled and shall conform to the following criteria:

.1 Compressor shall be a cast iron head single or dual cylinder with 37.85, 75.7, or 113.5 litre (10, 20, or 30 gallon) tank. Tank size shall be selected based upon the following equation:

.1 $0.02 \times SC = TS$

TS = Tank capacity in litres
SC = System capacity in litres
*** For gallons divide by 3.785

.2 The tank size shall be rounded up to the nearest above listed capacity.

.2 Compressor shall be capable of restoring system to normal operating pressure from zero (0) pressure within 30 minutes. Required flow rate shall be determined by the following equation:

.1 $(4.8487 \times 10^{-7}) \times SC = FR$

FR = Required flow rate in m^3/s
SC = System capacity in litres
*** For CFM (ft^3/min) multiply m^3/s by 2119

.3 Air compressor shall be set to automatically start at 34.5 kPa above system air pressure for sprinkler system and shall fill compressor air tank to 690.5 kPa.

.4 Air compressor shall be complete with the following accessories:

.1 All fitting, gauges, piping, appurtenances, etc. required for connection of air tank to piston compressor.

.2 All fitting, gauges, piping, appurtenances, etc. required for connection of air tank to system air maintenance device.

.3 Electric motor, manufacturer recommended starter pre-wired to motor at factory if required (see Division 16 motor schedule) and any necessary controls or controllers. See division 16 motor schedule for voltages and electrical characteristics. Wiring by division 16.

.10 All preaction sprinkler systems shall be properly braced to prevent movement, vibration, etc. that may compromise the systems integrity. Submit bracing details to Contract Administrator for review prior to installation.

.11 Electric release panel and/or fire alarm panel supplied by division 16 shall contain primary power supply, emergency batteries, battery charger, transfer switches, pilot lights and auxiliary contacts as required for operation of the actuated system preaction alarm valve. Panel shall be capable of release control. Provide normally open and normally closed contacts for fire alarm system as required by Division 16.

.12 All smoke/heat detector heads that activate this system shall be identified. Co-ordinate with Division 16 – Electrical.

.13 Provide complete instructions for normal/emergency operation of system and for routine testing, draining, and pre-activating system. Mount on wall adjacent to valve station at approximately 1500mm above floor. Instructions shall be mounted in a frame complete with Plexiglas.

.14 Provide and install all fittings, piping, appurtenances, etc. necessary and as required by NFPA standards, by this sub-section and as intended by the Contract Drawings and this Specification to properly install a complete preaction automatic sprinkler system.

2.5 FIRE EXTINGUISHERS, CABINETS, MOUNTING AND LOCATIONS.

.1 Provide new fire extinguishers, cabinets, surface mounting hardware, etc. as indicated on Drawings. All fire extinguishers and appurtenances shall be UL and ULC listed.

.2 Wall hung Class A, B and C rated fire extinguishers used in mechanical rooms, shall use a mono ammonium phosphate based dry chemical agent. Extinguisher shall be Ansul SENTRY Model No. A05, 2.3 kg rated at 3-A, 10-BC.

.3 Class C rated fire extinguishers used in computer, communications equipment, telecom equipment, information technology computer and network, data storage, irreplaceable data storage, irreplaceable document and art storage, laboratories, sensitive/expensive equipment and other similar areas/rooms shall use a Co2 based non-conductive agent. Extinguisher shall be Ansul SENTRY Model No. CD05A, 2.3 kg rated at 5-BC or Model No. CD10A, 4.6 kg rated at 10-BC as indicated on Drawings.

2.6 FIRE, JOCKEY, EXCESS PRESSURE PUMPS AND CONTROLLERS

.1 See Division 15 and Division 16 motor schedule. Where conflicts or discrepancies in electrical characteristics occur between motor schedules and/or this section the electrical characteristics shown on the Division 16 motor schedule shall take precedence. Notify Contract Administrator prior to Bid Opportunity closing of any conflicts or discrepancies.

.2 Fire Pump(s)

.1 Armstrong Darling Vertical In-line fire pump Model Series 4300F LA-FXlisted by Underwriters Laboratories of Canada (ULC), Underwriters Laboratories Inc. (UL) and approved by Factory Mutual (FM) having a capacity of 500 USGPM for a pressure boost of 120 PSIG.

.1 The pump shall have a bronze impeller, non-corrosive shaft sleeve, packed gland with external flush line to the lantern ring suitable for 125 PSIG suction pressure. Pumps to be supplied with cast iron casings incorporating a double volute design.

.2 The pump shall be driven by a 60 HP at 3550 RPM standard vertical close-coupled open drip proof motor with a 1.15 service factor. Confirm horsepower and electrical characteristics with division 16 motor schedule.

.3 The pump shall be supplied with the following accessories:

.1 One (1) 3½”dial type suction gauge with ¼” cock and lever handle.

.2 One (1) 3½”dial type discharge gauge with ¼” cock and lever handle.

.3 One (1) circulation relief valve.

.4 Pump shall be fitted with one (1) eccentric suction reducer and one (1) concentric discharge increaser (by mechanical Contractor) to fit NFPA20 recommended piping sizes.

.5 One (1) outside test header shall be supplied with one set (2) of 2½” hose valves with caps and chains.

.3 Fire Pump Controller(s)

.1 Electric Fire Pump Controller(s)

.1 The transfer switch fire pump controller shall be of the FT60 model as manufactured by Cutler-Hammer.

.2 The Fire Pump Controller shall meet the requirements of the latest edition of NFPA 20 and shall be UL and ULC listed, FM and CSA approved for fire pump service. The controller shall be suitable for the available short circuit current at the line terminals of the controller.

.3 The automatic transfer switch shall conform to the requirements of the most current edition of NFPA 20. It shall be installed in a barriered compartment of the fire pump controller.

.4 The complete assembly, controller and transfer switch shall be shipped as a single unit.

.5 A single uni-gear motor shall electrically operate the transfer mechanism. It shall also be capable of being operated manually and shall have suitable provisions for readily disengaging the gear motor when necessary.

.6 The transfer switch shall be mechanically and electrically interlocked so that it shall not be possible for the load circuits to be connected to normal and emergency sources simultaneously, regardless of whether the switch is electrically or mechanically operated. The switch shall have a manual neutral position.

.7 A solid state sensing and control logic panel shall be separately mounted from the power switching portion of the Transfer Switch. The two sections shall be connected together by control cables and plug-in connectors. The control section shall be capable of being isolated from the power section for maintenance purposes.

.8 The normal power source shall be set to pickup at 95% and drop out at 90% of nominal voltage. The voltage sensing on the alternate supply shall be set to pickup at 90% of nominal voltage.

.9 In order to over-ride momentary fluctuations in the system, a time delay transfer from normal to alternate power supply shall be adjustable up to 15 seconds, factory set at 3 seconds. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of the normal or original supply. Upon restoration of the normal supply, the transfer switch shall automatically retransfer its load circuits to the normal supply. Mechanically held transfer mechanisms shall be energized only momentarily during transfer or retransfer. A built in time delay for generator cool down (unloaded) period shall be adjustable up to 8 minutes; factory set at 5 minutes.

.10 If the emergency/standby power should fail while carrying the load, transfer to the normal supply shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

.11 The transfer switch shall meet UL 1008 and shall be regularly subjected to Endurance, Interrupting Capacity, and Dielectric Voltage-Withstand test as outlined by UL 489 standards.

.12 The controller shall be of the combined manual and automatic type designed for Reduced Voltage Autotransformer starting of the fire pump motor and having the horsepower, voltage, phase and frequency rating as per division 16 motor schedule to match fire pump.

.13 The controller shall be housed in a NEMA Type-2 Drip-Proof enclosure provided with mounting feet for floor mounting. The entire controller shall be withstand rated for 100,000 RMS symmetrical amperes [25,000 @ 600VAC].

.14 An LCD display, visible through a shatterproof glass panel in the door, shall indicate the following:
- .1 System pressure, three-phase voltage and amperes, weekly test time, elapsed run time, number of operations and the most recent 2048 alarm and operational events.
- .2 Green LEDs shall display the following starting and running conditions:
  - .1 Power On Pump Running RPT Timing
  - .2 Sequence Timer Local Start Remote Start
  - .3 Deluge Valve Interlock On Low Pressure
- .3 Red LEDs shall display the following alarm conditions:
  - .1 Phase Reversal Phase Failure Fail To Start
  - .2 Undervoltage Overvoltage Relief Valve Discharge
  - .3 Locked Rotor Trip Low Suction Pressure Emergency Start

.15 A Fail-To-Start alarm shall occur if the motor controller sees less than 20% of FLA after a time delay. Time delay shall be adjustable between 1-90 seconds.

.16 Locked rotor protection shall be provided. After a trip condition and restoration of power, the LCD display shall indicate “LOCKED ROTOR TRIP”.

.17 A solid state pressure transducer shall be provided, rated for 600 psi with +/- 1.5% accuracy. The pressure START and STOP points shall be adjustable in increments of one (1) psi.

.18 A LOW PRESSURE pre-alarm, indicated with a flashing green LED, shall denote a potential pump starting condition and will remain lit once the pump has started to indicate the starting cause.

.19 Auxiliary relays shall be provided to indicate the following conditions:
- .1 Fail-To-Start
- .2 Low Pressure
- .3 Motor Overload (125% of FLA)
- .4 Interlock On
- .5 Low Suction Pressure
- .6 Undervoltage
- .7 Overvoltage
- .8 Respond to a dry contact wired to terminals in the controller.

.20 A sequential start timer and test timer shall be provided as a standard feature.

.21 A restart time delay of two (2) seconds shall be provided to allow the residual voltage of the motor to decay prior to re-starting the motor. In the event that the pump motor continues to run after a request to stop, then the controller must display a ‘Fail-To-Stop’ message to indicate this condition.

.22 OVERVOLTAGE (5-20%) and UNDERVOLTAGE (5-30%) sensing and alarming shall be provided as standard.

.23 The controller shall be equipped with a line printer-recorder. It shall produce hard copy reports of system STATUS including software version, shop order number, customer order number, time of day, date, incoming voltage, start pressure, stop pressure, pressure deviation, SST

setting, RPT setting, acceleration timer, undervoltage, overvoltage, CT ratio, and weekly test time.

.24 The controller shall have the capability of storing and sending the 2048 operational and alarm events to the printer-recorder. All 2048 events shall be viewable via the LCD display, without opening the enclosure door, and shall have the capability of being downloaded to a PC for further manipulation of data.

.25 The pressure recording frequency shall be based on the amount of pressure change as selected by the user, and shall not be time frequency based. The time/date stamped pressure values shall be visible via the LCD display, stored in memory and printed on a printer-recorder. An RS232 serial port shall be provided to download these values as well as status and alarm conditions, to a computer.

.26 The controller shall be supplied with interlock and shutdown circuits as standard. A flashing green LED shall indicate an INTERLOCK ON condition. Where shutdown of the pumps(s) due to “Low Suction Pressure” is required, it shall be accomplished without the addition of another panel or enclosure. The LCD display shall indicate ‘Low Suction Shutdown”, which can printed as an alarm message on the printer-recorder. Reset of the condition shall be “automatic” or “manual” as selected by the user.

.27 A common alarm relay and a bell alarm shall be supplied. One set of Form-C contacts from the common alarm relay shall be wired to the main terminal block.

.28 All relays shall be of the plug-in type. An LED on the relay panel shall indicate the energized state of the relay. All relay contacts shall be rated @ 10A, 277VAC/30VDC. Two (2) sets of Form-C contacts shall be provided for each of the following:

.1 Pump running,
.2 Loss of phase,
.3 Phase reversal,
.4 Alternate source,
.5 Common alarm and
.6 “FUTURE” relay.

.29 All relays shall be available on both normal power and emergency power and shall be designed for remote annunciation/indication. When a transfer switch is equipped with the panel failure to transfer shall also be monitored including cause of failure.

.30 One (1) normally open and one (1) Form-C contact shall be available for Pump Run.

.31 A means shall be provided to test the operation of all the LED’s (Lamps) to ensure their functionality.

.32 The LCD shall have the ability to display English or French.

.33 The controller manufacturer shall manufacturer all major components of the controller including enclosures, circuit breakers, pilot devices, contactors, control relays and surge arrestors.

.4 Jockey Pumps

.1 Jockey pump shall be Burks CT series, close coupled turbine pump type. Pump shall be complete with motor available in 120V or 208V/0.19kW, 0.37kW or 0.56kW/1-phase/60Hz, 3450 RPM or 1725 RPM. See Division 16 motor

schedule for voltage requirements. Pump shall be rated for temperatures up to 107°C and shall be of all bronze construction. Pump shall be furnished with the following equipment; braided flexible hose connections, discharge check valve, suction strainer, mounting bracket, and PRV set at 1085 kPa.

.2 Minimum pump capacity shall be determined by the following equation:

.1 $$\frac{0.039 \times SC}{1800} + 0.096 = PC$$

PC = Pump capacity in litres per second (l/s)
SC = System volumetric capacity in litres
*** For GPM multiply l/s by 15.85

.5 Provide and install an FDJ series jockey pump controller as manufactured by Cutler-Hammer. Controller unit shall meet the following requirements:

.1 The jockey pump controller shall be UL and ULC listed and meet CSA requirements. Where approval agencies include Factory Mutual (FM) obtain FM approval of controller.

.2 Jockey pump controller shall be rated for the horsepower, voltage, phase and frequency rating as per division 16 motor schedule to match jockey pump.

.3 Controller shall be a full voltage, across-the-line type unit capable of sustaining an inrush current of approximately 600% of rated full load amperes.

.4 The unit shall be a wall mounted enclosure meeting NEMA/UL/CSA 3 and 3R (water splash protected) protection level and operational between 5°C and 50°C.

.5 The controller shall be factory assembled and tested and shall be identifiable by an individual serial number. All test reports for the jockey pump controller shall be available for review upon request.

.6 The controller shall be complete with 2 electrical rating labels located on the outside and the inside surface of the enclosure door. The labels shall clearly indicate the controller catalogue and serial no, line and control voltage, HP rating, phase, frequency, short circuit interrupting capacity, full load current, max. fusing, ampacity, options no., wiring diagram no. and production date.

.7 Complete installation and maintenance manuals including Drawings of the controller shall be provided inside the controller enclosure.

.8 The controller shall be supplied with the following door mounted components approved to match the NEMA rating of the enclosure:

.1 One main disconnect switch complete with door interlock and padlock provision in the OFF position.

.2 One Hand-Off-Auto rotary type, heavy duty selector switch.

.9 The following control components shall be mounted inside the controller:

.1 One magnetic across-the-line motor contactor HP rated.

.2 One thermomagnetic motor protector complete with short circuit and motor overload protection.

.3 One pressure switch for clean water only complete with adjustable cut-in setting and independent differential adjustment (300 PSIG max.)

.10 The controller shall be supplied with the following optional features:

.1 Extra “Pump Run” contacts.

.2 "Power on" light.

.3 "Run" light.

.4 Low suction pressure switch and alarm pilot light.

.5 Labelling.

2.7 CONNECTION TO DOMESTIC WATER SUPPLY

.1 All connections to potable water sources shall have appropriate backflow prevention equipment installed as shown on Drawings and as outlined in this Specification.

.2 Wafer, resilient or single check valves are not considered as backflow prevention equipment.

.3 All piping up to listed backflow prevention equipment shall be schedule 40 or 10 series 304 stainless steel or Type-L copper. Where the authority having jurisdiction requires differing Materials for connection to potable water source supply as required. Inform Contract Administrator prior to closing of Bid Opportunity if AHJ requires alternate Materials.

.4 Valves, equipment and all appurtenances excluding piping up to and including backflow prevention equipment shall be epoxy or polyphenylene sulfide coated and listed for use in potable water systems.

.5 All couplings, fittings, Materials, and appurtenances up to backflow preventer shall conform to the general Materials section. Where stainless steel or copper tubing is used before the backflow preventer joining methods shall be as follows:

.1 Victaulic grooved stainless steel system complete with stainless steel fittings and rigid malleable iron mechanical couplings. Couplings shall be complete with flush-seal gaskets.

.2 Stainless steel piping may be shop-welded where and as required. Good welding practices including the preparation, cleaning and acid treatment of piping against corrosion shall be followed. Submit procedures to Contract Administrator for review.

.3 Victaulic grooved copper system complete with copper fittings and rigid malleable iron mechanical couplings. Couplings shall be complete with flush-seal gaskets.

Part 3 Execution

3.1 QUALIFICATION OF SUB-CONTRACTOR

.1 Only experienced Fire Protection Subcontractors, as determined by Contract Administrator, will be considered for this Work. Subcontractors must be able to show evidence of having performed Work of similar type and size.

3.2 SHOP DRAWINGS, PERMITS, FEES

.1 Prior to installation, prepare complete set of detailed Shop Drawings in accordance with requirements of NFPA Standard #13, #14, #20 and inspecting authority. Information as to architectural, mechanical and electrical systems shall be obtained from respective Drawings and/or from Site. Carry out any necessary flow tests without extra compensation.

.2 Detail design shown on Shop Drawings shall conform to general piping layout and sprinkler arrangement shown on Drawings. Contract Administrators approval is required for alternative designs or revisions other than as required for co-ordination with other trades and existing Site conditions.

.3 If sprinkler Contractor is requested to provide costing for a proposed change notice (PCN's) the pricing shall be complete with a detailed Material, labour and services breakdown. Sufficient information shall be provided to allow and ensure verification of pricing. Failure to submit detailed price breakdowns for PCN's may result in hourly charges payable by sprinkler Contractor for each additional review of PCN pricing to Contract Administrator and the City. Charges shall not be applied to any party when detailed pricing is submitted and rejected due to cost of Work or when re-pricing is requested.

.4 At completion of Work, provide:
- .1 Two (2) paper sets (hard copies) of "As-Built" Drawings with all changes incorporated.
- .2 Electronic data files in AutoCAD (2000+) format including .DWG, .DWF, .DXF(R12) files and all external reference files (XREF) in same Drawing formats. Binding files is considered acceptable. Provide all files on CD-ROM in a PC readable format.

.5 Submit Shop Drawings and calculations to Contract Administrator for review and to inspecting and inspection fees. Inspecting authorities for this project will be:
- .1 Local building inspection department and/or fire department.
- .2 The City's Insurance Underwriters.

.6 Arrange for inspection and testing of all Work, and make any changes required to comply with regulations of inspecting authority.

.7 Systems shall be designed in accordance with requirements of:
- .1 The City's Insurance Underwriters.
- .2 National Building Code of Canada and National Fire Code of Canada.
- .3 Manitoba Building Code and Manitoba Fire Code.
- .4 Local building regulations.
- .5 All applicable NFPA Codes & Standards.

3.3 EXAMINATION OF DRAWINGS AND CO-OPERATION

.1 Examine all architectural, structural, mechanical and electrical Drawings before preparing Shop Drawings. Arrange position of sprinkler heads, pipes, etc. as required to prevent interference with Work of other trades, and existing conditions.

.2 Co-operate with all other Subcontractors and/or Subcontractors installing equipment which may affect proper installation and operation of Work and arrange sprinkler heads, etc. in proper relation to other apparatus, such as lighting fixtures, unit heaters, air inlets, air outlets etc., both new and existing.

.3 Provide wiring diagrams, dimensions of concrete bases, dimensions of masonry openings, etc. as required by other Subcontractors and/or Subcontractors.

3.4 EXISTING CONDITIONS

.1 Before commencement of any Work, examine Work of other trades and make immediate report to Contract Administrators of any defect or interference affecting Work or guarantee of this Work.

3.5 PIPING SYSTEMS

.1 Inside of all pipe, fittings, valves and all other equipment to be left smooth, clean, and free from blisters, loose mill scale, sand and dirt.

.2 Install unions or flanges at all equipment connections, valves, etc.

.3 Install dielectric insulating couplings between all pipes or apparatus constructed of dissimilar metals.

.4 Pipe bending, other than wrought iron, permitted only if seamless steel pipe is used without distortion, rippling and reduction in wall thickness. Contract Administrator reserves right to have pipe section replaced with fittings if bending is not satisfactory.

.5 Cut all pipe accurately to measurements taken at Site, and shall be installed without springing or forcing.

.6 Run all piping in accessible pipe spaces in such a way that it does not interfere with free access into pipe space.

.7 All pipe concealed in walls or inaccessible spaces shall have welded joints.

.8 Welded pipe sections shall be shop fabricated as far as possible and/or to minimize field welding required. Welding on Site is not permitted except with special approval of authorities having jurisdiction. If Site welding is required obtain written approval of authorities having jurisdiction and follow all safety precautions required by such authorities.

.9 All pipe Work that generates metal filings shall be performed outside of the Data Room to avoid contamination of room and equipment. Seventh floor mechanical room may be used as a staging/Work area for prepping pipe.

3.6 HOLES IN STRUCTURAL MEMBERS

.1 If drilling of structural beams or other load bearing members is required by design or by Site conditions for passage of piping, obtain Contract Administrators approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling required by design or existing Site conditions be responsible for carrying out same to approved procedure.

.2 Drilling shall be carried out by Section 15500. Co-ordinate as required for proper location and procedure.

.3 Do not cut or install piping until final drilling locations are approved by Contract Administrator. Section 15500 will not be reimbursed for extra cost incurred to relocate piping previously installed on basis of unapproved drill locations.

3.7 HYDRAULIC DESIGN

.1 Section 15500 shall use hydraulic design in preparing Shop Drawings for system. It shall be responsibility of Section 15500 to carry out necessary calculations and to submit calculations, data, and Drawings in accordance with requirements of NFPA Standard #13 and authority having jurisdiction.

3.8 PROVISION FOR FUTURE EXPANSION/INTERCONNECTION

.1 Due to project scheduling requirements, systems have been broken down into stages for phased installation under separate Contracts.

.2 Where noted on Drawings piping shall be capped off for future expansion, or connected to existing systems.

.3 Where piping is shown capped off for future expansion, Section 15500 shall ensure adequate size piping is installed to feed future system expansion. Section 15500 shall:

- .1 Provide hydraulic calculations acceptable to authority having jurisdiction and Contract Administrator to prove adequate sizing of supply piping to future system taking account of all future sprinklers required. Design area of operation shall not be reduced.

.4 Where piping is shown connecting to existing system make all connections as required.

- .1 When new system is supplied from existing system provide hydraulic calculations based on flow data, etc. for existing systems to prove adequate water supply to new system.
- .2 When new system supplies existing provide hydraulic calculations for both systems to prove adequate water supply to both systems.

3.9 FIRE PUMP INSTALLATION

.1 Section 15500 shall engage and shall include for services of pump manufacturer's factory-trained technicians to supervise installation, start-up, adjustment and acceptance testing of all equipment furnished under fire pump Contract, including controllers.

.2 Driving shaft of motor connected to impeller of horizontal split case pumps shall be checked and trued to be within manufacturer's tolerances by millwright. Section 15500 shall be responsible for all costs and provisions necessary for such Work.

.3 Section 15500 shall engage the services of manufacturer's factory-trained technicians to provide instruction of The City's operating personnel, in operation and maintenance of equipment.

.4 Section 15500 shall submit a report to Contract Administrator with copy to the City stating that above actions have been completed.

3.10 INSPECTION AND TESTING OF FIRE PROTECTION SYSTEMS

.1 Provide all labour, Material, equipment, etc. as required to carry out testing as specified herein and as required by authorities having jurisdiction to prove satisfactory completion, performance and acceptance of all systems.

.2 Testing shall include:

- .1 Flow Tests
- .2 Pressure Tests
- .3 Inspectors Tests
- .4 Fire Pump Tests

.3 Conduct actual/simulated flow tests on water systems as required by authority having jurisdiction.

.4 Pressure Tests

.1 Perform pressure tests on all new or modified piping systems to requirements of NFPA #13, #14, authority having jurisdiction, and additional requirements noted in this Specification.
.2 All systems shall be pressure tested after final completion. If subsequent modifications are necessary; eg. relocation of sprinkler drops or similar minor revisions, pressure tests shall be repeated as directed by Contract Administrator.
.3 Sprinkler mains and branch piping above new ceilings shall be pressure tested and all leakage repaired before installation of ceiling tiles.
.4 Final pressure test shall be carried out after installation of sprinklers.
.5 In addition to hydrostatic pressure tests noted above, and operational tests noted below, all preaction sprinkler systems shall be subjected to a pneumatic test. This test shall be carried out after satisfactory completion of operational tests noted below. On completion of operational tests, drain entire pre-action system including each sprinkler drop leg to pendent sprinklers. Install new sprinkler heads and test system under 175 kPa air pressure for 24 hours. Test shall be considered satisfactory when observed pressure drop is less than 10 kPa over 24-hour period.

.5 Inspectors Tests
.1 Inspectors tests shall be performed at all dry pipe preaction and alarm check valve stations, at all zone stations, flow switches, etc., and at other locations as required by authority having jurisdiction.
.2 Tests shall prove satisfactory operation of all flow switches and other alarm devices and all fire detectors connected to preaction system.

.6 Preaction System Test
.1 Each preaction system shall be subject to a complete operational test after successful completion of hydrostatic pressure tests noted above.
.2 Notify Contract Administrator before testing and arrange suitable time for Contract Administrator to witness test.
.3 For each system, verify that main preaction water valve will trip through every associated fire alarm detector circuit. Co-ordinate testing with fire alarm supplier when fire alarm system is being verified. Verify that flow switch for building sprinkler system annunciates on building fire alarm system each time the main preaction sprinkler valve is tripped by an associated fire alarm control circuit.
.4 System control valve shall be open and all other system conditions shall be in normal ‘ready’ condition. System shall be allowed to flood completely and pressurize on at least one occasion. System(s) shall remain flooded with water and under normal pressure for a minimum 24-hour period.
.5 Verify correct operation of system and components, and provide test documentation of same per Clause .8 Documentation. Correct any deficiencies and re-test to satisfaction of Contract Administrator. Include copy of all test documentation in each maintenance/operating manual.
.6 Drain entire system after testing, including all sprinkler drop legs.
.7 Install sprinkler heads after testing is completed, if heads were installed during testing replace sprinkler heads with new. All sprinkler heads being replaced are to be stored and shown to Contract Administrator prior to disposal. The current market salvage value of these sprinkler heads is to be turned over to the City.
.8 After replacing or installing sprinkler heads carry out pneumatic pressure test as noted in 4.3 above.

.7 Fire Pump Operation

.1 Testing will cause fire pump to run. Notify The City's representative accordingly.

.8 Fire Pump Tests

.1 Fire pumps and controllers shall be shop tested in manufacturer's factory prior to shipment. On satisfactory completion of such tests, test reports shall be forwarded to Contract Administrator. Fire pump shall not be shipped to Site prior to Contract Administrator receiving such test reports. Shop tests will be considered to be satisfactory when equipment is demonstrated to perform according to Specifications, subject to requirements of all applicable codes and standards.

.2 Fire pump shall be hydrostatically tested to a pressure recommended by UL, ULC and FM.

.3 The fire pump shall be subjected to a performance test at rated speed and shall furnish not less than 150% of rated capacity at a pressure not less than 65% of rated head. The shut-off head shall not exceed 140% of rated head.

.4 All pumps and controllers shall be tested on Site after completion of installation. Pump manufacturer's representative shall conduct tests in the presence of The City and/or his representative including The City's insurance inspection authority. Notice of these tests shall be issued to the City in writing not less than five (5) working days in advance of date set for testing.

.5 Tests shall be in accordance with pump manufacturer's requirements for testing, the requirements listed in NFPA 13, 20 & 25, the requirements by the authority having jurisdiction and the requirements of the Contract Administrator.

.9 Documentation

.1 Section 15500 shall properly document all testing distribute same to all authorities having jurisdiction, Contract Administrator, and The City. Testing shall be repeated as required until acceptable results obtained as determined by authority having jurisdiction and Contract Administrator.

.2 On completion on inspections and testing submit to Contract Administrator and authorities having jurisdiction completed signed copies of appropriate NFPA-13 Contractor's Material & Test Certificate, Forms 85-A and 85-B.

.10 Advance Notice of Testing

.1 Arrange suitable times with authorities having jurisdiction, Contract Administrator and The City in advance of all testing so that all have opportunity to witness testing.

.11 Activation

.1 All systems and fire pumps shall be left in normal active duty condition immediately following satisfactory completion of testing.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

1.2 WORK INCLUDED

.1 Labour, Materials, plant, tools, equipment and services necessary and reasonably incidental to completion of air conditioning and/or ventilation Work.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 15010 Mechanical General Provisions

.2 Section 15180 Insulation

.3 Section 15400 Plumbing

.4 Section 15990 Testing, Adjusting and Balancing

.5 Section 16010 Electrical General Provisions

Part 2 Products

2.1 DUCT OPENINGS

.1 Pack area between ducts and openings with fireproof self-supporting insulation. Seal with 25mm (1") mastic topping.

.2 Use 1.2mm (18 ga.) galv. iron sleeves where ductwork passes through mechanical room and kitchen floors. Sleeves to extend 150mm (6") above floor. Use watertight mastic between sleeve and floor Material.

2.2 WALL RELIEF AIR OPENING

.1 Provide 1.2mm (18 ga.) galv. iron sleeve 50mm (2") wider than wall thickness. Opening located in fire rated walls to have sleeve c/w louvred fire damper to meet code requirements.

.2 Provide 300mm (12") duct extension in mechanical room openings, where smoke detectors are noted on Electrical Drawings, to support detector and provide proper sensing plenums.

2.3 DUCT AND EQUIPMENT SUPPORTS, HANGERS AND INSERTS

.1 Support horizontal ducts on maximum 2.4m (8'0") centres by non perforated galv. steel, rivetted strap for ductwork 900mm (36") (either dimension) or less, and minimum 25mm x 25mm x 3mm (1" x 1" x 1/8") galv. angle iron passing under ducts 925mm (37") or over (either dimension) with 9.4mm (3/8") diam. threaded rods suspending angles from structure.

.2 Support vertical ducts at every floor with angle iron collars sized to provide proper bearing.

.3 Use universal concrete type inserts of black malleable iron, for threaded connection with lateral adjustment, top slot for reinforcing rods and lugs for attaching to forms.

.4 Where inserts must be placed in existing concrete use Hilti H.K.D. steel anchors as recommended by manufacturer, or if heavy weights must by supported, drill hole through slab and provide 50mm x 50mm (2" x 2") washer and nut above rough slab before floor finish is poured.

.5 To Steel Beams: Where pipe size is 50mm (2") or less, Anvil Fig. 87 Malleable Iron C-Clamp and Retaining Clip, or equal. Where pipe size is over 50mm (2"), use Anvil Fig. 229 Malleable Beam Clamp or Fig. 228 Forged Steel Beam Clamp.

.6 To Wooden Ceilings and Beams: Anvil Fig. 153 Pipe Hanger Flange or Fig. 156 or equal.

.7 Support hangers in corrugated steel deck by 50mm (2") wide piece of 3mm (1/8") thick steel plate across top of steel deck, secured to hanger rod by washer and nut; prior to pouring of concrete topping.

2.4 LOW PRESSURE DUCTWORK

.1 Low Pressure Rectangular Ductwork Schedule

Max. Side	Bracing
.1 Up to 600mm (24”)	None
.1 Gauge: .60mm (24 USSG)	

.2 Ductwork to be galvanized steel unless noted otherwise.

.3 Outdoor ductwork to be two gauges heavier than directed above.

.4 Turning vanes (Ducturns)
- .1 Use duct elbows which have throat radius of 1-1/2" times the diameter.
- .2 Where use of above specified item is precluded by space limitations, use duct elbows fabricated square throats and backs and fitted with Rovane turning vanes.
- .3 Standard of Acceptance: S.E. Rozell & Sons Limited, Kitchener, Ontario.

.5 Provide E.H. Price AE-1 c/w #3 operator at all supply registers.

2.5 FIRE DAMPERS

.1 Install U.L.C. labelled fusible link folding blade fire dampers as manufactured by Air Balance of Canada Limited in fire separations where shown, and where otherwise required by authorities having jurisdiction. Fire dampers shall conform to the most recent issue of N.B.C. Fire dampers and fusible links shall be tested and approved by ULC or other Testing Agency recognized by the authorities having jurisdiction. Fusible links shall be readily removable by hand for testing without use of auxiliary equipment such as pliers.

.2 Depending on the rating of fire separation, based on Architectural Drawing and Specifications, the rating, construction and testing of fire dampers shall meet the following:
- .1 N.B.C.
- .2 ULC S 112
- .3 NFPA 252
- .4 ULC or ULI 10(b)

.5 Authorities Having Jurisdiction

.3 Use type 'B' fire dampers, i.e. blades out of air stream, in all ducts passing through fire separations. Use combination fire damper-balancing damper, with blades in air stream, on sidewall supply or return or floor mounted supply registers, up to maximum size of 0.372m (576 sq.in.). For all sidewall return grilles or sidewall return registers above 0.372m (576 sq.in.) in size, use a type 'A' fire damper, i.e. blades in the air stream.

.4 Fire dampers in fume hood exhaust system shall have #316 stainless steel blades, shafts, linkage and casing.

2.6 CEILING FIRE STOPS

.1 Install fusible link ceiling fire stops as manufactured by Air Balance of Canada Limited on all diffusers, registers, and grilles located in every membrane ceiling forming a part of an assembly required to have a fire-resistance rating. Refer to Architectural room finish schedules for rated ceilings. Ceiling fire stops shall conform to N.B.C. and local authorities.

.2 Units mounted behind supply or exhaust units to be type 'B'. Units mounted behind gravity return/relief units to be type 'A'.

2.7 FAN SYSTEMS - GENERAL

.1 Fan Connections

.1 Duro-Dyne Metal-Fab of neoprene coated fibreglass, airtight, water tight and flameproof, 75mm (3") wide with 75mm (3") galv. metal connections.

.2 V-Belt Fan Drives

.1 Provide multi-matched set of belts for all fans with motors of 1.12 kW (1-1/2 hp) and larger.

.2 Provide vari-speed adjustable drive on units with motors of 7.46 kW (10 hp) and less. Drive to allow speed variation of plus or minus 15% of fan speed at specified capacity. Should this variation not be attainable, manufacturer to provide extra fixed pulley and if necessary, matched belts to provide this speed range, if requested by Contract Administrator.

.3 Provide fixed pitch on units with motors of 7.46 kW (10 hp) and greater. Manufacturer shall include for one change in drive; i.e. allow for additional pulley and matched belts for each air handling unit.

.4 Fans mounted outside of building to have belt drives capable of operating satisfactorily at -37 deg.C ambient.

.5

.1 Vari-pitch type with multi-belt matched set of belts with factor of 1.3 against motor nameplate rating.

.2 Drive shall allow speed variation of +/- 15% of fan speed at specified capacity.

.3 Fan Bearings

.1 Fan bearings shall be selected to have minimum B10 life of 15,000 hours or minimum average life of 75,000 hours.

.2 All grease lubricated bearings that are not directly accessible shall be fitted with extended grease leads terminating at some convenient accessible location on the fan casing.

.4 Fan Vibration Isolators

.1 Spring vibration isolators designed and selected to operate at no greater than 2/3 solid deflection and be stable for lateral displacements. Spring mounts c/w levelling device and rubber sound pads. For loads less than 227 kg (500 lbs.) and deflection l less than 31mm (1.2"), use Vibro Acoustics CM cast type mount. For loads and deflections greater than this, Vibro-Acoustics type FS open type mounts shall be used.

.2 Unless noted otherwise, mount floor mounted air handling units upon CM spring mounts to give 25mm (1") static deflection.

.3 Hang all suspended fans with SH-1 spring hangers to provide 25mm (1") static deflection.

.5 Fans to have prime coat finish of red oxide except dome exhausters. Wheels and shafts to be statically and dynamically balanced.

.6 Scheduled operating fan speeds and outlet velocities noted in Specification herein and/or in fan schedules shall be maximum acceptable.

.7 Guards

.1 Protect V-belt drives by guards that encompass all sides of the drive. Any expanded mesh or ventilation openings in the guard are to be "finger proof" to meet OSHA requirements.

.2 Mount guards to the fan by bolted clips. They shall be completely removable.

.3 Each guard shall be c/w two 25mm diameter holes opposite both fan and motor shaft for purpose of allowing tachometer readings. Each hole will be covered with gravity-actuated swing cap.

.4 Front face of drive guard shall be hinged and latched for convenient access to interior.

.8 Refer to Drawing for fan sizes, capacities, etc.

2.8 IN-LINE BELT DRIVEN VENTILATING SETS

.1 Greenheck Fan Model BSQ In-Line Belt Drive Fan

.1 Duct mounted, centrifugal belt drive in-line type.

.2 The fan housing of the square design constructed of heavy gauge galvanized steel, square duct mounting collars.

.3 Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. Access panels of sufficient size to permit access to all interior components.

.4 Centrifugal backward inclined, fan wheel, constructed of aluminum wheel cone matched to the inlet cone for precise running tolerances. Wheels statically and dynamically balanced.

.5 Motors shall be heavy duty ball bearing type, matched to fan load, furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the airstream. Motors shall be readily accessible for maintenance.

.6 Precision ground and polished fan shafts mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum catalogued operating speed.

.7 Drives sized for a minimum of 150% of driven horsepower. Pulleys fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

.8 Motor pulleys adjustable for final system balancing. A NEMA-1 disconnect switch. Factory wiring shall be provided from motor to handy box.

.9 All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

.10 Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

.11 Refer to Fan Schedule.

Part 3 Execution

3.1 DUCT OPENINGS

.1 Locate only openings in walls, floors, partitions, beams, etc. required for ducts, equipment, etc. General Contractor to form all openings for same, except as noted below.

3.2 WALL RELIEF AIR OPENING

.1 Locate openings in walls above ceilings to allow passage of return and relief air.

3.3 DUCT AND EQUIPMENT SUPPORTS, HANGERS AND INSERTS

.1 Design, Installation

.1 Supports to secure ducts and equipment, prevent vibration and provide for expansion and contraction. Design supports of strength and rigidity in a manner which will not stress the building construction. Use inserts for suspending hangers. Do not use vertical expansion shields without Contract Administrator's approval.

.2 Concrete Inserts

.1 Do not weaken concrete or penetrate waterproofing membrane. Use reinforcing rods through inserts for pipe sizes over 50mm (2"), or equivalent weight. Where concrete slab is finished ceiling, inserts to be flush with surface.

.3 Protect insulation at contact with hangers and support with approved metal shields.

3.4 CO-ORDINATION WITH H.V.A.C. BALANCE AND TESTING AGENCY

.1 Refer to Section 15990 H.V.A.C. Balance and Testing. Co-ordinate Work with Section 15990.

.2 As a part of this Contract, Section 15800 shall make any changes in pulleys and belts, and add manual dampers for correct balance as recommended by 15990, at no additional cost to The City.

.3 Section 15800 responsible for initial alignment and tension of all fan pulleys and belts, of equipment supplied by Section 15800.

3.5 LOW PRESSURE DUCTWORK

.1 Where duct width exceeds 450mm (18") in largest dimension, stiffen by cross breaking sheets diagonally. Beaded ducts as per SMACNA Catalogue Fig. 1.13 acceptable alternative.

.2 Duct sizes are inside dimensions. If ducts are acoustically lined, outside duct size to be increased as required.

.3 Provide ducturns in all elbows of ducts 1200mm (48") wide and greater, in segments of 600mm (24") maximum.

.4 Single thickness partitions between ducts not accepted.

.5

.1 All ductwork shall have seams and joints sealed watertight with Duro-Dyne S-2 duct sealer and FT-2 fibreglass duct tape. Prior to installation ductwork to be clean, dry and free of grease. Apply duct sealer with stiff brush or trowel. Wrap wet seam or joint with duct tape and apply further coat of duct sealer. Duct sealer and glassfiber to extend 25mm (1") on each side of joint or seam. On outside ductwork construct duct so that top of duct slopes 12mm (1/2") per 300mm (12") minimum to ensure that water does not collect on top.

.2 Ductwork exposed in finished rooms do not require duct tape application, but seams and joints shall be sealed with S-2 duct sealer. Sealer must be capable of accepting finish painting.

.3 Ductwork on roof shall have seams and joints sealed by application of TREMCO MONO black acrylic sealant applied with application gun and levelled with putty knife. Material shall be used in accordance with manufacturer's printed recommendations.

.6 Provide openings for thermostats and controllers by Section 15900.

.7 Where ductwork conflicts with mechanical and electrical piping and it is not possible to divert ductwork or piping to stay within allowable space limitations, provide duct easements. Easements not required on pipes 100mm (4") and smaller outside dimension, unless this exceeds 20% duct area. Irregular or flat shaped piping requires duct easement. Hangers and stays in ductwork to be parallel to air flow. If easement exceeds 20% of duct area, duct to be split into two ducts with original duct area being maintained. Easements to be approved by Contract Administrator before installation.

.8 At points within air system where air streams at different temperatures meet, install baffling for a good mix. Baffling to be by Section 15800 in locations recommended by Section 15900, approved by Contract Administrator, and at no additional cost to The City.

.9 If ductwork is not adequately braced and/or supported to provide good installation, additional bracing and/or supports to be provided at no extra cost to The City. Contract Administrator to interpret.

.10 Assemble round duct sections using beaded couplings attached with sheet metal screws.

.11 Every intake and exhaust duct up through the roof shall be installed with a 2" (50mm) deep water-tight drip pocket at base of duct complete with drain, unless noted otherwise. Refer to Specification details. This shall not apply to kitchen exhaust systems. Refer to plans for drain requirements.

.12 All steam room and shower room exhaust ductwork to be graded at 5% slope to exhaust registers.

3.6 FLEXIBLE DUCTWORK CONNECTORS

.1 Mount on ducts with mastic seal and sheet metal screws. Formed conical connections approved by Contract Administrator, to be considered equal.

3.7 FIRE DAMPERS

.1 Fire dampers shall be installed in the plane of the fire separation so as to stay in place should the duct be dislodged during a fire. Install fire dampers only in positions for which they have been tested. Refer to Specification details.

.2 Installation shall conform to N.B.C. 1995 and local authorities.

3.8 CEILING FIRE STOPS

.1 Ceiling fire stops installation shall conform to N.B.C. 1975 and local authorities.

.2 Ceiling fire stops shall be supported from the structure above, not from the air outlets or any associated ductwork. Refer to Specification details.

3.9 DUCT ACCESS DOORS

.1 Locate properly for inspection and servicing. Doors and frame to be rigid, close-fitting, with rubber gaskets, galvanized hinges with brass pins and at least two galvanized cam locks. Rivet frame and hardware to ducts.

.2 Where impossible to swing access doors, install removable door with four cam locks.

.3 Access doors for humidifier application shall be liquid tight, and installed on side of duct (not bottom).

3.10 PITOT TUBE TEST OPENING ENCLOSURES

.1 Locate in ductwork at supply fan discharges, on intake of exhaust and return air fans, in hot and cold ducts coming off plenums, in major duct branches and everywhere pitot tube opening is required for proper balancing of air conditioning, ventilation and exhaust systems. Do not place closer than 1524mm (6 ft/) to elbows. Space every 150mm (6") across air stream at each location. Refer to Drawings for additional opening requirements.

.2 For each HEPA filter requiring the "total penetration test" as described in Section 15010, provide a single enclosure upstream, and a single enclosure downstream of the filter.

.3 The enclosure upstream of the filter shall be located at a distance sufficiently away from the filter to allow for proper dispersion of the aerosol. There shall be no obstructions such as other filters, humidifier grids, elbows, dampers, etc. between the opening location and the HEPA filter.

.4 The enclosure downstream of the filter shall be located a minimum of 10 feet away from the filter. The Contract Administrator shall be notified when suitable location cannot be found on Site.

.5 All enclosures for HEPA filter integrity testing shall be 2" in diameter.

3.11 FAN SYSTEMS - GENERAL

.1 Use flexible connections at inlets and outlets where ductwork and plenums connect to fans and air-handling equipment.

.2 Fan Vibration Isolation

.1 Fan manufacturer to submit necessary information for proper isolation selection. This information to be incorporated in Shop Drawings and shall include fan sizes, fan speeds, equipment weights, etc.

.3 Fan Vibration Isolation
.1 Install as per Isolation manufacturer's published data.

.4 All equipment shall be installed in strict accordance with manufacturer's published data.

.5 Protection of Fan Equipment Before Installation
.1 Grease shafts, sheaves, etc. to prevent corrosion. Fan bearings to be greased or oiled at time of building takeover.

.6 Centrifugal fans located outdoors to have drain holes in casing.

.7 Co-ordinate installation of smoke detectors with Division 16 - Electrical.

3.12 TESTING OF DUCTWORK

.1 Visually and audibly check for air leaks that can be heard or felt under normal operating conditions. Repair all leaks in ductwork.

3.13 TESTING OF FIRE DAMPERS AND CEILING FIRE STOPS MOTORIZED SMOKE DAMPERS

.1 Refer to Section 15990 H.V.A.C. Balance and Testing.

.2 Section 15800 shall repair all units that have been identified as being faulty by Section 15990.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

.2 Testing, Adjusting and Balancing (TAB) Agency shall be an experienced, independent Contractor specializing in the testing, adjusting and balancing of HVAC systems.

.3 TAB Agency shall be a member of the Associated Air Balance Council (AABC) and Work shall carry standard AABC Certificate of Guarantee.

.4 Include extended service for 90 days after completion of final balancing Work, during which time Contract Administrator at his discretion may request re-check or re-setting of any systems and/or equipment listed in test report

1.2 SCOPE OF WORK

.1 Provide complete testing, adjustment and final balancing of all building air systems.

.2 Provide complete ductwork leakage testing as specified.

.3 Provide inspection, verification and testing of all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops after installation. Coordinate the Work with Sections 15800.

1.3 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 15010 Mechanical General Provisions

.2 Section 15800 Air Distribution

Part 2 Products

2.1 BALANCING REPORTS

.1 Provide two copies of detailed draft balancing report to Contract Administrator for review after completion of all adjustments.

.2 Final balancing report shall incorporate all changes resulting from Contract Administrator's comments and any adjustments undertaken since the draft report was issued.

.3 Provide four copies of final balancing report.

.4 Provide sufficient number of copies of final balancing report to Mechanical Subcontractor for inclusion in Operating & Maintenance Manuals.

2.2 DUCT LEAKAGE TEST REPORTS

.1 Provide two copies of duct leakage test reports to Contract Administrator including test data for all preliminary and final tests.

2.3 FIRE PROTECTION EQUIPMENT VERIFICATION REPORTS

.1 Provide detailed verification report to include all fire protection devices noted herein. Report shall list each device and verification of its operation and installation per the requirements specified herein.

.2 Provide two copies of completed draft verification report to Contract Administrator for review.

.3 Incorporate comments or changes requested by Contract Administrator and provide sufficient number of copies of final report to Mechanical Subcontractor for inclusion in Operating & Maintenance Manuals

Part 3 Execution

3.1 GENERAL

.1 All instruments used shall be accurately calibrated and maintained in good working order. If requested, tests shall be conducted in the presence of Contract Administrator and/or his representative.

.2 Schedule all Work to comply with completion date.

.3 Work shall not begin until system has been completed and in full working order. Division 15 shall put all heating, ventilating, and air-conditioning systems and equipment into full operation, as season would demand, and shall continue operation of same during each working day of testing, adjusting and balancing.

3.2 AIR BALANCING

.1 Coordinate with Section 15800 to ensure installation of all manual adjusting dampers and pitot tube enclosures are as indicated, as specified and as required to allow proper adjustment of air systems.

.2 Section 15800 to provide initial alignment and tension of all fan pulleys and belts supplied by them.

.3 Testing Procedure:

.1 Test, adjust and record all fan speeds, motor amperes.

.2 Make pitot tube traverse to main supply and obtain cfm at fan.

.3 Test and record static pressure for each system at fan suction and discharge.

.4 Adjust all supply and return air ducts to proper design cfm.

.5 Test and adjust each diffuser, grille, and register to within 5% of design requirements. Balance as per manufacturer's recommendations.

.6 All outlets shall be adjusted to provide proper throw and distribution, in accordance with architectural requirements.

.7 Fan operating conditions tested shall confirm air delivery within 5% of manufacturer's fan curves.

.8 Systems shall be balanced so that fans operate at lowest possible static pressure.

.9 Inlet vanes or variable speed drives shall not be used to reduce fan capacity to achieve balance condition. Balance on fan drive only with VAV or VSD at 100% capacity.

.10 Prepare single line diagrams of duct systems indicating terminal outlets identified by number. List on data sheets all such outlets denoted by the same numbers, including the outlet sizes, 'K' factor, location, cubic feet per minute and jet velocity. Provide this data for all supply, return and exhaust air systems.

.4 As part of Work of this Contract, Section 15800 shall make any changes in the pulleys and belts, and any additional manual dampers for correct balance as recommended by Section 15990, at no additional cost to The City. Section 15990 shall provide final alignment and tension adjustment of fan pulleys and belts.

.5 All constant and variable volume valves are pre-balanced at factory. Section 15990 shall field check and reset, if necessary, air capacities for all units for both maximum air capacity settings and minimum air capacity settings. (Refer to Schedule or Drawings). Confirm maximum and minimum settings in Air Balance Report. Obtain instructions from and co-ordinate Work with successful valve manufacturer and Section 15900.

3.3 SYSTEM CHECK

.1 Provide spot checks of systems if called upon by Contract Administrator. If capacities, fan speeds, ratings, etc. do not agree with submitted balance report, rebalance system or systems in question, until satisfactory results are received.

3.4 LEAK TESTING OF AIR DUCTS

.1 General:

.1 Tests shall be performed by Section 15990.

.2 Section 15800 shall provide all necessary temporary connections, blank-offs, tees, required for testing. Section 15990 shall provide all test fans, equipment and labour required for testing.

.3 Section 15800 shall clean all ducts before testing.

.4 During installation of ductwork include separate leakage air tests of each complete air riser; each completed horizontal distribution system, and after ductwork is installed and central station apparatus is erected, leakage testing of flexible runouts (where applicable).

.5 Perform preliminary tests and repair all leaks before notifying Contract Administrator of final tests.

.6 Maintain log book of all tests showing dates, personnel, observers' initials.

.7 Be responsible for any damage resulting from failure of items under test.

.8 Section 15800 shall repair all leaks in duct systems.

.9 Section 15990 shall retest ductwork after leaks have been repaired.

.10 Coordinate the Work as required with Section15800, Mechanical Contractor and General Contractor to ensure that all ductwork is tested:

.1 Before ducts are insulated.

.2 Before ducts are concealed.

.11 Issue report to Contract Administrator after witnessing final tests.

.2 Low Pressure Ductwork Test: (below 50mm water gauge operating pressure)

.1 Visual and audible check for leaks that can be heard or felt under normal operating conditions.

.3 Leakage Testing of Other Systems: (including all variable air volume systems)

.1 Make tests prior to insulation of system being tested using suitable test equipment, including 'U' tube, orifice, tubing and cocks, arrange to indicate amount of air leakage.

.2 Make leakage test with pressure maintained for minimum of 5 minutes at level of 150% of average operating pressure of duct section under test, obtained by operation of air supply fan, or if fan cannot be operated, by use of test blower. Inspect and check joints for leakage, record and submit results.

.3 Allowable leakage at test pressure: 5% of design maximum flow rate of duct section under test.

3.5 TESTING/VERIFICATION OF FIRE PROTECTION EQUIPMENT

.1 Section 15990 shall test and verify operation all new and/or relocated fire dampers, combination fire/smoke dampers, ceiling fire stops and smoke control dampers on this project. Co-ordinate Work with Sections 15800 and 15900.

.2 Testing shall be performed after air balancing has been completed.

.3 Test shall include following:

.1 Visual inspection of each device:

.1 Confirm appropriately rated device installed and CSA/ULC label affixed and visible through duct/ceiling access door.

.2 Confirm appropriate duct and/or ceiling access door provided to permit servicing of device. Confirm duct access door openable without interference from adjacent ceiling, pipes, ducts, etc.

.3 Confirm device has been installed in accordance with requirements of the Specifications, manufacturer's instructions and codes.

.4 Confirm proper installation, clearances, use of proper angle framing, use of proper fasteners, use of fire rated Material in wall opening, location of breakaway joints etc.

.5 Confirm that device has not been painted.

.2 Operational inspection of each device to include:

.1 Manual release of fusible link allowing device to close. Confirm tight fit closure without binding.

.2 Confirm that appropriate fusible link is installed.

.3 Re-open device and reset fusible link connection.

.3 Following requirements are in addition to the above noted testing requirements and shall apply to all motorized smoke and fire/smoke dampers, including all motorized dampers associated with smoke control systems:

.1 Associated fan system shall be operating as per normal conditions.

.2 Power to operator shall be applied/removed, as required, to cause damper to open. Ensure full opening operation without binding or overdriving of operator.

.3 Power to operator shall be removed/restored, as opening operation without binding or overdriving of operator.

.4 Ensure damper closes/opens against associated fan operating static pressure.

.5 Ensure proper adjustment of all damper drive linkages for fully open and fully closed positions and operation through full range without binding.

.6 Ensure proper device configuration e.g. power-to-open or power-to-close as specified.

.4 Co-ordinate Work with Sections 15800 and 15990. Instruct Sections 15800 and 15990 as appropriate to repair or replace, as required, all devices or components of devices identified as being faulty, and to correct any installation deficiencies noted.

.5 After necessary repairs have been completed, Section 15990 shall reinspect/retest each device as indicated above.

.6 Provide verification report on completion of Work. Report shall indicate general location (e.g. room number or description) and specific location (e.g. north wall above ceiling) of access door to device. Report shall include itemized verification of following, as appropriate, for each device:

.1 Device is fully accessible.

.2 Device has been properly installed

.3 Device has been successfully tested.

.4 Device has been reset.

.5 Name of tester.

.6 Date device tested successfully.

3.6 IDENTIFICATION OF FIRE DAMPERS AND CEILING FIRE STOPS

.1 At all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops, supply and install identification tags. Tags c/w envelopes shall be of type approved by Contract Administrator.

.2 Envelopes shall be mechanically fastened to adjacent duct access door, or onto structure near dampers or ceiling fire stop where there is no connecting ductwork.

.3 After each device has been verified as noted above, Section 15990 shall label tag with permanent ink identifying device, location (room number), inspection date, inspector's signature and TAB Agency name.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1.

.2 All Drawings and all sections of the Specifications shall apply to and form an integral part of this section.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Abbreviations for electrical terms: to CSA Z85.

.3 The electrical installation shall comply with the requirements of the Electrical Supply Authority, the latest edition of the Canadian Electrical Code, with all Provincial and Municipal Laws, Rules and Ordinances, and to the satisfaction of those persons having jurisdiction over same.

.4 Notify the Contract Administrator of any discrepancies or conflictions with any regulation seven in accordance with B4. Failing such notification, meet all such requirements without change to the Contract price.

.5 In no instance shall the standard established by these Specifications and Drawings be reduced by any of the codes, rules or ordinances.

1.3 CARE, OPERATION AND START-UP

.1 Upon completion of the project, demonstrate the operation of all equipment in the presence of the City, or his representative, and the Contract Administrator. Obtain signed certification from the City that such equipment was shown to be fully operational and that all necessary operating instructions have been provided.

.2 Arrange and pay for services of manufacturer's factory service Contract Administrator to supervise start-up of installation, check, adjust, balance, calibrate, test and commission components as specified in subsequent sections.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

.4 Carefully examine all plans and Specifications pertaining to this Contract and become familiar with all details. Visit the Site and determine all factors affecting this section of the Work and include all costs for same in Bid Opportunity.

1.4 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of Drawings and Specifications for examination and approval prior to commencement of Work.

.2 Pay all associated fees for inspection of the Work by authorities having jurisdiction.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of Work to Contract Administrator. Copies to be included in Maintenance Manuals.

1.6 MATERIALS AND EQUIPMENT

.1 Provide Materials and equipment in accordance with Div. 16.

.2 Equipment and Material to be CSA certified or certified by an equivalent recognized certifying agency to meet Canadian Standards. Where there is no alternative to supplying equipment which is certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.3 Factory assemble control panels and component assemblies.

.4 Submit for Contract Administrator's approval, a duplicate list of makes and types of all equipment and Materials for this project, prior to placing of orders for same. This shall be done within fourteen (14) days of the award of the project Contract to the General Contractor in order to avoid delays in delivery and completion.

.5 Any Material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved Material or equipment without a change in the Contract price.

1.7 RESPONSIBILITY

.1 Be responsible for any damage caused the City’s, or their Contractors due to improperly carrying out this Work.

.2 Install all components of this Work promptly and where applicable, in advance of concrete pouring, or similar construction. Provide and set in the proper sequence of construction, all sleeves, hangers, inserts, etc. and arrange for all necessary openings, where required to accommodate the electrical installation.

.3 Work shall be arranged in co-operation with other divisions of this Specification in such a manner that it doesn't interfere with the progress of the project. In areas where ducts or

pipes must be installed along with conduit or cable, co-operate with other divisions so that the finished job will represent the most efficient use of the space.

.4 In no case proceed with any Work in uncertainty. Obtain, from the Contract Administrator, any clarification necessary and thoroughly understand all portions of the Work to be performed.

1.8 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor Schedule on electrical Drawings, or in this Specification and related mechanical responsibility is indicated in Mechanical Equipment Schedule on mechanical Drawings.

.2 Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50V which are related to temperature control systems specified in Division 15 and/or shown on mechanical Drawings.

1.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

1.10 WORKMANSHIP AND MATERIALS

.1 The installation shall consist of Material and equipment specified unless as provided herein. Electrical equipment provided under this Contract shall be built in accordance with EEMAC standards and shall be C.S.A. certified (or certified by an equivalent recognized certifying agency to meet Canadian Standards) and/or locally approved. All equipment supplied under this Contract shall be new and the best of its respective kind and of uniform pattern throughout.

.2 Any Material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved Material or equipment without a change to the Contract.

.3 Replace inferior Work if so ordered by Contract Administrator without a change to the Contract.

.4 Retain same foreman or superintendent on the job until completed, unless otherwise directed by the Contract Administrator.

1.11 CLEANLINESS AND CLEANING

.1 This division shall maintain a clean tidy job Site. All boxes, crates, and construction debris due to this portion of the Work shall be neatly piled outside the construction area and shall be removed at least weekly during the construction period. All construction areas shall be kept clear of debris.

.2 Before the project will be accepted by the City, all lighting fixtures, lamps, lens, panelboards, switches, receptacles, cover plates, and other electrical equipment shall be clean and free of dust, plaster, paint, etc. Any equipment which is scratched or damaged shall be refinished or replaced if so designated by the Contract Administrator.

1.12 MODIFICATIONS

.1 Locations of all light fixtures, convenience receptacles, outlets, switches, telephone or similar outlets, fire alarm stations, bells, etc. are subject to modification by the Contract Administrator, who reserves the right to move these up to 3000 mm from the position shown, without change to the Contract price, provided notice is given before the related Work has commenced.

1.13 REQUEST FOR EQUAL

.1 Applications for approval of equal, or alternate Materials, or methods, as substitutions for those specified or shown, shall be submitted to the Contract Administrator in accordance with B6. If an “Equal” has been granted, the choice between the Materials or methods specified and those approved as equal shall be optional with this Contractor.

1.14 CONTRACT ADMINISTRATORING OBSERVATIONS

.1 Contractor's Work will be observed periodically by City, and/or Contract Administrator or their representatives, solely for purpose of determining general quality of Work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and Specifications to assist him to carry out Work. Observation and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install Work in all its parts in a safe and workmanlike manner, and in accordance with plans and Specifications, nor impose upon City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any Work.

.2 Contractor shall notify Contract Administrator for a final distribution inspection prior to energizing distribution system. All distribution equipment shall be left with covers removed to allow a thorough inspection.

1.15 GUARANTEE

.1 Guarantee the satisfactory operation of all Work and equipment supplied and installed as a part of this section of the Specifications.

.2 Replace forthwith, at no additional Material or labour cost, any part which may fail, or prove defective within a period of twelve (12) calendar months after the final acceptance of the complete installation, provided that such failure is not due to improper usage, or ordinary wear and tear.

.3 No certificate given, payment made, partial or entire use of the equipment by the City or his representative shall be construed as acceptance of defective workmanship or Materials.

.4 This general guarantee shall not act as a waiver of any specified guarantee or special equipment guarantees covering a greater length of time.

1.16 IDENTIFICATION OF EQUIPMENT

.1 Identify electrical equipment with nameplates and labels as follows and as indicated in other Specification sections.

.2 Nameplates:

.1 Lamacoid 3mm thick plastic engraving sheet, shall be white with black letters or as directed, mechanically attached with self tapping screws. Nameplates for equipment fed from emergency power or from emergency UPS power (increase nameplate size as required to suit wording) shall be white with red letters.

NAMEPLATE SIZES

Size 1	10 x 50mm	1 line	3mm high letters
Size 2	12 x 70mm	1 lines	5mm high letters
Size 3	12 x 70mm	2 lines	3mm high letters
Size 4	20 x 90mm	1 line	8mm high letters
Size 5	20 x 90mm	2 lines	5mm high letters
Size 6	25 x 100mm	1 line	12mm high letters
Size 7	25 x 100mm	2 lines	6mm high letters

.3 Labels:

.1 Embossed plastic labels with 6mm high letters unless specified otherwise.

.4 Fabrication details of all nameplates labels and wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.5 Allow an average of twenty-five (25) letters per nameplate and label.

.6 Room names and numbers used shall be actual room names and numbers that will be used on the project. Division 16 to co-ordinate and confirm with trades involved.

.7 Identification to be English.

.8 Co-ordinate names of equipment and systems with Division 15 to ensure that identical names are used.

.9 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.10 Nameplates for disconnects, starters and contactors: Indicate equipment being controlled and voltage.

.11 Nameplates for terminal cabinets and pull boxes: Indicate system and voltage.

.12 Nameplates for transformers: Indicate capacity, primary and secondary voltages.

.13 Nameplates for control devices: indicate equipment controlled.

.14 Adjacent to each breaker in CDP type panelboards, provide and mount lamacoid nameplates identifying the respective load and location.

.15 To match existing where applicable.

.16 All convenience receptacles shall have a lamacoid size 1 plate on which the panel and circuit number from which it is fed, is indicated. The identification shall be mechanically secured to the coverplate on the appropriate outlet. Pressure indented adhesive strip nameplates are not acceptable and shall not be used.

1.17 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders (coloured plastic tapes) and branch circuit wiring (numbered wire markers). Conductor marker identification shall correspond with panel or terminal board directory information.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour Code: To CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system. Colour coding used shall be documented by individual systems in Maintenance Manuals.

.5 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.

1.18 CONDUIT, OUTLET BOXES AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cable.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250V (normal power)	yellow	
Up to 600V (normal power)	yellow	green
Up to 250V (emergency power)	yellow & red	
Up to 600V (emergency power)	yellow & red	green
Telephone	green	
Other communication systems	green	blue
Fire alarm	red	
Emergency voice	red	blue
Other security systems	red	yellow
Control	blue	
Fibre optic	orange	

.4 Other conduit systems as directed on Site; all conduit systems shall be identified.

.5 Color outlet box covers to color designated and show circuit numbers in black felt marker on inside of covers.

1.19 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.20 MANUFACTURERS AND CSA CERTIFICATION LABELS

.1 Visible and legible after equipment is installed.

1.21 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.

.2 Decal signs, minimum size 175 x 250mm.

1.22 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: Schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm each side.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduit and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

1.23 FIELD QUALITY CONTROL

.1 Conduct and pay for following tests:

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: Fire alarm system, security system, communication systems.

.6 Any other electrical systems.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

.4 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.

.2 Megger 350V - 600V circuits, feeders and equipment with a 1000V instrument.

.3 Check resistance to ground before energizing.

.5 Advise Contract Administrator of dates and times for all testing with sufficient advance notice to allow Contract Administrator to make arrangements to attend.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Contract Administrator's review.

.8 Insert test results and supplier's certifications in Maintenance Manuals.

1.24 DRAWINGS

.1 Carefully examine all Drawings and Specifications relating to all Work, and all electrical Work indicated thereon shall be considered as a part of the Work by this section unless indicated otherwise. Prior to the date of the last addendum report at once to the Contract Administrator, any defect, discrepancy, omission or interference affecting the Work of this section, or the guarantee of same.

.2 Install all equipment as shown or as specified and in accordance with manufacturer's approved Shop Drawings.

.3 The Drawings accompanying these Specifications are intended to show the general arrangement and extent of the Work to be carried out, but the exact location and arrangement of all parts shall be determined as the Work progresses. The location of equipment, outlets, etc., as given on the Drawings are approximately correct, but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural or Contract Administrator requirements. Such changes shall be implemented as directed by the Contract Administrator, without additional charge.

.4 Electrical Drawings do not show all structural and other details. Contract Administrator and structural conditions shall govern, and this Section shall make without charge, changes or additions to accommodate these conditions. Check all Contract Administrator plans, elevations and details for location of electrical devices, equipment and equipment to be connected.

.5 Where Drawings indicate the general location and route to be followed by conduit, cable, etc., these locations must be governed by job conditions. Where the required conduit, cable, an boxes are not shown on Drawings or only shown diagrammatically, they shall be installed to conserve maximum head room and interfere as little as possible with free use of space through which they pass. Maximum clearance above floor shall be maintained under all suspended conduit and equipment, unless otherwise shown on the Drawings, or approved by the Contract Administrator.

.6 Submit a complete set of Drawings for the proposed installation to the Inspection Department having jurisdiction and receive written approval before installation or

fabrication of any equipment. No extra compensation will be allowed for any changes or rearrangement of any electrical apparatus or Materials necessary due to failure to receive this approval.

1.25 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit Shop Drawings, produce detailed data and samples in accordance with previous sections, as specified herein, and to Contract Administrator's satisfaction.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or Material.

.3 Where applicable, include actual wiring, single line and schematic diagrams. Include all technical data and full details of each component.

.4 Include wiring Drawings or diagrams showing interconnection with Work of other sections.

.5 Shop Drawings of all equipment must be submitted to the Contract Administrator for review in sufficient time to enable him to retain them for at least ten (10) working days.

.6 One print and one reproducible sepia of each Shop Drawing shall be submitted.

.7 Cross out or eradicate all non-related items.

.8 Bind each system separately eg. P.A., CCTV, Nurse Call, Intercom, Fire Alarm, etc. One common binder from one supplier will not be acceptable.

.9 Shop Drawing submission shall include a photocopy of all applicable Specification sections showing a complete compliance/ non-compliance listing. Refer to spec. detail sheet "Shop Drawing Compliance List Sample" for example.

.10 Division 16 shall check all Shop Drawings and make necessary changes, or cause the supplier to make necessary changes, prior to submission to the Contract Administrator. Shop Drawings will be reviewed by the Contract Administrator and if re-submission is required, Division 16 shall ensure that the supplier's Drawings have been changed to comply before returning them to the Contract Administrator for review again.

.11 Review of the Shop Drawings by the Contract Administrator shall not relieve the Contractor from responsibility for errors and omissions therein.

.12 Each Drawing submission to bear the following signed stamp, and shall include name of project, equipment supplier, and clause number equipment is specified under.

CONTRACTORS CERTIFICATION
This Drawing has been reviewed by
(firm name) .

All dimensions have been checked and found compatible with the Contract Drawings and all capacities, quantities, sizes, and other data contained in the Contract documents

have been listed by the supplier on this Drawing and have been checked by the undersigned and found correct.

Date Per:

.13 Clearly show division of responsibility. No item, equipment or description of Work shall be indicated to be supplied or Work to be done "By Others" or "By Purchaser". Any item, equipment or description of Work shown on Shop Drawings shall form part of Contract, unless specifically noted to the contrary.

.14 Provide field dimensions required by electrical suppliers and sub-Subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related Drawings and obtain clarification from Contract Administrator if necessary.

.15 Main distribution and utility metering Shop Drawings must be approved by local utility prior to submission to Contract Administrator.

.16 Incomplete submissions will be returned for updating and re-submittal without Contract Administrator's review.

1.26 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature alone is not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers.

.5 Copy of reviewed Shop Drawings.

.3 Provide five (5) complete, hard-backed, D-ring loose leaf Maintenance Manuals. These shall consist of typewritten or printed instructions for operating and maintaining all systems and equipment provided under this section of the Specification. Manuals shall also contain Shop Drawings, wiring diagrams, test results and manufacturer's brochures on all equipment, together with typed index tab sheets.

.4 As Work progresses, record on one (1) set of Drawings, installed conduit layout as well as any approved changes and deviations from the original Contract and/or working Drawings, including outlets, equipment and panel locations. At completion of Work, submit to the Contract Administrator, at the Contractor's costs, reproducible mylar Record Drawings. The Contract shall not be considered complete and no final payment shall be made until these Drawings are accepted by the Contract Administrator. (Provide separate Drawings for each system in order not to "crowd" Drawings.)

.5 Reproducible sepias of Record Drawings are to be mylar (diazo coated plastic film).

1.27 TEMPORARY LIGHTING AND POWER

.1 All temporary and construction lighting and power Work and costs for same are not included as part of the scope of the Work of this section. Refer to such clauses in other sections of the Specification.

1.28 TESTING

.1 Test all circuits and wires for continuity, insulation resistance and high impedance grounds. Those circuits which test non-continuous, with an insulation resistance less than 2 Megohms or with high impedance grounds shall be replaced.

.2 All empty conduits shall be left with an insulated #14 AWG fish wire.

.3 Keep a record of all final tests, bind, and turn over typewritten results to the Contract Administrator as a part of the maintenance manual. All final test values measured, date of each measurement, company name and signature of person making each measurement shall be neatly recorded. After all tests have been successfully completed, each test report shall contain a summary which clearly states that all results were satisfactory.

.4 Upon completion of the Work and adjustments of all equipment, all systems shall be tested in the presence of the Contract Administrator to demonstrate that all equipment furnished and installed or connected as a part of this section of the Contract shall function electrically in the required manner as determined by the Contract Administrator.

.5 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

1.29 CUTTING AND PATCHING

.1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by Div. 16 - Electrical in Bid Opportunity price. Division 16 - Electrical to employ and pay appropriate sub-trade whose Work is involved, for carrying out Work described above.

.2 Perform all cutting and patching required for installing electrical systems.

.3 Division 16 shall mark all openings required for conduits, cables, ducts, and the like.

.4 Cutting to be 'neat' sizes. Patch all edges such as cover plates, etc. Hide cut edges.

.5 If, in the opinion of Contract Administrator, cutting of holes has been improperly performed (i.e. too large for conduits or cables) Division 16 - Electrical to do all patching as per original Specifications and all costs will be borne by him.

1.30 FIREPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with 3 M Brand 7900 Series Fire Barrier System or equivalent, to maintain fire rating.

.2 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.

1.31 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with an appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.32 SCHEDULING OF WORK

.1 Existing buildings will remain in use during construction. Arrange Work so that interruption of services is kept to a minimum. Obtain permission from City prior to cutting into electrical services. Where deemed necessary by Contract Administrator, temporary electrical shall be installed and/or Work shall be carried out at night and on weekends.

.2 Contractor to maintain continuous and adequate all existing electrical systems and other services during entire time of this Contract. Provide temporary conduit, wire, equipment, etc. where necessary to meet this requirement.

1.33 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine all plans and Specifications pertaining to this Contract and become familiar with all details. Visit the Site and determine all factors affecting this section of the Work; include all costs for same in Bid Opportunity.

1.34 DEMOLITION OF EXISTING ELECTRICAL

.1 Remove all unnecessary existing electrical equipment, wiring, fixtures, in those portions of the existing building which are being remodelled or demolished. All devices/fixtures, etc. are not necessarily shown on the plans. The City shall select from the Materials and/or equipment remaining that which he wishes to retain, and the remainder shall be removed from the Site. Any electrical equipment in remodelled sections or in structures removed or altered, adjacent to new Work, necessary for the operation of existing building, shall be relocated as necessary. All existing equipment re-used shall be made good and guaranteed. Power interruptions to be kept to a minimum and shall be at a time suitable to the building occupant. Refer to Contract Administrator plans for demolition areas/phasing.

.2 Drawings do not show all electrical requiring removal to accommodate renovations such as receptacles, switches, lights, starters, motors, nurse call systems, components, heaters,

etc. Division 16 shall visit Site, refer to Contract Administrator and electrical Drawings and include all costs for demolition.

.3 Refer to Specification Section 16195 - Work in Existing Building.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

1.2 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

.2 Produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

Part 2 Products

2.1 CONDUITS

.1 Rigid galvanized steel threaded conduit.

.2 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 19mm.

.3 Rigid PVC conduit.

.4 Flexible metal conduit and liquid-tight flexible metal conduit.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel Work.

.3 U channel type supports for two or more conduits at 1500 mm oc. (Surface mounted or suspended).

.4 Six mm dia. galv. threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings for raceways: to CSA C22.2 No. 18.

.2 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.3 Factory "ells" where 90 deg. bends are required for 25 mm and larger conduits.

.4 Steel set screw connectors and couplings. Insulated throat liners on connectors.

.5 Raintight connectors and fittings c/w O-rings for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene c/w 3m spare length at each conduit end.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Use rigid galvanized steel threaded conduit where specified.

.4 Use electrical metallic tubing (EMT) except where specified otherwise.

.5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, transformers and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.7 Install conduit sealing fittings in hazardous areas. Fill with compound.

.8 Conduit stubs from floor slabs where exposed to damage to be rigid galv. steel.

.9 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.

.10 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm dia.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Run a minimum of 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

.17 Conduit to be sized as per Canadian Electrical Code or as shown on Drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the Drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit.

.18 Running threads will not be permitted; proper couplings shall be used.

.19 Not less than 900mm (3'-0") of flexible conduit (and of sufficient length to allow the lighting fixture to be relocated to any location within a 6 ft. (1.8m) radius) shall be used for the connection of recessed lighting fixtures. A separate drop to be used for each fixture unless fixtures are mounted in continuous rows.

.20 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.

.21 Provide separate conduit system for emergency distribution.

.22 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.

.23 Refer to 16010 for identification requirements.

.24 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended or surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 150 mm parallel to steam or hot water lines with minimum of 75 mm at crossovers.

.7 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16191 Fastenings and Support

Part 2 Products

2.1 MATERIALS

.1 Conductors in Conduit:

- .1 Type: RW90
- .2 Conductors:
  - .1 Solid Copper #10 AWG and smaller.
  - .2 Stranded Copper #8 AWG and larger.
  - .3 Sized as indicated (Minimum # 12 AWG).
- .3 Insulation: cross link polyethylene (RW90), (RWU90), 90 deg. C.
- .4 Configuration: Single conductor.
- .5 Voltage Rating: Minimum 600V.
- .6 Certification: CSA C22.22 No. 38 or latest revision.

.2 Armored Cable (TECK):

- .1 Type: TECK
- .2 Conductors:
  - .1 Solid Copper #10 AWG and smaller.
  - .2 Stranded Copper #8 AWG and larger.
  - .3 Sized as indicated (Minimum # 12 AWG).
- .3 Insulation: cross link polyethylene (RW90), 90 deg. C.
- .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
- .5 Colour Code: Black, red, blue and white in 4/C cable. Cables of more than 4/C to be number coded.
- .6 Voltage Rating: 1KV, 5KV, or 15KV as indicated.
- .7 Inner Jacket:
  - .1 Black polyvinyl chloride (PVC)
  - .2 Low Flame Spread (LFS)
  - .3 Low Gas Emission (LGE)
- .8 Armor: Inter-locked aluminum
- .9 Outer Jacket:

.1 Black polyvinyl chloride (PVC), -40 deg. C
.2 Low Flame Spread (LFS)
.3 Low Gas Emission (LGE)

.10 Flame Rating: FT4

.11 Certification: CSA C22.22 No. 131 or latest revision.

.3 Electronic Cables:

.1 Conductors:
.1 Minimum #18 AWG - STC Solid Copper

.2 Insulation: polyvinyl chloride (PVC)

.3 Configuration: twisted pairs (No. as indicated)

.4 Shielding: Copper braid

.5 Voltage Rating: 300V

.6 Certification: CSA

.7 Suitable for use with VFD and DDC controller.

.8 Ground the shield as per equipment manufacturer's instructions.

.4 Fire Alarm Cable:

.1 Conductor: Solid Copper minimum #18 AWG

.2 Insulation: 105 deg. C Flame retardent PVC

.3 Configuration: Multi-conductor, (minimum 4 conductors per cable).

.4 Voltage Rating: 300V

.5 Conductor Identification: Colour coded

.6 Shielding: Aluminum mylar foil

.7 Outer Jacket: 105 deg. C red PVC jacket

.8 Certification: CSA Class #5851-01 File #LR41741

.9 Flame Rating: FT4

.10 Refer to Fire Alarm section for wiring to suit addressable fire alarm systems.

.5 Low Voltage Control Cables:

.1 Type: LVT

.2 Conductor: Solid Copper #18 AWG

.3 Insulation: Thermoplastic, colour coded

.4 Configuration: single, two conductor - parallel, three or more conductors twisted

.5 Voltage Rating: 30V

.6 Outer Jacket: thermoplastic

.7 Certification: CSA C22.22 No. 35

.8 Flame Rating: FT4

.6 Mineral Insulated Cables:

.1 Type: M.I., two hour fire rated.

.2 Conductors:
.1 Solid Copper Sized as indicated

.3 Insulation: magnesium oxide

.4 Configuration: Single, two, three or four conductor as indicated.

.5 Voltage Rating: 600V

.6 Outer Jacket: copper

.7 Acceptable manufacturers: Pyrotenax (BICC Cables).

.8 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs as required.

.7 RA90 Cables

.1 Single conductor RW90 insulation, minimum 600V, -40C

.2 Stranded copper, size as indicated.

.3 Liquid and vapour tight corrugated aluminum sheath.

.4 Overall PVC jacket rated FT-4.

Part 3 Execution

3.1 GENERAL

.1 To Minimize Voltage Drop on 120 Volt, 15 Amp Branch Circuits:

.1 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, light fixtures, etc.

3.2 INSTALLATION IN RACEWAYS

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16111.

.2 Ensure conduits are dry and free of debris before pulling cables.

.3 Colour coding and identification as per this section.

.4 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.

.5 Branch circuits exceeding 21 metres shall be #10 AWG, branch circuits exceeding 35 metres shall be #8 AWG.

3.3 INSTALLATION OF SINGLE CONDUCTOR CABLES

.1 Single conductor cables shall be installed one cable diam. apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diam. and bends shall not damage or distort the outer sheath.

.2 Do not install PVC jacketted cables in circulating air plenums.

.3 Single conductor cables installed underground shall be installed in the installation configuration outlined in Appendix B of the Canadian Electrical Code to provide the allowable ampacity required for the feeder.

3.4 INSTALLATION OF MINERAL - INSULATED CABLES

.1 Mineral insulated (MI) wiring shall have a minimum of two hour fire rating unless otherwise noted. Mineral insulated (MI) cables shall be as manufactured by (Pyrotenax) (BICC Cables).

.1 Refer to Drawings and Specifications for MI power feeders. All testing is to be done after cables are bent and formed within panelboards but before the cables are terminated on breakers or lugs. All insulation resistance values to be 50 megohms or more. Any cables with values less than 50 megohms are to be re-terminated and re-tested. At completion of all testing and verification, submit a final report to the Contract Administrator. The report is to include test results for each cable, confirmation that all cables and terminations have been installed according to manufacturer's installation instructions and confirmation that there are no outstanding deficiencies in the installation.

.2 Division 16 shall arrange for and shall pay all necessary charges for Pyrotenax to provide the testing services and to verify all terminations have been done correctly. Division 16 shall provide sufficient advance notice to Pyrotenax to allow them to be present at the required time to provide training prior to start of cable installation and to perform testing.

.3 Division 16 shall provide sufficient advance notice to Pyrotenax to allow them to be present at the required time to provide training prior to start of cable installation.

.4 All mineral insulated (MI) cables shall be spaced and installed to manufacturers recommendations. Continuous lengths of M.I. cable without joints shall be used. Mineral insulated cable shall be clipped on minimum 1m centres. All cables shall be terminated with the self threading sealing end pot inside the brass gland body. In no case shall the copper sheath and sealing end pot extend beyond the brass gland body. Complete installation to meet all Code requirements and manufacturer's recommendations necessary for a two hour rating. All forming/bending of M.I. cable shall be done by manufacturer's recommended method.

.5 All Pyrotenax cable terminations shall be tested and verified. Each and every termination is to be tested immediately on completion of terminations and test results turned over to Contract Administrator immediately.

.6 Lugs for M.I. cable shall be CSA approved for M.I. cable. Where CSA approved lugs are not available for M.I. cable, Pyrotenax "Quick Terminating Kits" shall be used.

.7 Type "P" cable clamps shall not be used to secure M.I. cable. Use approved two piece strut clamps.

3.5 INSTALLATION IN EQUIPMENT

.1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.6 TERMINATIONS

.1 Terminate wires and cables with appropriate connectors in an approved manner.

.2 Compression adapters intended to terminate larger feeders on small lugs are not acceptable. All lugs, including breaker lugs, are to be sized to accommodate the cable being terminated.

3.7 IDENTIFICATION

.1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, color coded as listed below.

.2 Wire in conduit 1/0 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 150 mm band of coloured vinyl tape of the appropriate colour. Emergency power feeders shall be provided with an additional 75 mm band of red vinyl tape installed adjacent to the 150 mm band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

.3 Color code wire in conduit and single conductor cables as follows:

Phase A - red
Phase B - black
Phase C - blue
Neutral - white
Ground - green

.4 Maintain phase sequence and colour coding throughout project.

.5 Use colour coded wires in communication cables, matched throughout system.

.6 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.

.7 Refer to 16010 for additional requirements.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16191 Fastenings & Supports

1.2 LOCATION

.1 Locate splitters, junction and pull boxes as indicated or as needed for each system.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Sprinklerproof

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Minimum three spare terminals on each set of lugs in splitters.

.4 Explosion proof in hazardous areas to suit the hazardous classification.

.5 Weatherproof where installed outdoors.

.6 Enclosures in other areas to suit environment.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Cast type with gasketted covers where exposed to weather.

.4 Explosion proof in hazardous areas to suit the hazardous classification.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard. Cabinets to be flush or surface mounted as indicated.

.3 Provide other systems cabinets as specified and located on Drawings.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated.

.4 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.5 Install junction and pull boxes clear of all mechanical ductwork and piping.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Identify splitters with size 7 nameplates.

.3 Identify junction and pull boxes with size 3 nameplates.

.4 Identify cabinets with size 5 nameplates.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 Sectional boxes shall not be used without specific approval of the Contract Administrator.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 In finished areas switch, convenience receptacle, voice/data and blank cover plates shall be stainless steel. In finished area ceilings, junction and pull box covers shall be solid covers, painted to match the finish of the adjacent surface.

.7 In moist or dusty areas, gasketted watertight or dust tight boxes and covers shall be provided.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel device boxes for flush installation, minimum size 102 mm square outlet boxes with extension and plaster rings as required.

.2 Electro-galvanized steel device boxes for flush installation in drywall and minimum size 102mm square outlet boxes with extension and square cornered tile covers as required.

.3 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, sized as required for the installation.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved Material to prevent entry of debris during construction. Remove upon completion of Work.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.4 Boxes to be mounted plumb and square with building lines.

.5 Install pull boxes, or fittings, in conduit runs where more than four bends are necessary.

.6 Install pull boxes where run exceeds 23.0 (75 feet) in length.

.7 All junction, outlets and pull boxes shall be so installed that they are always readily accessible.

.8 No power driven pins (Ramset) shall be utilized to secure boxes without specific approval from Contract Administrator.

.9 Check opening provided for each recessed outlet box and if it is not completely covered by cover plate, report discrepancy to the division responsible and ensure that it is rectified.

.10 Verify exact location of floor boxes with Contract Administrator. Adjust floor boxes level with finished floor.

.11 Verify exact location of service fittings with furniture Drawings and/or Contract Administrator. Service fittings to be installed parallel and perpendicular to building lines.

.12 No more than two extension rings shall be used in sequence.

.13 For installations in hazardous areas, meet all requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

1.2 SUBMITTALS

.1 Submit Shop Drawings and product data in accordance with Section 16010.

Part 2 Products

2.1 SWITCHES

.1 Toggle operated general purpose AC Switches 15A and 20A 120Vac and 347Vac single pole, double pole, three-way and four-way switches as indicated, with the following features:

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea molding.
.4 Suitable for back and side wiring.
.5 Brown toggle for normal power; red toggle for emergency power.
.6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.2 Switches of one manufacturer throughout project.

.3 Switches to be premium Specification grade.

.4 Acceptable manufacturers:

Manufacturer	120 Volt
Hubbell	1200 Series
Bryant	4800 Series
Leviton	1200 Series
Pass & Seymour	AG-1 Series
Smith & Stone	4-4800 Series
Slater	710 Series

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 Vac, 15 A, U ground, with following features:

.1 Nylon face, brown or ivory for normal power, red for emergency power.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.

.4 Double wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 VAC, 15 A, U ground with following features:

.1 Nylon face, brown or ivory for normal power, red for emergency power.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Receptacles to be orange face isolated ground type where indicated. Provide a separate insulated ground wire and a separate neutral for each isolated ground circuit.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Pass & Seymour, Slater. Catalogue No. 5262 for all manufacturers.

.6 Acceptable manufacturers for ground fault receptacles shall be:

.1 Arrow Hart - GF 5242

.2 Bryant - GFR 52FT

.3 Hubbell - GF 5252

.4 Pass & Seymour - 1591-R

2.3 COVER PLATES

.1 Cover plates from one manufacturer throughout project.

.2 Stainless steel cover plates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Cast gasketted cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof cover plates complete with gaskets for single receptacles or switches as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 16010 or as indicated.

.4 Switches shall be mounted 1.4m (4'-6") above finished floor on the strike side of the door.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles horizontally at height specified in Section 16010 or as indicated.

.3 Horizontally mounted receptacles shall have the hot line terminal on the bottom.

.4 Where switch and convenience outlets are shown close to one another, mount receptacles below and in line with the switch.

.5 Suitably ground all receptacles with #12 green insulated wire to outlet box.

.3 Coverplates:

.1 Install suitable common cover plates where wiring devices are ganged.

.2 Do not use cover plates intended for flush outlet boxes on surface-mounted boxes.

.3 Provide a coverplate on each outlet.

3.2 IDENTIFICATION

.1 Identify receptacles with size 1 nameplate indicating panel and circuit number. Nameplates to be mechanically fastened. Refer to Section 16010.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16122 Wires and Cables

Part 2 Product

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings or as required.

.1 Manufacturers: B-Line, Burndy, Electrovert, Unistrut, Pilgrim, Pursley.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with cast in or expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation. Provide additional support as required.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel Work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 1500 mm oc spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Threaded rod to be minimum 6 mm diam. galv. or nickel plated. Black steel rod is not acceptable.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Division 15000 Mechanical Specifications

.2 Section 16010 Electrical General Requirements

.3 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.4 Section 16122 Wires and Cables

.5 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

.6 Section 16440 Disconnect Switches - Fused and Non-Fused up to 1000V

.7 Section 16811 Motor Starters to 600V

1.2 SYSTEM DESCRIPTION

.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

Part 2 Products

2.1 MATERIALS

.1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Div. 15. Motor horsepower ratings shall be as shown in the Div. 15 Specificaitons. Motor voltage and phase ratings shall be as shown on the Div. 16 Drawings.

Part 3 Execution

3.1 POWER WIRING

.1 Install power feeders, starters, disconnects and associated equipment and make connections to all mechanical equipment.

.2 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers. Control panels for equipment on emergency power to be connected to emergency branch circuits.

.3 Install main power feeders to starter/control panels furnished by Div. 15. Install branch circuit wiring for motors, electric coils, etc.

3.2 CONTROLS

.1 Install all electrical controls except controls supplied under Division 15, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.

.2 Wire and connect switches, pressure switches, alternators, alarms, etc. for booster pumps, jockey pumps and compressors.

.3 Wire and connect electrical interlocks for starters supplied by Div. 16.

3.3 FIRE PROTECTION (SPRINKLER AND STANDPIPE)

.1 Wire and connect the flow, pressure and tamper switches, installed on the sprinkler and standpipe systems, to separate zones in the fire alarm control panel, as indicated. Refer to sprinkler Shop Drawings for the exact location of these switches.

.2 Wire and connect fire pump controller supervisory signals to fire alarm control panel.

.3 Provide an E.O.L.R. for each zone where required and locate adjacent to monitored device.

3.4 COORDINATION

.1 Refer to mechanical Drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.

.2 Obtain full information from Div. 15, regarding wiring, controls, overload heaters, equipment ratings and overcurrent protection. Notify the Div. 15 Subcontractor, at once, if any information provided is incorrect or unsatisfactory.

.3 Coordinate control wiring requirements with Div. 15 and provide all control wiring and connections as required to make the control systems operate as specified.

.4 Refer to Div. 15 Specifications for any further electrical requirements.

3.5 SHOP DRAWING REVIEW

.1 Review Div. 15 equipment Shop Drawings and adjust breaker/feeder sizes as required.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16131 Splitters, Junction, Pull Boxes and Cabinets

.4 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

.5 Section 16191 Fastenings and Supports

1.2 COORDINATION

.1 The building shall remain open and in normal operation during the construction period.

.2 Where existing services such as electrical power, fire alarm system, sound system, etc. are required to be disrupted and/or shut down, coordinate the shut-downs with the City and carry out the Work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 120 hours in advance of performing Work and obtain the City's written consent prior to implementing.

.3 Should any temporary connections be required to maintain services during Work in the existing building, supply and install all necessary Material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the City and Contract Administrator.

.4 If existing equipment shown on Drawings is defective it shall be brought to the Contract Administrator and the City's attention prior to Work completion.

.5 Refer to General Conditions for phasing and staging of Work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.

.6 Coordinate complete installation of relocated utility services, if required, with Utilities to ensure minimum interruption of service. Coordinate the transfer of the existing hydro service point to the new service point with the Hydro utility in order to keep power interruptions to a minimum.

1.3 SCHEDULE OF WORK

.1 Carefully note and refer to the Contract Administrator's general schedule of Work and include for all requirements to conform to it.

Part 2 Products

2.1 MATERIALS

.1 Provide all Materials required for the complete interface and reconnection installation as herein described and as indicated on the Drawings.

.2 New fire alarm devices, speakers, starters, panelboards, etc. required to be tied in to existing systems shall match the existing devices.

.3 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturers requirements and instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Install boxes, conduit and wiring through existing areas as required for the new installation.

.2 Add modules, switches, etc. in existing control panels, as required, to extend existing systems to new or renovated areas.

.3 Patch and repair walls and ceilings in existing areas that have been damaged or cut open due to the new electrical installation.

.4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 16010.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in CSA Enclosure and size as indicated. To suit the environment (i.e. weatherproof, watertight, dust-tight, general purpose, etc.)

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, to Section 16478 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action, heavy duty industrial grade.

.7 ON-OFF switch position indication on switch enclosure cover.

.8 Disconnects used for service entrances shall be approved service entrance switches.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate name of load controlled and voltage on size 6 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as indicated.

.2 Install additional brackets, supports, etc. required for mounting the disconnect switches.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16122 Wires and Cables

1.2 REFERENCES

.1 Ground equipment to: CSA C22.2 No. 41.

.2 Copper grounding conductors to: CSA G7.1.

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors system, circuit and equipment, grounding to be bare (or green insulated if indicated/required) stranded copper sized in accordance with the Canadian Electrical Code.

.2 System and circuit, equipment, grounding conductors, bare stranded copper, tinned, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, type RW-90.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs. Soldered joints not permitted.

.5 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.6 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point street side of water pipe. Avoid loop connections.

.8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.9 All conduit runs containing feeders and branch circuits shall be complete with an insulated green ground wire bonded to all outlet boxes, junction boxes, pull boxes,

equipment enclosures, etc. The conduit system shall be continuous but shall not be relied on to serve as the equipment grounding means. Ground conductors shall be sized according to the Canadian Electrical Code, but shall be minimum #12 AWG. All locknuts and couplings shall be securely tightened. All flexible conduit shall include an insulated ground wire and shall be properly grounded through an approved fitting. A separate ground conductor shall be installed in all fibre, PVC or plastic duct runs and shall be connected to maintain the grounding of the system.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors, motor control centres, starters, control panels, building steel Work, generators, elevator distributions, panels, outdoor lighting.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 16010.

.2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of the local inspection authority. A report shall be submitted to the Contract Administrator from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator, if provided, during tests.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit Shop Drawings and product data in accordance with Section 16010.

.2 Submit fuse performance data characteristics for each fuse type and size above 30 A. Performance data to include: average melting time-current characteristics, I(for fuse coordination), and peak let-through current.

1.3 MAINTENANCE MATERIALS

.1 Provide maintenance Materials in accordance with Section 16010.

.2 Three spare fuses of each type and size installed above 600 A.

.3 Six spare fuses of each type and size installed up to and including 600 A.

1.4 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet.

Part 2 Products

2.1 FUSES GENERAL

.1 Plug and cartridge fuses: to CSA C22.2 No. 59.

.2 Fuse type references L1, L2, J1 etc. have been adopted for use in this Specification.

.3 Fuses: product of one manufacturer.

2.2 FUSE TYPES

.1 HRC-L fuses (formerly Class L), motor loads:
- .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Type L2, fast acting.

.2 HRCI-J fuses (formerly Class J), Panel loads:
- .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .2 Type J2, fast acting.

2.3 FUSE STORAGE CABINET

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 16010 - Electrical-General Requirements.

Part 3 Execution

3.1 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.
- .1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Provide a fuse cabinet in each main and sub-electrical room where fuses are installed.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit Shop Drawings in accordance with Section 16010.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Contract Administrator.

.3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, base type and order code.

1.3 GUARANTEE

.1 Replace:
- .1 Fluorescent lamps burning out within 12 months of takeover.
- .2 Ballasts that fail or exceed their labelled noise level rating within 12 months of takeover.

1.4 CO-ORDINATION

.1 Co-ordinate luminaire locations with Work of other trades.

.2 Co-ordinate luminaire types with ceiling finishes to ensure compatibility.

.3 Luminaires to be c/w lamps, suspension devices, plaster rings and other attachments required for best appearance and proper mechanical installation.

Part 2 Products

2.1 MATERIALS

.1 Incandescent and electric discharge fixtures: to CSA C22.2 No. 9.

.2 Socket screw-shell lampholders: to CSA C22.2 No. 43.

.3 Electric discharge lampholders: to CSA C22.2 No. 74.

.4 Incandescent lamps to: CSA C10 and CSA C22.2 No. 84.

.5 Tungsten halogen lamps: to CSA C22.2 No. 84.

.6 Fluorescent lamps: to ANSI C78 series.

.7 Ballasts: to CSA C22.2 No. 74.

2.2 LUMINAIRE DETAILS

.1 Luminaires shall carry the CSA label.

.2 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.

.3 Provide lenses or diffusers of glass or acrylic Material as indicated. Acrylic lenses used with fluorescent luminaires shall be a K-12 pattern with a minimum of .125" (3mm) thickness.

.4 Include finishes to Section 16010 and as indicated.

.5 Provide gasketting, stops and barriers to prevent light leaks.

.6 Recessed luminaires shall be suitable for mounting in the particular type of ceiling where the luminaires are to be mounted.

2.3 LAMPS

.1 Provide lamps as indicated.

.2 Incandescent lamps to be extended service type rated 2500 hours, 130 volts, inside frosted unless indicated otherwise.

.3 Fluorescent lamps (T8) shall be rapid start, 2850 Lumens rated 20,000 hours, 3500 K.

2.4 BALLASTS AND ACCESSORIES

.1 Provide ballasts and accessories as indicated.

.2 Provide ballasts with non-PCB type capacitors with pressure sensitive devices to prevent rupturing.

.3 Provide fluorescent ballasts of 120 and 347 V design, automatic reset thermal protected, 90% power factor, group A noise rating. Ballasts to be Phillips/Advance Mark III.

.4 Fluorescent ballast: CBM certified, energy efficient electronic type, design. (Hybrid type not acceptable).

.1 Rating: 60 Hz, voltage as indicated, for use with 2-32 W, T-8, rapid start lamps.
.2 Totally encased and designed for 40 deg C ambient temperature.
.3 Power factor: minimum 90% with 95% of rated lamp lumens.
.4 Capacitor: non PCB, thermally protected.
.5 Thermal protection: non-resettable auto reset on coil.
.6 Sound rated: A.
.7 Mounting: remote integral with luminaire.
.8 Total harmonic distortion less than 20%.
.9 Ballast must be listed by Manitoba Hydro as acceptable by their "Power Smart" rebate program.
.10 Line amperes for ballast with two 4-foot T-8 lamps to be 0.6 Amps at 120 V maximum, 68 VA. volt-amperes for ballast with four 4-foot T-8 lamps to be 1.0 Amps at 120V maximum.

Part 3 Execution

3.1 INSTALLATION

.1 Install luminaires at locations indicated, c/w lamps, all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.

.2 Install luminaires and lens Materials in Contract Administrator details, as indicated.

.3 Install luminaires parallel with building lines. Wall mounted luminaires to be installed plumb.

.4 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, frames, rings and similar features are included for and match the required installation.

.5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction c/w all fasteners, framing and hangers as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the Drawings.

.6 Where luminaires are suspended from ceilings using self-aligning box covers and additional ground wire from the outlet box to the luminaires shall be provided.

.7 Co-ordinate the installation of luminaires with the Work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by the Contract Administrator.

.8 Install post top, landscape and roadway luminaires plumb.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

3.3 LAMPS

.1 Adjust lamp position in adjustable lampholder type luminaires to produce the proper beam distribution for the specified lamp.

3.4 TESTS

.1 Perform tests in accordance with Section 16010.

3.5 CLEANING

.1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with a damp cloth to remove dust, smudges and fingerprints.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16122 Wires and Cables

.4 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 16010.

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 16010.

.2 Operation and Maintenance Manual to include:

.1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved Shop Drawings.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance Materials in accordance with Section 16010.

.2 Include:

.1 Five spare lamps of each type supplied for remote heads.

1.5 WARRANTY

.1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in Material and workmanship for a period of 10 years, with a no-charge replacement during the first lustrum and a pro-rate charge on the second lustrum, from the date of the Final Acceptance from the City.

1.6 SYSTEM DESCRIPTION

.1 The system to include battery unit(s) controls, remote heads, wire and conduit etc. to provide backup emergency lighting in the event of a loss of AC power to the normal lighting system.

Part 2 Products

2.1 EQUIPMENT

.1 Supply voltage: 120 V ac. as indicated.

.2 Output voltage: 12 V dc. as indicated.

.3 Operating time: 60 min. as indicated.

.4 Battery: sealed, long life, lead acid or lead calcium maintenance free.

.5 Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.

.6 Solid state transfer.

.7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.

.8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.

.9 Lamp heads: integral on unit 360 deg. horizontal and 180 deg. vertical adjustment. Lamp type: tungsten-halogen, 12 W, glare free, (mini style).

.10 Cabinet: minimum 20 gauge steel cabinet c/w white polyester paint finish c/w knockouts for conduit.

.11 Auxiliary equipment:
- .1 Low voltage disconnect switch.
- .2 Lamp disconnect switch.
- .3 Test switch.
- .4 Time delay relay.
- .5 Battery disconnect device.
- .6 ac input and dc output terminal blocks inside cabinet.
- .7 Shelf where required.
- .8 Cord and 3-prong straight blade NEMA 5-15P plug connection for ac.

.12 Wall mounted battery banks to be direct wall mounted or with wall mounting shelf. Provide removable or hinged front panel for easy access to the batteries. LED diagnostics display and test switch mounted by side of enclosure.

.13 T-bar mounted battery banks to be mounted in T-bar ceilings at locations shown. Units to be c/w flanges to access T-bar ceiling tiles. Units to be independently suspended from structure above. LED diagnostics display and test switch to be mounted on underside of enclosure.

2.2 MANUFACTURERS

.1 Acceptable Manufacturers: Dual-Lite, Emergi-lite, Lithonia, Lumacell, Luxnet, Uniglo.

2.3 REMOTE HEADS

.1 Remote micro heads fixture:
- .1 Double or triple heads as indicated.
- .2 Wall or ceiling mountable c/w mounting plate.
- .3 Molded thermoplastic housing and mounting plate.
- .4 Adjustable rotary collar and adjustable swivel heads for proper aiming of fixture.
- .5 Prismatic acrylic lens over lamp.
- .6 12 Watt quartz halogen lamp at voltage indicated.
- .7 Approved Manufacturers:
  - .1 Dual-Lite: MRH series
  - .2 Emergi-Lite: P18 series
  - .3 Lithonia: P18 series
  - .4 Lumacell: MQ series

.5 Luxnet: R1Q series
.6 Uniglo: MR series

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting in accordance with CSA C22.1.

.2 Install conduit and wiring as indicated.

.3 Install unit equipment and remote mounted fixtures as indicated.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads indicated to provide maximum lighting level along means of egress routes.

.6 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.

.7 Charge the batteries and test the system for proper operation (minimum of 35 or 65 minutes discharge time).

.8 Adjacent to each battery bank unit install a 120V duplex receptacle and wire to AC night lighting circuit.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16122 Wires and Cable

.4 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

.5 Section 16195 Work in Existing Building

1.2 REFERENCES

.1 CAN/ULC-S524 Installation of Fire Alarm Systems

.2 ULC-S525 Audible Signal Appliances, Fire Alarm

.3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems

.4 CAN/ULC-S527 Control Units, Fire Alarm

.5 ULC-S528 Manually Actuated Signalling Boxes, Fire Alarm

.6 CAN/ULC-S529 Smoke Detectors, Fire Alarm

.7 ULC-S530 Heat Actuated Fire Detectors, Fire Alarm

.8 CAN/ULC-S531 Smoke Alarms

.9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems

.10 CAN/ULC-S537 Verification of Fire Alarm Systems

.11 DFC No. 310(M) Computer Systems

.12 Manitoba Building Code

1.3 DESCRIPTION OF SYSTEM

.1 The existing Base Building fire alarm system is an Edwards ‘Quick-Start’ addressable fire alarm panel located in the main Electrical Room.

.2 Provide all components/wiring/modifications/programming/etc. as required to extend this existing system as indicated on the plans.

.3 Provide new devices to match existing.

1.4 ENTS OF REGULATORY AGENCIES

.1 The equipment and installation shall comply with the current ULC and Building Code requirements.

.2 Manitoba Building Code.

.3 Local and Municipal By-Laws.

.4 Authorities having jurisdiction.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 16010 for the complete Fire Alarm system including:
- .1 All devices.
- .2 Control panels
- .3 Zoning System, including isolator locations.
- .4 Programming of the Fire Alarm System.
- .5 Connection to fire suppression system.
- .6 All other components of the fire alarm system.
- .7 Description of the operational sequences of the system.
- .8 Complete set of Drawings, indicating location of all devices, including analogue and signalling devices, control and annunciator panels, all interconnections to mechanical equipment, to fire suppression systems and to existing computer room system, all conduit routing and sizes, all wire sizes, types, number and a riser for each control panel indicating all of the above.
- .9 Pictorial Drawings of control equipment indicating the location of the components and parts and their respective catalogue number and electrical characteristics.
- .10 Interconnecting diagrams and cable manual.
- .11 System descriptions of the actual installation.
- .12 Maintenance instructions.
- .13 Recommended spare parts list.
- .14 Provide name, address and telephone number of the manufacturer's service representative to be contacted during the warranty period.

.2 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 16010.

.2 Include:
- .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of as-built Shop Drawings.

1.7 WARRANTY

.1 Warranty all Equipment, Sensors, Materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide a complete inspection and testing of the fire alarm system 1 year after final acceptance. Inspection tests to conform to be ULC-S536. Submit inspection report to Contract Administrator.

.3 Provide all programming of system as directed during the warranty period at no cost to the City.

1.8 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during year. The second inspection can be done at the same time as the ULC-S536 inspection and testing specified in 1.7 Warranty.

1.9 TRAINING

.1 Arrange and pay for on-Site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 Provide video tape (3 copies) of all training provided.
- .1 Provide training sessions which will explain general system operation to staff.
- .2 Provide training sessions for staff to explain detailed operating and maintenance procedures.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer, to match existing.

2.2 MODULES

.1 Single Input Module
- .1 The intelligent Single Input Module shall be capable of a minimum of 4 personalities, each with a distinct operation.
- .2 The personality of the module shall be programmable at Site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
- .3 The single input module shall support the following circuit types:
  - .1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
  - .2 Delayed Waterflow
  - .3 Non-Latching Monitor
  - .4 Supervisory
- .4 Input circuit wiring shall be supervised for open and ground faults.
- .5 The input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
- .6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
- .7 The single input module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1 gang, 1 1/2" (38mm) deep 4" square box with 1 gang cover.
- .8 The input module shall be suitable for operation in the following environment:
  - .1 Temperature: 32F to 120F (0C to 49C)
  - .2 Humidity: 0-93% RH, non-condensing
- .9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.2 Dual Input Module

.1 The intelligent Dual Input Module shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.

.2 The personality of the module shall be programmable at Site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The dual input module shall support the following circuit types:

.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow

.2 Delayed Waterflow

.3 Non-Latching Monitor

.4 Supervisory

.4 Input circuit wiring shall be supervised for open and ground faults.

.5 The dual input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.6 The dual input module shall be suitable for mounting on North American, 2 1/2" (64mm) deep 1 gang, 1 1/2" (38mm) deep 4" square box with 1 gang cover.

.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.8 The input module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.3 Single Input Signal Module

.1 The intelligent Single Input Riser/Signal Module shall provide one supervised output circuit. The output circuit shall be suitable for any of the following operations:

.1 24 vdc, polarized audible and visible signal appliances

.2 The personality of the module shall be programmable at Site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 Circuit wiring shall be supervised for open and ground faults.

.4 The signal module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.5 The signal module shall be suitable for mounting on North American 2 1/2" (64mm) deep, 2 gang or 1 1/2" (38mm) deep, 4" square boxes.

.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.7 The signal module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing

.8 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.4 Control Relay Module

.1 The intelligent micro-processor based Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps. @ 24 Vdc. to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. Provide auxiliary relays (wired for fail safe operation) where amp rating of Control Relay Module is exceeded.

.2 The position of the relay contact shall be confirmed by the system firmware.

.3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.4 The control relay module shall be suitable for mounting on North American; 2 1/2" (64mm) deep, 1 gang, 1 1/2" (38mm) deep, 4" square box with 1 gang cover.

.5 The module shall be suitable for operation in the following environment:

.1 Temperature: 32F to 120F (0C to 49C)

.2 Humidity: 0-93% RH, non-condensing

.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.7 It shall be possible to address each module without the use of DIP switches. Devices using DIP switches for addressing shall not be acceptable.

.5 Universal Class A/B Module

.1 The intelligent Universal Class A/B Module shall be capable of a minimum of 15 distinct operations.

.2 The personality of the module shall be programmable at Site to suit conditions and may be changed at any time using a personality code downloaded from the ZAS-2, Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The Universal Class A/B module shall support the following circuit types:

.1 Two Class B or one Class A Initiating Device Circuits (IDC) capable of delayed waterflow alarm operation.

.2 One Class A or B Indicating Device (Signal) Appliance Circuit (IAC)

.3 One Class A or B Circuit for 2 wire Smoke Detectors (Verified or non-verified).

.4 One Form "C" (NO/NC) Dry Output Contact Relay

.4 Input/Output circuit wiring shall be supervised for open and ground faults.

.5 The universal Class A/B module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.

.6 The module shall be suitable for mounting on North American 2 1/2" (64mm) deep, 2 gang or 1 1/2" (38mm) deep, 4" square boxes.

.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.

.8 The universal Class A/B module shall be suitable for operation in the following environment:
- .1 Temperature: 32F to 120F (0C to 49C)
- .2 Humidity: 0-93% RH, non-condensing

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524, DFC-410(M), manufacturer's requirements, authorities having jurisdiction, etc.

.2 Install end-of-line devices where required.

.3 Locate and install intelligent modules as required.

.4 Fire Suppression System: wire alarm switches, supervisory switches, solenoids, etc. and connect to control panel.

.5 Connect sprinkler switches.

3.2 VERIFICATION, DATA AND TESTING

.1 System Verification

.1 Upon completion of all wiring and installation of all equipment, devices, etc., do complete verification of the fire alarm system. Verification shall be in accordance with current edition of Standard CAN/ULC-S537 "The Verification of Fire Alarm Systems" and following requirements. Even if permitted by Code and recognized standards and regulations, grade of Work shall in no case be lower than specified in the project Specifications. Verify all new initiating and signal/ solenoid zones and circuits, etc. Verify that every component installed, is working and functions as intended.

.2 Manufacturer with assistance of electrical Contractor shall do a complete verification of system to ULC S-537 to ensure:

- .1 That system is installed as per plans and Specifications and is operative and acceptable to all authorities having jurisdiction.
- .2 That system is installed as per recommendations of manufacturer.
- .3 That system is electrically supervised, including all zone lamps. To accomplish this, manufacturer with assistance of electrical Contractor shall:
  - .1 remove each and every device from its applicable circuit by disconnecting circuit wiring
  - .2 verify presence of the applicable trouble signal and indications at control panel and remote annunciators.
- .4 That all devices are operative. Check each switch, device, etc. for proper operation.
- .5 That all system functions are operating as intended, including:
  - .1 all main control circuits,
  - .2 all remote annunciator circuits,
  - .3 all manual and automatic initiating devices,
  - .4 all audible and visual alarm signals,
  - .5 all ancillary controls, including fan shutdown, door release, etc.

.6 All existing systems functions (such as alarm signals, ancillary controls, etc.) that are not modified, but are required to operate from any new zones added, shall be verified for correct operation.

.7 When fire alarm system is verified, Contractor shall measure and record all loop or circuit resistance values at the fire alarm panel when end-of-line resistor is shorted. Contractor shall highlight all values which exceed the manufacturer's recommendations and report them to the Contract Administrator for action to correct this deficiency.

.3 Any necessary changes required to conform to the above shall be completed by the electrical Contractor with technical assistance provided by the system manufacturer.

.4 During the period of this inspection, the electrical Contractor shall assist the manufacturer with the services of electricians.

.5 To assist the electrical Contractor in preparing his bid, the manufacturer shall indicate in his Bid Opportunity the number of hours required to complete this inspection.

.6 Upon completion of the above inspection, including any changes required, the manufacturer shall submit the following documentation to the Contract Administrator.

.1 Certification of Verification

.2 A complete report of all equipment verified, including:

.1 sprinkler system switches
.2 automatic detectors
.3 alarm signals
.4 annunciators
.5 door hold open devices
.6 fan shutdown
.7 the number and type of devices connected to each circuit

.7 For each piece of equipment verified, the following information shall be included in the report:

.1 Catalogue number and type of device
.2 Location of device
.3 Zoning or circuit devices including ancillary devices
.4 Supervision test results
.5 Operation of device
.6 Inspection date
.7 Serial number of every smoke detector
.8 Sensitivity reading of every smoke detector, including duct detectors
.9 Record the time delay of all sprinkler flow switches
.10 Zone circuit loop resistance
.11 Fire alarm system supplier shall verify that alarm descriptions match and are consistent at each of following reporting locations:

.1 Fire alarm control panel
.2 Fire alarm remote annunciators

.8 Report shall also indicate operation of ancillary functions such as remote alarm indicators, door release, fan shutdown, etc. which are required to be activated. Operation shall be verified by actual observation of the entire function (e.g. bells ringing, checking to ensure proper fans shut down, etc.). Observing a change of state in the fire alarm control panel (e.g. observing relay function) is not

considered complete verification of the entire function. Verification shall include actual field checking of proper operation of ancillary devices and equipment. Complete fire alarm system verification report shall be submitted to Contract Administrator, City and authorities having jurisdiction minimum of one week before City of Winnipeg Acceptance Inspections.

.9 All costs necessary for this verification shall be included in electrical trade's Bid Opportunity price.

.10 Upon completion of this inspection, manufacturer shall demonstrate the operation of system to Citys.

.11 Verify identification of all terminals (markers, directories and diagrams) in interconnecting wires and cables, certifying their correctness. Upon completion of verification, submit all documentation to Contract Administrator, including mylar sepia of as-built system riser block diagram and all tub or cabinet directories. Indicate on all documentation submitted that in fact it has been verified.

.12 Any errors in verification report shall be just cause for complete reverification of all verification Work performed by Contractor, at discretion of Contract Administrator. Contractor shall be responsible for all costs associated with system reverification.

.13 Verify number of detectors on each zone and include verification report quantity of detectors on each zone.

.14 Sprinkler Flow Switches: Check and calibrate time delay of all sprinkler flow switches such that time delay is between 25 and 30 seconds. Record 'final setting' time delay of every flow switch in verification report.

.15 Manitoba Fire Alarm Technician ‘M’ License:

.1 A Manitoba Fire Alarm Technician ‘M’ License is required to perform fire alarm verifications. The scope of this license allows holders to maintain, service, repair and verify fire alarm systems. Installations of fire alarm systems must still be performed by a licensed electrician. Fire alarm verifications shall be conducted by a qualified person other than the installing Contractor or Contract Administrator.

.2 In addition to the name and contact information of the verifying organization, the verification report must include the printed name, the signature, the ‘M’ license number and the CFAA (Canadian Fire Alarm Association) certificate number of the primary technician conducting the verification.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Section 16010 Electrical General Requirements

.2 Section 16111 Conduits, Conduit Fastenings and Conduit Fittings

.3 Section 16122 Wires and Cable

.4 Section 16132 Outlet Boxes, Conduit Boxes and Fittings

.5 Section 16195 Work in Existing Building

1.2 REFERENCES

.1 CAN/ULC-S524 Installation of Fire Alarm Systems

.2 ULC-S525 Audible Signal Appliances, Fire Alarm

.3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems

.4 CAN/ULC-S527 Control Units, Fire Alarm

.5 ULC-S528 Manually Actuated Signalling Boxes, Fire Alarm

.6 CAN/ULC-S529 Smoke Detectors, Fire Alarm

.7 ULC-S530 Heat Actuated Fire Detectors, Fire Alarm

.8 CAN/ULC-S531 Smoke Alarms

.9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems

.10 CAN/ULC-S537 Verification of Fire Alarm Systems

.11 DFC No. 310(M) Computer Systems

.12 Manitoba Building Code

1.3 DESCRIPTION OF SYSTEM

.1 The existing pre-action release panel is a Cerberus FACP, located on the 7th floor and presently configured as a Halon Release panel.

.2 Provide all components/wiring/modifications/programming/etc. as required to extend this existing system as indicated on the plans.

.3 Existing smoke detectors connected are to remain. Refer to floor plans.

.4 Connect the existing panel to the new pre-action sprinkler system as required.

.5 Provide existing “Programmed” information, re-program as directed.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

.1 The equipment and installation shall comply with the current ULC and Building Code requirements.

.2 Manitoba Building Code.

.3 Local and Municipal By-Laws.

.4 Authorities having jurisdiction.

1.5 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 16010 for the complete Fire Alarm system including:
- .1 All devices.
- .2 Control panels, DGP's, amplifiers, graphic annunciators, LCD annunciators, printer, accessories, etc.
- .3 Zoning System, including isolator locations.
- .4 Programming of the Fire Alarm System.
- .5 Connection to fire suppression system.
- .6 All other components of the fire alarm system.
- .7 Description of the operational sequences of the system.
- .8 Complete set of Drawings, indicating location of all devices, including analogue and signalling devices, control and annunciator panels, all interconnections to mechanical equipment, to fire suppression systems and to existing computer room system, all conduit routing and sizes, all wire sizes, types, number and a riser for each control panel indicating all of the above.
- .9 Pictorial Drawings of control equipment indicating the location of the components and parts and their respective catalogue number and electrical characteristics.
- .10 Interconnecting diagrams and cable manual.
- .11 System descriptions of the actual installation.
- .12 Maintenance instructions.
- .13 Recommended spare parts list.
- .14 Provide name, address and telephone number of the manufacturer's service representative to be contacted during the warranty period.

.2 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 16010.

.2 Include:
- .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of as-built Shop Drawings.

1.7 WARRANTY

.1 Warranty all Equipment, Sensors, Materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide a complete inspection and testing of the fire alarm system 1 year after final acceptance. Inspection tests to conform to be ULC-S536. Submit inspection report to Contract Administrator.

.3 Provide all programming of system as directed during the warranty period at no cost to the City.

1.8 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during year. The second inspection can be done at the same time as the ULC-S536 inspection and testing specified in 1.7 Warranty.

1.9 TRAINING

.1 Arrange and pay for on-Site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 Provide video tape (3 copies) of all training provided.
- .1 Provide training sessions which will explain general system operation to staff.
- .2 Provide training sessions for staff to explain detailed operating and maintenance procedures.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S525.

.4 Control unit: to CAN/ULC-S527.

.5 Manual fire alarm stations: to ULC-S528.

.6 Thermal detectors: to ULC-S530.

.7 Smoke detectors: to CAN/ULC-S529.

.8 Smoke alarms: to CAN/ULC-S531.

.9 Visual alarms: to CAN/ULC-S526.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524, DFC-410(M), manufacturer's requirements, authorities having jurisdiction, etc.

.2 Locate and install intelligent modules as required.

.3 Fire Suppression System: wire alarm switches, supervisory switches, solenoids, etc. and connect to control panel.

.4 Connect sprinkler switches.

3.2 VERIFICATION, DATA AND TESTING

.1 System Verification

.1 Upon completion of all wiring and installation of all equipment, devices, etc., do complete verification of the fire alarm system. Verification shall be in accordance with current edition of Standard CAN/ULC-S537 "The Verification of Fire Alarm Systems" and following requirements. Even if permitted by Code and recognized standards and regulations, grade of Work shall in no case be lower than specified in the project Specifications. Verify all new initiating and signal/ solenoid zones and circuits, etc. Verify that every component installed, is working and functions as intended.

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- .1 That system is installed as per plans and Specifications and is operative and acceptable to all authorities having jurisdiction.
- .2 That system is installed as per recommendations of manufacturer.
- .3 That system is electrically supervised, including all zone lamps. To accomplish this, manufacturer with assistance of electrical Contractor shall:
  - .1 remove each and every device from its applicable circuit by disconnecting circuit wiring
  - .2 verify presence of the applicable trouble signal and indications at control panel and remote annunciators.
- .4 That all devices are operative. Check each switch, device, etc. for proper operation.
- .5 That all system functions are operating as intended, including:
  - .1 all main control circuits,
  - .2 all remote annunciator circuits,
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  - .4 all audible and visual alarm signals,
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  - .6 All existing systems functions (such as alarm signals, ancillary controls, etc.) that are not modified, but are required to operate from any new zones added, shall be verified for correct operation.
  - .7 When fire alarm system is verified, Contractor shall measure and record all loop or circuit resistance values at the fire alarm panel when end-of-line resistor is shorted. Contractor shall highlight all values which exceed the manufacturer's recommendations and report them to the Contract Administrator for action to correct this deficiency.

.3 Any necessary changes required to conform to the above shall be completed by the electrical Contractor with technical assistance provided by the system manufacturer.

.4 During the period of this inspection, the electrical Contractor shall assist the manufacturer with the services of electricians.

.5 To assist the electrical Contractor in preparing his bid, the manufacturer shall indicate in his Bid Opportunity the number of hours required to complete this inspection.

.6 Upon completion of the above inspection, including any changes required, the manufacturer shall submit the following documentation to the Contract Administrator.

- .1 Certification of Verification
- .2 A complete report of all equipment verified, including:

.1 sprinkler system switches
.2 automatic detectors
.3 alarm signals
.4 annunciators
.5 door hold open devices
.6 fan shutdown
.7 the number and type of devices connected to each circuit

.7 For each piece of equipment verified, the following information shall be included in the report:
.1 Catalogue number and type of device
.2 Location of device
.3 Zoning or circuit devices including ancillary devices
.4 Supervision test results
.5 Operation of device
.6 Inspection date
.7 Serial number of every smoke detector
.8 Sensitivity reading of every smoke detector, including duct detectors
.9 Record the time delay of all sprinkler flow switches
.10 Zone circuit loop resistance
.11 Fire alarm system supplier shall verify that alarm descriptions match and are consistent at each of following reporting locations:
.1 Fire alarm control panel
.2 Fire alarm remote annunciators

.8 Report shall also indicate operation of ancillary functions such as remote alarm indicators, door release, fan shutdown, etc. which are required to be activated. Operation shall be verified by actual observation of the entire function (e.g. bells ringing, checking to ensure proper fans shut down, etc.). Observing a change of state in the fire alarm control panel (e.g. observing relay function) is not considered complete verification of the entire function. Verification shall include actual field checking of proper operation of ancillary devices and equipment. Complete fire alarm system verification report shall be submitted to Contract Administrator, City and authorities having jurisdiction minimum of one week before City of Winnipeg Acceptance Inspections.

.9 All costs necessary for this verification shall be included in electrical trade's Bid Opportunity price.

.10 Upon completion of this inspection, manufacturer shall demonstrate the operation of system to Citys.

.11 Verify identification of all terminals (markers, directories and diagrams) in interconnecting wires and cables, certifying their correctness. Upon completion of verification, submit all documentation to Contract Administrator, including mylar sepia of as-built system riser block diagram and all tub or cabinet directories. Indicate on all documentation submitted that in fact it has been verified.

.12 Any errors in verification report shall be just cause for complete reverification of all verification Work performed by Contractor, at discretion of Contract Administrator. Contractor shall be responsible for all costs associated with system reverification.

.13 Verify number of detectors on each zone and include verification report quantity of detectors on each zone.

.14 Sprinkler Flow Switches: Check and calibrate time delay of all sprinkler flow switches such that time delay is between 25 and 30 seconds. Record 'final setting' time delay of every flow switch in verification report.

.15 Manitoba Fire Alarm Technician ‘M’ License:

.1 A Manitoba Fire Alarm Technician ‘M’ License is required to perform fire alarm verifications. The scope of this license allows holders to maintain, service, repair and verify fire alarm systems. Installations of fire alarm systems must still be performed by a licensed electrician. Fire alarm verifications shall be conducted by a qualified person other than the installing Contractor or Contract Administrator.

.2 In addition to the name and contact information of the verifying organization, the verification report must include the printed name, the signature, the ‘M’ license number and the CFAA (Canadian Fire Alarm Association) certificate number of the primary technician conducting the verification.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cables	Section 16122

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit Shop Drawings and indicate:

- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for motor starters for incorporation into manual.

.2 Include operation and maintenance data for each type and style of starter.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance Materials in accordance with Section 16010.

.2 Provide listed spare parts for each different size and type of starter:

- .1 4 contacts, stationary.
- .2 4 contacts, movable.
- .3 2 contacts, auxiliary.
- .4 2 control transformers.
- .5 2 operating coils.
- .6 2 fuses.
- .7 10 indicating lamps.
- .8 1 HOA kit.

Part 2 Products

2.1 MATERIALS

.1 Starters: EEMAC E14-1.

.1 Half size starters not acceptable.

.2 Provide NEMA rated starters only; IEC rated starters are not acceptable.

2.2 MANUAL MOTOR STARTERS

.1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Overload heaters, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch labelled as indicated.

.2 Indicating light: type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

.4 Flush mounted type in public areas or as indicated.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Power and control terminals.

.4 Wiring and schematic diagram inside starter enclosure in visible location.

.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.6 Control transformer.

.7 Starters to be two speed where required; type to match requirement of motor provided by Division 15.

.2 Accessories:

.1 Pushbuttons and Selector switches: labelled as indicated.

.2 Indicating lights: type and color as indicated.

.3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

.4 HOA selector switch.

.5 Two speed single winding starters shall have individual Red run pilot lights for LOW and HIGH speed run indication.

.6 An adjustable 20 sec. - 3 min. time delay relay (set at 30 sec.) shall be installed in two speed starters. It shall function only during the transition from HIGH SPEED to LOW SPEED where the motor will be in a de-energized state for a period of 30 seconds after initiation of this switching.

.7 Provide and install time delay relay (to sequence starting after power failure) adjustable 0 - 120 seconds for motors 15 horsepower and larger.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 16010 - Electrical - General Provisions.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 16010 - Electrical - General Provisions.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

2.7 MANUFACTURERS

.1 Acceptable manufacturers: Allen Bradley Canada Ltd.; Cutler Hammer Canada Ltd.; "System 89" Siemens Electric Limited; Square D.

.2 All manufacturers shall provide their industrial quality product line; commercial quality starters are not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 All starters for two speed motors to be provided with six pole disconnect switches and wired with six conductors. Refer to motor schedule and Drawings for two speed motors.

3.2 TESTS

.1 Perform tests in accordance with Section 16010 - Electrical - General Requirements and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Ensure motor rotation corresponds with the direction required by the driven equipment.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Electrical General Requirements	Section 16010
.2	Mechanical Equipment Connections	Section 16192
.3	Motor Starters to 600V	Section 16811

1.2 SOURCE QUALITY CONTROL

.1 Conduct equipment inspection at manufacturer's plant.

.2 Provide manufacturer's type test certificates.

.3 Submit written test results to Contract Administrator.

1.3 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 16010.

.2 Indicate:

- .1 Outline dimensions
- .2 Configuration of identified compartments.
- .3 Floor anchoring method and dimensioned foundation template.
- .4 Cable Bus duct entry and exit locations.
- .5 Dimensioned position and size of busbars and details of provision for future extension.
- .6 Schematic and wiring diagrams.
- .7 Complete nameplate schedule.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for motor control centre for incorporation into manual specified in Section 16010.

.2 Include data for each type and style of starter.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance manuals in accordance with Section 16010.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 600V, 60 Hz, 3 phase, 3 wire, grounded.

.2 KAIC RMS symmetrical fault current to match existing.

2.2 GENERAL DESCRIPTION

.1 Existing compartmentalized vertical sections with common power busbars.

.2 Indoor CSA-1.

2.3 MOTOR STARTERS AND DEVICES

.1 Starters to be as specified in Section 16811.

2.4 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 4 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.

.2 Unit mounting:

.1 Engaged position - unit stabbed into vertical bus.

.2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.

.3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.

.4 Stab-on connectors free floating silver plated clips, self-aligning, backed up with steel springs.

.3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.

.4 Hinge unit doors on same side.

.5 Overload relays manually reset from front with door closed.

.6 Pushbuttons and indicating lights mounted on door front.

.7 Devices and components by one manufacturer to facilitate maintenance.

2.5 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 16010 - Electrical - General Requirements.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 16010 - Electrical - General Requirements.

.1 Motor control centre main nameplate: size No. 7, engraved name number and system.

.2 Individual compartment nameplates: size No. 5, engraved with motor number, name and horsepower.

2.7 FINISHES

.1 Apply finishes in accordance with Section 16010 - Electrical - General Requirements.

.2 Paint motor control centre exterior light gray and interiors white.

Part 3 Execution

3.1 INSTALLATION

.1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.2 Make field power and control connections as indicated.

.3 Ensure correct overload heater elements are installed.

3.2 TESTS

.1 Perform tests in accordance with Section 16010 - Electrical - General Requirements.

.2 Ensure moving and Working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre, motors, control devices, sequences, etc.

End Of Section