

**CITY OF WINNIPEG
PLANNING, PROPERTY & DEVELOPMENT
DEPARTMENT CIVIC ACCOMODATIONS DIVISION**

**BASEMENT AND SUB-BASEMENT
FIRE SUPPRESSION SYSTEM**

**510 MAIN STREET, CITY HALL
ADMINISTRATION BUILDING**

SMS Project Number: 11-173-01
City of Winnipeg Bid Opportunity: 501-2012

The City of Winnipeg
Corporate Finance Department
Materials Management Division
Main Floor, 185 King Street
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ISSUED FOR BID OPPORTUNITY

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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 15500 Fire Protection
- .2 All Mechanical Work to be bid as a single complete Subcontract even if 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 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.
- .2 Should any temporary connections be required to maintain services during the 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.
- .3 If existing equipment shown on Drawings is defective it shall be brought to the Contract Administrator and the City's attention prior to commencement of work involving defective equipment.
- .4 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. The building will remain open and in normal operation during the construction period.

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.

- .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 neatly, close to building structure so furring is minimum size. Pipes 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. Contractor shall provide trained persons armed with suitable type extinguishers, with no other duties than to watch for and extinguish sparks, etc.
- .5 Coordinate Work with other sections to avoid conflict and to ensure proper installation of all equipment. Review all Contract Drawings.
- .6 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 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 temperature of base metal is lower than -17 deg. C except with consent of Contract Administrator. At temperature below 0 deg. C, surface of all areas within 75mm (3") of point where weld is to be started to be heated to temperature 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 SCHEDULING OF WORK

- .1 Complete building to be occupied during term of this Contract. Schedule Work so normal functions within building are not interrupted. In general, Work in sub-basement to be performed during normal hours. Work in remainder of building to be scheduled so as to provide minimum inconvenience to The City. i.e. Perform Work either when 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.
- .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.

1.11 DRAWINGS

- .1 Drawings are diagrammatic only and do not show all details. Information involving accurate measurements of building to be taken from building at worksite. Make, without additional expense to The City, all necessary changes or additions to runs to accommodate site and structural conditions. Locations of pipes and other equipment to be altered without charge to The City, and 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 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 are diagrammatic and indicate general location and route to be followed by pipes. Contractor to re-route piping where location or routing indicated on drawings is not possible due to structural interference or other site conditions. Install above ceilings or exposed when no ceiling is present to conserve head room and with minimum interfere to use of space and equipment.
- .5 Where required pipes are not shown on plans install above ceilings or exposed when no ceiling is present to conserve head room and with minimum interfere to use of space and equipment.

1.12 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 Materials of same general type to be of same manufacture (e.g. all mechanical couplings and fittings 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 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.

1.13 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 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 and pipes capped off by Contractor at no additional cost to The City.

1.14 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.

kW	Minimum efficiency (%)			
	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 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.

1.15 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.

1.16 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 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.

1.17 SUPPORTS, BASES, PITS

- .1 Supply and erect all special structural Work required for installation of equipment or piping.

- .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.
- .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.

1.18 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 basement sprinkler).
- .4 Provide manufacturers' registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.
- .5 Identification tags to be labelled sequentially based on existing tag numbering at site.

1.19 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 galvanized oversize pipe sleeves when passing through walls or partitions, for building into wall construction, by other trades.
- .5 Prior to installing sleeves in concrete beams, receive final jobsite approval by the Structural Contract Administrator.

1.20 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 type 304 stainless steel for exterior areas.
- .3 Bolts used on equipment shall be heavy-duty and shall not project more than one diameter beyond nuts.

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

1.21 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.

1.22 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.

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

1.24 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.

1.25 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.
 - .1 Record drawings to be used by contractor to create AutoCAD format Record Drawings for owner's manuals specified in clause 1.27.3.

1.26 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. 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 Equipment Shop Drawings.
 - .4 Printed Record 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.

1.27 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.

1.28 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.

<u>Primary Classification</u>	<u>Secondary Classification</u>	<u>Legend and Direction Arrows</u>
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

1.29 CUTTING AND PATCHING

- .1 Cutting, patching, repairs, and replacement of existing surfaces or building elements as a result of the removal or relocation of existing equipment or piping, or, installation of new equipment or piping to be included in Bid Opportunity price. Employ and pay appropriate Subcontractor to carrying out Work.
 - .1 Submit written request in advance of work affecting:
 - .1 Structural integrity of any building element.
 - .2 Integrity exposing to weather or exterior elements.
 - .3 Maintenance or safety of any operational element.
 - .4 Visual quality of elements.
 - .5 Request to include:
 - .1 Location and description of Work.
 - .2 Description of proposed method and products for repair.
 - .3 Alternatives to proposed method of repair.
 - .2 Review existing conditions prior to performing Work, assess conditions affecting performance of Work. Beginning of cutting or patching means acceptance of existing conditions.
 - .3 Provide temporary supports for structural integrity of Work.
 - .4 Protect Work from exposure to elements and mechanical damage.
 - .5 Repair or replace building elements and finishes to match existing conditions and finishes.

1.30 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.

1.31 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.

1.32 LIST OF ACCEPTABLE MANUFACTURERS

- .1 Refer to Section 15051

1.33 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 subsections of Mechanical Work Specifications.
- .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 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 five (5) 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 FIRE PROTECTION
 - .1 Automatic sprinkler equipment* Reliable; Victaulic; Tyco Fire Products
 - .2 Ball valves Nibco; Anvil; Crane
 - .3 Check valves* Victaulic; Gruvlok; Nibco; Check-Rite; Crane
 - .4 Butterfly valves* Victaulic; Gruvlok; Nibco
 - .5 Pressure gauges* Ashcroft; Winters; Morrison
 - .6 Mechanical Joints* Victaulic; Gruvlok; Smith-Cooper
 - .7 Backflow Prventers* Wilkins/Zurn; Watts; Conbraco
 - .8 Valve monitor & flow switches* Potter; System Sensor
 - .9 Ductile Iron Pipe Fittings* Ward; Smith-Cooper; Anvil
 - .10 Mechanical Tees Victaulic; Gruvlok; Smith-Cooper
 - .11 Outlet Tees Victaulic; Anvil-Star (MT-3 only)

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 Single-interlock preaction automatic sprinkler system.
- .3 Wet pipe automatic sprinkler system.
- .4 Modification to existing standpipe and hose system.
- .5 Dry pipe automatic sprinkler system.
- .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.

1.3 RELATED WORK SPECIFIED ELSEWHERE.

- .1 Section 15010 – Mechanical General Provisions
- .2 Section 15051 – Acceptable Materials and Equipment
- .3 Section 16010 – Electrical General Requirements

1.4 WORK BY OTHER TRADES

- .1 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 and NFPA 14 – Standpipe and Hose Systems.
 - .3 All Materials shall conform to the appropriate standards listed in the most current published Manitoba Building Code (MBC), Manitoba Fire Code (MFC), 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), 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 to be manufactured in North America.
 - .2 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.
 - .3 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.
 - .4 All piping in sprinkler systems shall be schedule 40, black or galvanized steel.
 - .5 All piping in standpipe and hose systems shall be schedule 40, black or galvanized steel.
 - .6 Pipe 32mm (1¼”) 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.
 - .7 Pipe 38mm (1½”) 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.
 - .8 Copper tubing shall be joined by ULC approved methods for sprinkler systems and shall meet the joining requirements and methods in NFPA 13 – Installation of Sprinkler Systems.
- .3 Fittings
 - .1 General
 - .1 All fittings not listed herein to be of suitable quality and listed for use in fire protection systems. Shop drawings to be submitted on all items not listed herein.
 - .2 Weld fittings up to and including 38mm shall be 13,790 kPa socket weld, 50mm and larger shall be butt weld.
 - .3 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.
 - .4 Threaded fittings shall be malleable or ductile iron class 150, where pressures exceed rating provide similar material suitable for system operating pressure meeting the requirements of NFPA 13 – Installation of Sprinkler Systems and NFPA 14 – Standpipe and Hose Systems.
 - .5 Close thread nipples are not permitted.
 - .6 Grooved fittings; Victaulic, Gruvlok, Smith-Cooper (Cooplok).
 - .7 Mechanical grooved couplings; Victaulic 005 Firelock, Gruvlok 7400 Rigidlite, Smith-Cooper 65LR/66LR, standard weight rigid coupling. Use Victaulic or Gruvlok flush seal type gaskets or Smith-Cooper TRI – Triple Seal Gasket in dry pipe or preaction systems gaskets to match coupling manufacturer.

- .8 Mechanical grooved reducing couplings are not permitted.
 - .9 Grooved flange adapters ; Victaulic 741, Gruvlok 7012, Smith-Cooper 65FH/66FH.
 - .10 Mechanical tees; Victaulic 920/920N, Gruvlok 7045/7046, Smith-Cooper 65MT/66MT, 65MG/66MG, 65MU/66MU, Mechanical Tee.
 - .11 Outlet or Branch tees: Victaulic 922, AnvilStar MT-3.
 - .12 All grooved fittings and couplings shall be coated with alkyd enamel paint or galvanizing.
- .4 Gaskets, Nuts, Bolts and Hardware
- .1 Flange gaskets shall be 1.6mm, full faced red rubber gaskets. Grooved flange and coupling gaskets shall be as supplied and recommended by manufacturer.
 - .1 Mate flanges with gaskets, discs, etc. as recommended by manufacturer..
 - .2 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.
 - .3 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.
 - .4 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 MBC, MFC, NFPA standards and the authority having jurisdiction. Gauges shall be ABS bodied, bronze-g 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 (1/4-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 MBC, MFC, NFPA standards and the authority having jurisdiction.
 - .2 Valves shall be ULC or cUL approved for use in fire protection systems. Valves shall be permanently marked with the manufacturers name or trademark, listing, and pressure ratings.
 - .3 Valves shall be of an indicating type with identification of open or closed position. OS&Y gate valves shall be of a rising stem design. 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 indicate, 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 ULC 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 type 6mm three way valve for connection of pressure gauges shall be Neo #563.
- .10 Ball valves 50mm and smaller, threaded ends, two single pole double throw pre-wired switches for supervision; NIBCO KT-505-W-8.
- .11 Butterfly valves 64mm and larger, grooved end; NIBCO GD4765-4/8. Butterfly valves 64mm and larger where flanged connections are required, lug style, two single pole double throw pre-wired switches for supervision; NIBCO LD3510-4/8.
- .12 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.
- .13 Check valves 50mm and smaller, bronze body, class 150, y-pattern, PTFE renewable disc, with threaded ends, Crane Figure 141TF. Check valves 64mm and larger, grooved ends, NIBCO G-6917-W.
- .14 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 Model A56/A156.
- .15 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.
- .16 Ball drip valves shall be piped locally over floor drains or directly into drain riser or line as indicated on Drawings.
- .17 Preaction and Dry Pipe Valves
 - .1 Actuated system valves (Deluge and Preaction); Reliable DDX.
 - .2 Dry system check valves; Reliable DDX.
- .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 MBC, MFC, 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 MBC, MFC, 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 MBC, MFC, 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, Reliable F1FR 56.
 - .2 Provide brass upright automatic sprinklers in unfinished areas where sprinkler piping cannot be concealed, Reliable F1FR 56.
 - .3 Provide brass standard horizontal sidewall automatic sprinklers and chrome plated recessed horizontal sidewall automatic sprinklers with white escutcheon finish where shown on Drawings; Reliable F1FR 56.
 - .4 Provide adjustable concealed automatic sprinklers with white escutcheon plate where indicated on Drawings; Reliable F4FR
 - .5 Provide sprinkler head storage cabinets to store stock of spare sprinkler heads as required by and as required by NFPA standards and the authority having jurisdiction. Cabinets 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.
- .9 Floor Plates and Sleeves
- .1 Where piping passes through masonry walls provide steel pipe sleeves full thickness of wall.
 - .2 Where piping penetrates floors or roofs provide watertight floor sleeves.
 - .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 ULC listed.

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, MBC, MFC, 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 All hangers shall be in conformance with the appropriate NFPA standards, the MBC, MFC, 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.
- .4 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.
- .5 Section 15500 shall submit all design documents and reports detailing the anchoring system and bracing with Shop Drawings prior to construction as part of sprinkler Shop Drawings.
- .6 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, MBC, MFC, 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 Provide pressure gauge complete with three-way test valve at top of all risers.
 - .4 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 Conventional wet automatic sprinkler systems shall be designed and installed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems, MBC, MFC, and the authority having jurisdiction’s requirements.
 - .1 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 sprinkler system.
- .2 Single-interlock preaction, automatic sprinkler systems shall be designed and installed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems, MBC, MFC, and the authority having jurisdiction’s requirements.
 - .1 Actuated system preaction alarm valves shall be of low air pressure (89 kPa) design.
 - .2 Provide inspectors test station 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.
 - .3 Provide and install an alarm pressure switch, supervisory low pressure switch, solenoid valve, and butterfly valve c/w supervisory tamper switch. Wiring by division 16.
 - .4 Provide air compressor sized in accordance with the manufacturer data sheet of actuated system preaction valve. Air compressor shall be factory assembled. Refer to 2.4.2.7.
 - .5 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.
 - .6 All smoke/heat detector heads that activate this system shall be identified. Coordinate with Division 16 – Electrical.

- .7 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 single interlock preaction system.
- .3 Conventional dry automatic sprinkler systems shall be designed and installed in accordance with NFPA 13 – Standard for the Installation of Sprinkler Systems, MBC, MFC, and the authority having jurisdiction's requirements.
 - .1 Dry sprinkler systems shall only be installed in locations that are subject to freezing conditions or where indicated on drawings.
 - .2 Provide inspectors test station 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.
 - .3 Provide and install an alarm pressure switch, supervisory low pressure switch and butterfly valve c/w supervisory tamper switch. Wiring by division 16.
 - .4 Provide air compressor sized in accordance with the manufacturer data sheet of dry pipe valve. Air compressor shall be factory assembled.
 - .5 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.
 - .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 dry sprinkler system.

Part 3 Execution

3.1 SHOP DRAWINGS, PERMITS, FEES

- .1 Prior to installation, prepare complete set of detailed Shop Drawings in accordance with requirements of NFPA Standard #13, #14 and inspecting authority. Information as to architectural, mechanical and electrical systems shall be obtained from respective Drawings and from Site. Carry out any necessary flow tests without extra compensation.
- .2 Detail design shown on Shop Drawings to generally conform to piping layout and sprinkler arrangement shown on Drawings.
- .3 At completion of Work, provide:
 - .1 Two (2) paper sets (hard copies) of Record Drawings with all changes incorporated.
 - .2 Electronic data files of Record Drawings in AutoCAD (2007).DWG, format 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.

- .4 Submit Shop Drawings and calculations to Contract Administrator for review and to inspecting authority along with inspection fees. Inspecting authorities for this project will be:
 - .1 Local building inspection department and/or fire department.
 - .2 The City's Insurance Underwriters.
- .5 Arrange for inspection and testing of all Work, and make any changes required to comply with regulations of inspecting authority.
- .6 Systems shall be designed in accordance with requirements of:
 - .1 The City's Insurance Underwriters.
 - .2 Manitoba Building Code and Manitoba Fire Code.
 - .3 Local building regulations.
 - .4 All applicable NFPA Codes & Standards.

3.2 EXAMINATION OF DRAWINGS AND COOPERATION

- .1 Examine all Drawings and site 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 Cooperate with all other 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.

3.3 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.

3.4 CUTTING AND PATCHING

- .1 When building elements or finishes are cut, damaged, or removed to perform installation of work. Repair or replace to match existing condition and finish. All cost and arrangements for performance of the work are responsibility of the Contractor. Refer to Section 15010 – Mechanical General Provisions.

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 install 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. Sub-Basement mechanical room may be used as a staging/work area for prepping pipe. Coordinate exact location with City's representative and operating personnel.

3.6 HOLES IN STRUCTURAL MEMBERS

- .1 Do not drill or cut structural beams or other load bearing members for passage of piping.

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 connected to existing systems.
- .3 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 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

- .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 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.
 - .9 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.
 - .10 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 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 conflicts 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.

	<u>Prime</u>	<u>Auxiliary</u>
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, or 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 (diaz 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 Fire Barrier Products or equivalent, to maintain fire rating.

- .2 Seal all holes resulting from removal of cables, conduits and equipment.
- .3 Refer to following table for 3M brand products.

Penetrating Item	3M Brand Fire Barrier Product Options	Range of Applications			Concrete Walls and Assemblies		Gypsum Wall Assemblies	
		Penetrating Items	Annular Space	Maximum Opening Size	F Ratings (Hrs)	T Ratings (Hrs)	F Ratings (Hrs)	T Ratings (Hrs)
1. Plastic Pipe/ Conduit & Cast-in Coupling	FS-195+ Wrap Strip, CP 25WB+ Caulk or MP Moldable Putty+	PVC: 8 in. Nominal Diameter 4 Wraps/Application	0.2 in.	9 in. Diameter	2	2	2	1-1/2
		PVC: 4 in. Nominal Diameter 3 Wraps/Application	0.75 in.	6 in. Diameter	3	2	2	2
		ABS: 4 in. Nominal Diameter 3 Wraps/Application	0.75 in.	6 in. Diameter	2	2	1-1/2	1-1/2
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	PVC: 4 in. Nominal Diameter	3.0 in.	10 in. Diameter	3	1/2	--	--
		ABS: 4 in. Nominal Diameter	3.0 in.	10 in. Diameter	3 (in wall) 1 (in floor)	3 (in wall) 0 (in floor)	--	--
		PB: 2 in. Nominal Diameter	3.0 in.	8 in. Diameter	1/2	--	--	--
2. Metal Pipe and Conduit	CP 25WB+ Caulk	1 in. Depth of Caulk: 20 in. Diameter	2.5 in.	22.5 in. Diameter	3	0	2	0
	FS-195+ Wrap Strip, CP 25WB+ Caulk or MP Moldable Putty+	4 in. Nominal Metal Pipe	1.75 in.	8 in. Diameter	2	0	2	2
	CS-195+ Composite Sheet with FS-195+ Wrap Strip and CP 25WB+ Caulk or MP Moldable Putty+	4 in. Nominal Metal Pipe (Multiple Pipes)	45.0 in.*	30 x 50 in.	4 (both sides) 3 (one side)	3/4	--	--
	PSS 7902 Penetration Sealing System CP 25 WB+ Caulk or MP Moldable Putty+	10 in. Nominal Diameter Pipe and 8x16 in Rectangular Cover Plate if fill is less than 10%	9.0 in.	10 x 20 in.	3	0	--	--
	CP 25WB+ Caulk	1/2 in. Diameter Depth of CP-25WB 12 in. Nominal Diameter Pipe	1.2 in.	14 in. Diameter	3	0	--	--
	FD 150 FireDam Caulk	2 in. Depth of FireDam 150 Chaulk 6 in. Nominal Diameter Pipe	2.0 in.	8-1/4 in. Diameter	3	0	--	--
	MP Moldable Putty+	1 in. Depth of Putty: 10 in. Nominal Diameter Pipe	0.75 in.*	12-1/4 in. Diameter	2 (1/2 in. Depth) 3 (1 in. Depth)	0	--	--
3. Insulated Electrical and Communications Cable	CP 25WB+ Caulk	1 in. Depth of Caulk; 43% of Area Filled, 350 MCM Cable and 100 Pair Telephone Cable	0.75 in.	6 in. Diameter	3	0	2	1-1/2
		1 in. Depth of Caulk; 37% of Area Filled, 3/0 350MCM Cable and 100 Pair Telephone Cable	0.75 in.					
		2-12 in. Depth of Caulk; 59% of Area Filled, 7C/12 AWG Cable, 100 Pair Telephone Cable	0.75 in.					
	FS-195+ Wrap Strip with CP 25WB+ Caulk or MP Moldable Putty+	4 in. Depth of Caulk with FS-195 Wrap; 59% Area Filled, 350 MCM Cable	0.75 in.	6 in. Diameter	2	0	--	--
	CS-195+ Composite Sheet with FS-195+ Wrap Strip and CP 25WB+ Caulk or MP Moldable Putty+	Multiconductor 12 AWG Cable, 100 Pair PVC Telephone Cable, Cable Bundle 3 in. Diameter	47.0 in.*	30 x 50 in.	4	1	--	--
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	350 MCM Cable; 30% of Area Filled. Cover Plate required if Fill is less than 10%	11.0 in.	8 x 16 in.	3	1/2	--	--
	MP Moldable Putty+	Telephone Cable; 100 Pair, 40% or Area Filled	0.75 in.	6-1/4 in. Diameter	2	0	--	--

4. Cable Tray	CS-195+ Composite Sheet with CP 25WB+ Caulk	Nominal Size Cable Tray 4 x 24 in.; 39% Area Filled in Tray; Cable Size: 300 MCM 4 in. Depth of Chaulk	14.64 in.	12 x 24 in.	3	0	--	--
	PSS 7904-R Penetration Sealing System with CP 25 WB+ Caulk	Nominal Size Cable Tray 4 x 18 in.; 52% Area Filled in Tray; 25 Pair No. 22 AWG Telephone Cable	9.0 in.	10 x 20 in.	3	3/4	--	--
5. Blank Openings and Construction Joints and Expansion Trenches	CP 25WB+ Caulk	1/2 to 1 in. Depth	--	Joint Width 4 in. Diameter Opening 4 in. Joint Width	3	3	--	--
		2 in. Depth Cover Plate required when joint width exceeds 2 in.	--	Joint Width	3	2	--	--
	MP Moldable Putty+	1 in. Depth	--	1 in. Joint Width	2	2	--	--
	PSS 7904 Penetration Sealing System with CP 25 WB+ Caulk	4 in. Depth of Kit. Cover Plate Required.	--	8 x 16 in.	3	1	--	--

* Distance Measured from the outer edge of the pentrant to the furthest edge of the opening

- .4 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 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 19mm.
- .2 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 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 electrical metallic tubing (EMT) except where specified otherwise.
- .4 Use flexible metal conduit for connection to motors in dry areas and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm dia.
- .9 Install fish cord in empty conduits.
- .10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.
- .12 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.
- .13 Running threads will not be permitted; proper couplings shall be used.
- .14 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.
- .15 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.

- .16 Refer to 16010 for identification requirements.

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 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.
- .3 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.
- .11 In EMT conduit.
- 4 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

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 IN EQUIPMENT

- .1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.4 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.

3.5 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 junction and pull boxes as indicated or as needed for each system.

Part 2 Products

2.1 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 gasketed covers where exposed to weather.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3 Install junction and pull boxes clear of all mechanical ductwork and piping.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.
- .2 Identify junction and pull boxes with size 3 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, gasketed 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 ferrous alloy 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 No more than two extension rings shall be used in sequence.

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 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 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.
- .6 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.
- .7 For surface mounting of two or more conduits use channels at 1500 mm oc spacing.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 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.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .13 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 Specifications. 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 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_t(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
- .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 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
 - .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)

- .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 City.
- .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 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 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.

2.3 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.

2.4 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 16010 - Electrical - General Provisions.

2.5 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.

2.6 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